North Pacific Fishery Management Council

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Certified:_____
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SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
October 1-3, 2009

The SSC met during October 1-3, 2009 at the Hilton Hotel, Anchorage, Alaska. Members present were:

Pat Livingston, Chair
NOAA Fisheries—AFSC
Keith Criddle, Vice Chair
University of Alaska Fairbanks
Milo Adkison
University of Alaska Fairbanks
Robert Clark
Alaska Department of Fish and Game
Anne Hollowed
NOAA Fisheries—AFSC
George Hunt
University of Washington
Gordon Kruse
University of Alaska Fairbanks
Kathy Kuletz
US Fish and Wildlife Service
Franz Mueter
University of Alaska Fairbanks
Lew Queirolo
NOAA Fisheries—Alaska Region
Farron Wallace
Washington Dept of Fish and Wildlife
Ray Webster
International Pacific Halibut Commission
Doug Woodby
Alaska Department of Fish and Game

Members absent were:

Troy Buell
Oregon Department of Fish and Wildlife
Sue Hills
University of Alaska Fairbanks
Seth Macinko
University of Rhode Island

C-3 (a) Electronic Monitoring EFP Phase II Report

Alan Kinsolving (NMFS AKR) and Julie Bonney (Alaska Groundfish Data Bank) presented details of a final report on Phase II of the project, conducted under an experimental fishery permit (EFP), to investigate the feasibility of using electronic monitoring (EM) to monitor the discard of Pacific halibut in the central Gulf of Alaska (CGOA) rockfish fishery. At present, all catches, except Pacific halibut and lingcod, are retained in this fishery. The goals of this second phase were to conduct a real world assessment of the accuracy, practicality, data flow, and costs of video-based estimates of Pacific halibut discards when implemented on fishing vessels under actual fishing conditions. The work was carried out on four vessels from a single cooperative within the Rockfish Pilot Program (RPP) that were willing to operate under the EFP. There was no public testimony.

Results of the phase II experiment showed that:

- EM hardware and software problems can occur, but can be alleviated quickly when identified.
- Length of discarded Pacific halibut was often difficult to assess, due to positioning of the discard chute and operations/positioning of the crew.
- EM-based estimates of biomass and count of Pacific halibut discarded were not significantly different than those obtained from a census.
- Self-reported tallies of Pacific halibut discard were not significantly different from the EM count.

- The time lag from acquisition of the EM video data to estimation of discard was appreciably longer than the current observer-based discard estimation system. This was largely due to the time spent by technicians reviewing the EM video data.
- Under reasonable assumptions, costs to implement EM in this fishery resulted in a wide range of savings when compared to the current observer-based program. Savings could be accrued if boats were fishing at least 30% of the time and used the EM system for at least 7 days in the season.

The authors concluded that EM should work well to monitor Pacific halibut discard, if newer hardware and software are used. They also noted that a variety of discard chutes worked equally well, as long as EM cameras had a clear view of the discard chute. Self-reported tallies of Pacific halibut discard could be used to monitor for halibut PSC cap during the season, but more research is needed in assessing the accuracy of self-reporting lengths of Pacific halibut. Improvements in turn around time of EM data (e.g., automated or semi-automated review of EM data) are clearly necessary to increase the applicability to inseason management of a PSC cap and to accrue cost savings across a wide variety of fishing patterns by different vessels and cooperatives. The continued use of observers to conduct biological sampling, estimate discard mortality rates of Pacific halibut, and to record fishery interactions with seabirds and marine mammals will need to be factored into any implementation of EM in the fishery.

The SSC appreciates the work done by the authors to investigate the practical use of EM and agrees with their assessment that EM shows considerable promise as a method to monitor Pacific halibut discard in this fishery. The SSC also agrees that flexibility is needed to implement EM in the future, rather than mandating its use before significant issues such as reliability of equipment, turn around time to reporting, and integration with onboard observers are resolved.

Suggestions for future research offered to the authors were: the possibility of downloading video EM data at sea, ensuring that the EM system notifies the captain of a system fault, and incorporating backup systems, such as a second control box. There is an apparent error in Table 5 (page 15) of the document where the total for the New Life was 8, but should have been 1954.6.

C-3 (b) Observer Program Implementation

Nicole Kimball (NPFMC) and Craig Faunce (NMFS-AFSC) gave a presentation on the implementation plan associated with the proposed restructuring of the Groundfish Observer Program. Public testimony was given by Gerry Merrigan (Prowler Fisheries) and Paul McGregor (At-Sea Processors Association). The design of the current observer program has different observation probabilities, depending on vessel size, with no observers on small vessels (<60'), 30% of trips observed on midsize vessels (60'-125'), and 100% (or 200%) of trips observed on large vessels (>125'). Processors are also divided into smaller facilities, with 30% of days observed, and larger facilities (>1,000 t), with 100% coverage. When coverage is 30%, industry selects the days on which the observer is present, leading to potential bias due to non-representative selection of observed fishing areas or times. It has been asserted that vessel sizes have been modified to reduce or avoid observer coverage.

The restructuring of the Plan aims to reduce biases due to the collection of a non-representative sample by randomizing observer coverage, as well as including vessels <60' that had previously had no observer coverage The proposed changes only affect sample selection at the highest level of the sampling hierarchy, that is, vessel trip. It was noted by staff that this report is an initial description, and proposals for restructuring will be refined and expanded in subsequent work. The most important change in the Plan is to have NMFS, rather than operators, control the selection of sampling units (trips, days). The process will be automated and incorporate randomization with known selection probabilities. It was noted that although there will be additional costs in implementing this new program, several similar systems are already successfully managed elsewhere.

New vessel sample strata are defined to replace the existing size-based strata. The 100% stratum will include all catcher processors and motherships, and all catcher vessels fishing co-ops with transferable

quotas. All remaining vessels (other than vessels strictly engaged in state-managed fisheries) will be sampled with unspecified coverage depending on available funding for the observer program. No changes to the sampling of processors were discussed, but the intention is to consider this component of the observer program in future versions of the restructured plan.

The report discusses the possibility of gaming under the proposed sampling program, such as cancellation of trips when notified an observer will be present. There is some discussion of potential rules to reduce the likelihood of this occurring.

Observer coverage for fishery components with <100% coverage would be selected using optimization procedures in order to minimize variance, given constraints on available funding. The SSC notes that results are likely to vary depending on the quantity of interest, so this may not be straightforward. **Any decisions on observer coverage must ensure that biological data and samples (e.g., lengths, otoliths) are sufficient to meet analytical needs**. **The SSC expressed concern that with current mandates for 100% or 200% coverage of some sectors, which would increase under the restructured plan, there may not be sufficient resources for adequate coverage of the <100% sector. The SSC also requests a more detailed analysis of proposed funding mechanisms.** Analysis of the funding mechanisms should include scenario analyses of likely variations in catch (as projected in the annual TAC setting process) and price. These analyses are necessary to convey an understanding of likely variations in the revenue stream to be used for funding the observer program.

C-4 (b) BS Crab Initial review Right of First Refusal (ROFR)

The SSC received a presentation of the initial RIR/IRFA from Mark Fina (NPFMC). There was no public comment.

The SSC appreciates the concisely written analysis. The amendment envisions three distinct actions to modify the existing "right of first refusal" provisions of the crab rationalization program. Each of the three actions is independent of the others, meaning any combination may be selected.

The SSC recommends release of the draft document for public review, with minor clarifying edits to the introductory discussion, supplied to the analyst.

C-4 (d) Review outline for BS Crab 5 year review

Time constraints precluded the SSC from addressing this agenda item.

C-4 (e) Review Crab SAFE and OFLs

The SSC received staff reports from Bob Foy (NMFS-AFSC), Diana Stram (NPFMC), and Forrest Bowers (ADF&G, Crab Plan Team chair). Public testimony was provided by Linda Kozak (Crab Group of Independent Harvesters) and Leonard Herzog (Alaska King Crab Harvesting Cooperative).

A report was presented detailing recent changes made to the time series of trawl survey assessments for crabs in the eastern Bering Sea. Changes included error fixes, correction of area-swept calculations using observed net widths using trawl mensuration data, and considerations of unmeasured crabs caught during the survey. There were 39 error fixes over 19 years; most affected snow and Tanner crabs. Application of the variable net width corrections did not result in large changes in biomass estimates, except for reductions early in the survey time series. The revised survey time series has been included in all crab stock assessments for 2009, except snow and Tanner crabs, which will be updated with the new series next year. Additional aspects of the historical survey time series to be addressed in the future include use of additional tows in research studies, re-tows, fishing power corrections among the two survey vessels, and the manner in which hot spots and unsampled areas are treated. The SSC suggests that a geostatistical approach could be explored to include the large number of opportunistic tows, when estimating crab abundances. The SSC further recommends using asymmetrical confidence intervals when displaying time

series of survey abundance, particularly for species with low and highly variable abundances, in order to avoid unrealistic confidence intervals that include negative values. The SSC commends staff for this excellent effort, which improves the scientific basis for management of Bering Sea crab stocks.

Overviews were presented of the crab SAFE, including OFL determinations, the Crab Plan Team report, and a discussion paper on crab bycatch in BSAI groundfish fisheries. In June 2009, the SSC conducted preliminary reviews of 8 of 10 BSAI crab stock assessments (see June 2009 SSC report). Two Tier 5 assessments (Pribilof Islands golden king crab, Adak red king crab) were deferred to this current meeting. **For the Adak red king crab fishery, the SSC agrees with the CPT's recommendation for a Tier 5 designation and the use of the time period 1984/85-2007/08 for calculation of the OFL. The SSC recommends a 2009/10 OFL of 500,000 pounds retained. The SSC also agrees with the Tier 5 designation and the use of the time period of 1993-98 for calculation of OFL for Pribilof Islands golden king crab. The SSC recommends a 2009/10 OFL of 170,000 pounds retained**. For the Aleutian Islands golden king crab fishery, the SSC corrects the CPT table to indicate the SSC recommendations from June, in which the SSC recommended an OFL of 9.18 million pounds retained, based on average catch over 1985/1986 to 1995/1996**. The SSC approves the final 2009/10 OFL recommendations for all ten crab stocks, as shown in Table 1 below.**

Table 1. SSC recommendations for Bering Sea crab assessment parameters and OFLs, October 2009. Bold indicates values approved by the SSC at this meeting. .

(Note diagonal fill indicates parameters not applicable for that tier level)

Chapter	Stock	Tier	Status (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$	Years[1] (biomass or catch)	2009/10[2] [3] MMB	2009/10 MMB / MMB_{MSY}	γ	Mortality (M)	2009/10 OFL mill lbs [retained]
1	EBS snow crab	3	b	0.52	326.7	1979-current [recruitment]	251	0.77		0.23 (males, immat.) 0.29 (mature females)	**73.0**
2	BB red king crab	3	a	0.32	68.5	1995-current [recruitment] [5]	95.17	1.08		0.18 default , estimated otherwise[4]	**22.56**
3	EBS Tanner crab	4	b	0.07	189.76	1969-1980 [survey]	70.2	0.37	1.0	0.23	**5.57**
4	Pribilof Islands red king crab	4	b	0.08	8.78	1991-current [survey][5]	4.46	0.51	1.0	0.18	**0.50**
5	Pribilof Islands blue king crab	4	c	0	9.01	1980-1984; 1990-1997 [survey][5]	1.13	0.13	1.0	0.18	**0.004**
6	St. Matthew Island blue king crab	4	a	0.18	7.99	1989-current [model estimate] [5]	12.47	1.56	1.0	0.18 (1978-98, 2000-08); 1.8 (1999)	**1.723** total male catch
7	Norton Sound red king crab	4	a	0.18	3.07	1983-current [model estimate]	5.83	1.9	1.0	0.18	0.7125 [retained]
8	AI golden king crab	5				1985/86-1995/96 [retained catch]					9.18 [retained]
9	Pribilof Island golden king crab	5				**1993-1998** [retained catch]					**0.17**[6] [retained]
10	Adak red king crab	5				**1984/85-2007/08** [retained catch]					**0.50** [retained]

The SSC offers these general comments to all stock assessment authors: (1) at the beginning of each SAFE chapter, summarize the SSC and Plan team requests to the author (and the response to each) to assure that these requests are not overlooked, especially as the SSC has been examining crab stock assessments spread over multiple Council meetings per year, and (2) each assessment should clearly state what is new and not new from the previous assessment. (3) All assessment authors should structure their assessment documents following the guidelines established by the crab plan team. In addition, the SSC offers the following comments on specific crab assessments.

Snow Crab - The Crab Plan Team recommended treating the industry survey as a separate survey not to be merged into the standard NMFS survey tows used in the assessment. In addition to this model scenario, the SSC requests model scenarios using a different approach in which q is estimated outside of the model using the net efficiency results and allowing natural mortality (M) to be a free parameter to be estimated in the model. The net efficiency results can also be used as priors in a Bayesian modeling

[1] For Tiers 3 and 4 where B_{MSY} or $B_{MSYproxy}$ is estimable, the years refer to the time period over which the estimate is made. For Tier 5 stocks it is the years upon which the catch average for OFL is obtained.
[2] MMB as projected for 2/15/2010 at time of mating.
[3] Model mature biomass
[4] Additional mortality males: two periods-1980-1985; 1968-1979 and 1986-2008. Females three periods: 1980-1984; 1976-1979; 1985 to 1993 and 1968-1975; 1994-2008. See assessment for mortality rates associated with these time periods.
[5] Revised EBS trawl survey time series data used
[6] For calendar year 2010

framework. In the future, the SSC looks forward to examining results of the recent net efficiency study after reviews by the assessment authors and Crab Plan Team.

Bristol Bay red king crab – The OFL for Bristol Bay red king crab was estimated using the model selected by the plan team and SSC. Model runs including 2009 survey data and the revised survey time series were completed over the summer and the impacts of changes to data weightings were explored. Changes to effective sample size estimates appeared to be quite influential and will be further explored for the May 2010 crab plan team meeting. A CIE review of this assessment was completed in June 2009 and the SSC looks forward to the seeing the results of this review and the author's responses at some future date. Moreover, the SSC commented on two emerging issues and has the following comments. First, there is evidence for increasing movement of the stock into the Northern District (Federal Area 514). Bycatch occurring in this area currently does not accrue to any fishery and survey catches from this area are not included in estimates of survey abundance in the Bristol Bay red king crab assessment. Bycatch data and survey data from the Northern District should be included in the assessment as soon as possible. Second, the Bristol Bay red king crab stock has shifted to the south in recent years. This has prompted concerns over potential habitat damage in southern Bristol Bay due to groundfish trawling in this area. The SSC agrees with plan team recommendations that these concerns should be raised in the context of the upcoming EFH analyses.

Norton Sound red king crab – The SSC approved the OFL for Norton Sound red king crab at the June 2009 meeting. The SSC reiterates two Crab Plan Team suggestions for future assessments. First, there should be further analysis of the retrospective pattern in the assessment given concerns regarding the consistent pattern indicating an overestimate of biomass compared to the trawl survey. Second, future assessments should include an assumed bycatch and discard mortality.

Adak red king crab – Last year, the SSC noted an urgent need to establish a systematic survey for this stock. The state and industry are responding to this need. The ADF&G plans to conduct a survey of the Petrel Bank region in November 2009. In addition, Linda Kozak (Crab Group of Independent Harvesters) reported that industry will be conducting additional pot surveys in five areas west of Petrel Bank in the fall and winter. The SSC supports efforts by ADF&G and industry to develop a fishery independent index of the abundance of Adak red king crab. If these surveys are meant to serve as an index of abundance, it will be important for the industry and state to standardize their survey designs. The SSC requests the opportunity to review the survey designs for both in advance. Also, it would be helpful to examine the historical distribution of the fishery across statistical areas with respect to the areas proposed for surveys. The SSC requests that the author incorporates the results of the ADF&G systematic survey of the Petrel Bank area in the 2010 SAFE chapter. The SSC agrees with the CPT recommendations of a tier 5 designation and establishment of a retained catch OFL of 0.5 million pounds based on average catch using the year of 1984/85 to 2007/08. It was also noted that there are concerns over the level of groundfish bycatch for this stock, which may need to be addressed.

Pribilof Islands golden king crab – The SSC notes that this fishery has been managed under a 150,000 lb GHL since 2000, although no permits have been issued since 2005. This assessment is data limited with no survey or assessment model and much of the directed fishery data is confidential due to low numbers of participating vessels or processors. The SSC agrees with plan team recommendations that this stock be assigned to tier 5 for lack of biomass information and establish a retained OFL of 0.17 million pounds based on average catch between 1993 and 1998. The SSC encourages the assessment author to evaluate all sources of mortality in order to present a total catch OFL and also encourages the author to investigate slope survey results in relation to future assessments for possible Tier 4 designation. Finally, the SSC notes that trawlable habitat may not represent the preferred habitat for this species.

Crab bycatch in BSAI groundfish fisheries—The SSC received a staff discussion paper that provided a review of the crab bycatch in the BSAI groundfish fisheries and the measures in place to limit that bycatch. Public testimony was received by Leonard Herzog (Alaska King Crab Harvesting Co-op).

The SSC appreciates receiving this report and sees this as a valuable precursor to the Council's decision to proceed with an analysis for an FMP amendment. If conducted, the SSC recommends that the analysis be made on a stock by (crab) stock basis to evaluate both the conservation and allocation concerns. Other analytical issues that need consideration include crab OFLs expressed in weight and groundfish bycatch expressed in numbers, the need to define crab stock-specific boundaries, and handling mortality rates to be used.

C-4 (f) Review crab rebuilding status

The SSC received staff reports from Diana Stram (NPFMC), Forrest Bowers (ADF&G, Crab Plan Team chair), and Jack Turnock (NMFS-AFSC). Relevant documents included a preliminary rebuilding analysis of snow crab (starting on p. 59 of the crab SAFE), and letters from Acting NMFS Regional Administrator Doug Mecum on the status of four BSAI crab stocks relative to rebuilding plans, NMFS-AFSC Director Doug DeMaster on the status of BSAI crab stocks relative to overfished and overfishing status, and NOAA Regional Counsel Lisa Lindeman on the SSC's role in providing advice to the Council on crab stock rebuilding. Public testimony was provided by Arni Thomson (Alaska Crab Coalition).

The SSC offers the following comments by stock:

Snow Crab:

- The SSC looks forward to incorporation of the new, error-corrected trawl survey dataset as the rebuilding analysis is further developed. It was noted, for instance, that the revised trawl survey time series using variable width net measurements resulted in a substantial decline in the abundance of pre-recruit male snow crab relative to those based on fixed width in 2009. This could affect rebuilding probabilities and timelines over the near term.
- A revised rebuilding plan analysis should incorporate estimates of snow crab bycatch in other fisheries.
- The analysis should clarify how recruitment is handled in the model. For short-term projections, the SSC understands that the estimated abundance of small crabs caught in the survey is projected forward. However, there is considerable uncertainty in year-strength estimated from survey catches of small crabs alone. The analysis should clarify how this is addressed and whether the projections are deterministic or sampled from a distribution of recruitments informed by the small crab catches.
- The SSC notes that the range of F values used in the analysis is sufficiently broad. The SSC had some discussion about the harvest rate to be used in the rebuilding model once the stock hits rebuilt status. At present, the model reverts to 75% F35% rate. An alternative is to revert to the rate used under the current rebuilding plan, but notes that the 75% F35% rate was intended to be a proxy for a harvest rate that might be employed when crab ACLs are implemented. It was also noted that under the present rebuilding analysis a rebuilding time period of no longer than 7 years could occur, given the restriction that harvest not exceed the maximum permissible rate of 75% F35%. However, this time frame could change when the analysis is updated with new data.
- An alternative rebuilding approach was offered in which annual adjustments could be made to the harvest rate each year so as to incrementally increase the probability of successful rebuilding with the passing of each year – e.g., start with the probability of 50%, then increase incrementally to 60% and so on in each subsequent rebuilding year. The SSC was intrigued with this approach and recommends exploring it further in the rebuilding analysis in addition to a fixed strategy in which no annual adjustments to harvest rate are made.

- The SSC had some confusion on the interpretation of 100% probabilities in Table 6 and requests clarification on the interpretation of this probability. Moreover, the SSC requests adding the probability of being rebuilt to the Tables.
- The rebuilding analysis should consider spatial dynamics of the stock, particularly the potential importance of southern versus northern areas occupied by the stock in terms of source of recruits, regional harvest rates, etc. Specifically, the environmental ratchet hypothesis of Orensanz, Armstrong, and colleagues suggests that densities of spawning stocks at the southern end of the range are disproportionately important. However, owing to the distributions of sea ice and operational costs, the southern portion of the stock experiences the highest harvest rates.
- Aside from harvest strategy for the directed snow crab fishery, the rebuilding plan should re-evaluate PSCs for snow crab in groundfish fisheries, both the rate and the 4,350,000 minimum, in terms of conservation of the snow crab stock.
- Analysis of economic impacts of the alternative rebuilding strategies for EBS snow crab needs to include a brief discussion of likely differences between conclusions based on comparison of gross revenues and conclusions based on comparison of net revenues. In addition, it would be useful to characterize the results for a reasonable range of alternative discount rates as suggested in 2009 Discount Rates for OMB Circular A-94. Finally, it would be useful to include a discussion of the extent to which participants in this fishery are exclusively dependent on revenues from this fishery.

Tanner Crab

The SSC did not receive any report on proposed Tanner crab rebuilding analyses. However, the SSC recommends that the forthcoming analyses consider the above snow crab recommendations when developing rebuilding strategies for this species. Further, the SSC recommends that an operational model for Tanner crab be developed to aid in these analyses.

Pribilof Is. Blue King Crab:

The Pribilof Island blue king crab stock, declared overfished in 2002, remains in an overfished condition because the estimated biomass remains below the minimum stock size threshold. A rebuilding plan for this stock is to be revised for implementation by the 2011/12 fishing year. The SSC provided recommendations for the rebuilding analysis in our June 2009 minutes, and we reiterate our support for consideration of five alternative measures in the revised building analysis:

- Pribilof Islands Area Habitat Conservation Zone closed to all groundfish fishing,
- Pribilof Islands Area Habitat Conservation Zone closed to pot cod fishing,
- Analyze the existing ADF&G closure areas for all groundfish or just pot cod fishing,
- Analyze new closures to cover the entire distribution of the stock
- Modifications to cod pots to reduce bycatch.

C-5 (a) Trawl Sweep modifications in the Bering Sea flatfish fishery and revised NBSRA boundaries.

The SSC received a presentation of a public review draft of the EA/RIR/IRFA for this action, from Diana Evans (NPFMC), Craig Rose (NMFS AFSC), and Melanie Brown (NMFS AKR). Public testimony was received from Jon Warrenchuck (Oceana) and John Gauvin (Best Use Cooperative). The SSC reviewed a discussion paper on this action in February 2007, a presentation on the trawl sweep modification experiments in April 2009, and reviewed an initial review draft at the June 2009 meeting. The analysis reports on a potentially economically and environmentally desirable fishery technology change, which should be regarded as a good first step to reduce adverse fishing impacts imposed by Bering Sea flatfish

trawls on the benthic ecosystem. Proposed boundary changes to the Northern Bering Sea Research Area and St. Matthew Island Habitat Conservation Area are also analyzed.

In June 2009, the SSC made several recommendations to improve the initial review draft and recommended that the draft not be released for public review, until a revised document could be reexamined by the SSC. The Council decided to release a revised draft of the document for public review, but before the SSC had a chance to review the revisions. **Upon review, the revised document does address all of the comments and recommendations made by the SSC and is sufficient for weighing the alternatives and options of the proposed action.** The SSC recommends that, if the Modified Gear Trawl Zone (wedge) is opened, the NMFS trawl survey should be expanded into that area.

C-5 (c) Groundfish Plan Team Reports and 2010/2011 BSAI and GOA Groundfish Specifications

The SSC reviewed and approved the proposed specifications for 2010-2011. The groundfish specifications for 2010 and 2011 are based on rollovers of the 2010 specifications, except for Eastern Bering Sea walleye pollock. The specification for EBS walleye pollock (815,000 t) is based on the 2009 final specification, rather than the projected 2010 ABC. The SSC agrees with this approach and the rationale provided by the Plan Team.

Pacific cod, sablefish, and Alaska plaice models – Grant Thompson (AFSC) presented a suite of alternative models for the EBS and GOA Pacific cod stocks that were stepwise modifications of the reference models adopted for last year's specifications. The alternative models were based on recommendations from the PT and SSC in 2008, and were intended to test model assumptions. Kenny Downs (Freezer Longliner Coalition) and Katy McGauley (Alaska Groundfish Data Bank) provided public testimony on analytical reviews of the GOA and BSAI models supplied by Mark Maunder (Quantitative Resource Assessment LLC).

GOA Pacific cod model results suggest that age-based selectivity for the 27+ survey performs better than length-based selectivities and that model fits generally did not improve when exponential logistic selectivity was used instead of the double normal selectivity used in last year's preferred model. The basic problem of a conflict between age/length data and survey data was not resolved by any of the models and the model estimates of survey biomass continue to be much higher than survey biomass in most years. BS model results suggest that general assumptions about catchability and selectivity made in the previous assessment were appropriate. However, both BS and GOA models frequently estimated a selectivity curve that declined sharply from the peak and then leveled off sharply. This pattern is biologically unrealistic and may lead to biased results.

For setting ABC and OFL we continue to favor the reference models adopted last year but, contrary to our previous guidance, we would like to see alternative models that constrain selectivity parameters to preserve a reasonable shape, for example by fixing selectivity at maximum age. In addition, selectivity for ages 0 and 1 at the end of the time series in general, and specifically in the BS assessment in 2007, is poorly estimated because few observations are available for these age classes. Therefore, the SSC recommends that alternatives that keep selectivity deviations in the last several years of the time series at "base" values. We agree with PT recommendations to abandon the use of exponential logistic selectivities for this assessment.

There remain a number of questions concerning cod age data, due to the mismatch between survey length modes and estimated mean length at age of younger fish in the Bering Sea and difficulty of fitting age compositions in the Gulf. The PT reported that there is ongoing research at AFSC focusing on ageing issues and the SSC looks forward to the results.

The SSC notes that the sablefish model has recently gone through a CIE review and we look forward to reviewing future model revisions. The SSC concurs with the plan team that the revised Alaska plaice model be used for future ABC/OFL recommendations.

Spatial management unit guidelines –The SSC received a report by Paul Spencer (NMFS AFSC) summarizing "Guidelines for determination of spatial management units for exploited populations in Alaskan groundfish fishery management plans." The SSC commends the workgroup for providing very useful guidelines for a challenging issue. Considering the importance of the report and the value of the guidelines, the SSC requests that the report also be presented to the crab and scallop plan teams for their consideration.

The SSC makes the following recommendations:

1. The groundfish plan teams should establish a schedule for conducting these evaluations for individual stocks using the proposed template. For example, a 3 year timeline could be considered, in which assessments would be assigned a completion date in either year 1, 2, or 3 and based on availability of data and any conservation concerns.
2. The groundfish plan teams should establish a review process, possibly via a committee, that would examine the completed templates and make a recommendation as to whether area specific OFLs are needed. Inclusion of genetic expertise in this process is recommended.

The SSC notes that the lack of genetic evidence for stock structure does not equate to a lack of ecological or demographic stock structure.

D-1 (a) Salmon bycatch Initial review salmon bycatch data collection

Mark Fina (NPFMC) and Marcus Hartley (Northern Economics) presented an overview of the initial review draft RIR/IRFA for four alternatives for a proposed Chinook Salmon Bycatch Data Collection Program, to support assessments on the efficacy and consequences of Amendment 91. Alan Haynie (NMFS-AFSC) presented an NMFS-AFSC expanded discussion of Alternatives 3 and 4. Public testimony was provided by Ed Richardson (Pollock Conservation Cooperative), John Gruver (United Catcher Boats), Donna Parker (Arctic Storm), and Bubba Cook (World Wildlife Fund).

The initial review draft RIR/IRFA does not meet the minimum requirements mandated under Executive Order 12866 or the Regulatory Flexibility Act. Consequently it is not suitable for release for public review. Although the draft RIR/IRFA (page 1, paragraphs 4 and 5) includes a number of suggestions about the types of questions the Council would like to have addressed and the types of information that might need to be collected, the draft document does not articulate a formal problem statement. Under the E.O. and MSFCMA, it is the Council's responsibility to articulate a problem statement and the suite of alternatives to be addressed. Lacking this explicit guidance, the analysts were placed in the inappropriate role of defining the Council's interests in these regards. In turn, the lack of a problem statement precludes the SSC from conducting a meaningful assessment of the extent to which the proposed alternatives are relevant to the problem statement, whether they offer a sufficiently broad range of options, let alone whether the actual analysis of the alternatives is appropriate.

SSC rejection of this document should not be construed as a lack of support for data collection. To the contrary, the SSC's April 2009 report to the Council states (emphasis as in the original text):

> **… implementation of Amendment 91 should mandate preparation of annual reports that document PSC bycatch rates, Chinook bycatch transfer prices, quantities, dates, and parties of transfers, payments made in the FIP, and banked salmon PSC amounts in the SSIP. The annual reports should provide enough information to allow NMFS, the Council, and the SSC to judge performance, with respect to the ICA requirements specified in the PPA. In addition, the efficacy and consequences (e.g., inadequate performance of the ICA would trigger a consequence) of Amendment 91 should be subject to a thorough program review three to five years after implementation.**

In June 2009, in response to this advice, we were presented with a coarse outline of a data collection program. At that time, we wrote (emphasis as in the original text):

> The Council's purpose for the Chinook PSC Avoidance Data Collection Program is not clearly articulated. This has resulted in some ambiguity regarding the choice of metrics to assess program performance, with respect to that purpose, and identification of the data needed to address those metrics. The question is whether, in the Council's view, a functional Chinook PSC Avoidance Program is demonstrated by a simple reduction in Chinook PSC count in the AFA pollock fisheries or by an increase in net benefit to society. Data and analytic needs depend on which of these questions is central to the Council's purpose for program monitoring and evaluation. **The six sample analytic goals outlined in the discussion paper (page 3) could serve as a focus for refinement of the Council's purpose statement. The SSC notes that, while the discussion paper considers questions that address program effects on some aspects of the pollock fishery (e.g., incremental operating costs of compliance), it does not address questions that explore the broader extent to which PSC avoidance savings translate into increased returns of salmon to their streams of origin (and, thus, value to people and communities dependent on those returns), nor how Chinook PSC avoidance compliance may impact profitability, sectoral economic stability, operational size-sector competitiveness, and consolidation within the regulated pollock sectors.**

The SSC again affirms support for annual reports and other data collection programs designed to assess the efficacy and impacts of Amendment 91. The RIR/IRFA needs to identify the questions of interest to the Council and the range of alternatives for collecting data to address those questions. The Council's Bering Sea AFA Pollock Trawl Fishery Chinook Salmon Bycatch Motion suggests that a wide variety of impacts are of interest to the Council. For example: 1) does the presence of an IPA reduce Chinook salmon PSC to levels below what would be expected to result from imposition of a simple hard cap; 2) what additional costs are incurred by vessels to avoid Chinook salmon; 3) do the IPAs lead to avoidance of Chinook salmon at all levels of Chinook salmon abundance and pollock biomass; 4) do the IPAs lead to undesired changes in the relative market power of different AFA sectors or among members of AFA co-ops; 5) are the IPA incentives (rewards/penalties) sufficient to engender changes in fishing behavior that reduce Chinook salmon PSC below levels that would be achieved in absence of the incentives; and 6) do the IPA incentives lead to reductions in Chinook salmon PSC at the individual vessel level or only at the level of the co-op; etc. **The problem statement needs to clearly identify the questions of interest to the Council; those questions will dictate what information is needed for analyses; the data collection alternatives can then be structured as alternative approaches for generating the information needed to address the Council's questions.**

It is also a concern that, while the draft RIR/IRFA's implicit purpose is to address the effectiveness of Amendment 91 provisions to create incentives to avoid Chinook salmon, there is, as yet, no determination as to which, if any, segments of the fishery will operate under IPAs, nor is there a determination of which incentives will be built into IPAs that are adopted. Until these are publicly available, it is not possible for staff to structure analyses to characterize how the relative effectiveness of Amendment 91 economic incentives might be evaluated.

That said, the SSC expresses its appreciation to the analytical group members for their efforts in presenting the data and information needs, contained in the subject document package. While technically deficient as an RIR/IRFA, the information contained in the subject document could, if the Council desired, be released to the public as a discussion paper, following editorial changes to remove assertions and structures suggesting the document constitutes an RIR/IRFA. With these modifications, the paper might serve to facilitate more focused public discussion of the various data elements, and their potential applications, within the context of evaluating the performance of the Amendment 91 Chinook salmon PSC reduction program in the AFA pollock fishery.

As staff move forward with the development of a revised initial review draft RIR/IRFA, the AFSC appendix should be integrated into the analysis or formally appended to the draft document. In addition,

the SSC suggests that the alternatives be restructured to represent information needs for analyses ranging from qualitative to rigorously quantitative assessments of the impacts.

D-1 (b) Salmon Bycatch - Geiger-Pella report

Hal Geiger (St. Hubert Research Group) presented a summary of a report, co-authored with Jerome Pella, with recommendations for sampling Chinook salmon PSC in the Bering Sea pollock fishery to characterize their geographic origins. Such analysis requires that samples be representative of the bycatch, so the estimates of proportions of bycatch by geographic origin are not biased by the sampling design. The report recommends systematic random sampling with a constant sampling rate be used to select fish for genetic tissue samples from bycaught Chinook salmon (sampled onboard or at the dock or plant). The premise is that tissue sampling should mimic a simple random sample. as this is a key assumption of the statistical modeling used to analyze the data. Full funding for the genetic sampling was also recommended, which they note will likely require additional resources. **The SSC supports the use of systematic random sampling of salmon for genetic data, but questions the feasibility and necessity of applying a constant sampling rate across all samples.** It is unlikely that small deviations from a constant sampling rate will affect the results.

The report notes that under current regulations, a census of Chinook salmon bycatch should, in theory, be available. The NMFS response letter states that this is not currently possible. because of imperfect observer coverage, but that recent recommendations (Amendment 91) will make a census of Chinook bycatch in the BS pollock fleet possible in 2011.

Regarding genetic samples, the requirement of the proposed maximum likelihood and Bayesian analyses that the fish are a simple random sample from all bycaught salmon seems unnecessarily restrictive. The SSC encourages research to examine whether a hierarchical sampling design can be accounted for in the modeling. Models would become more complex, and Markov chain Monte Carlo (MCMC) algorithms will be more difficult to construct, but nevertheless, modeling should reflect the actual sample design and not some unrealized ideal design. The SSC encouraged future research on developing statistical models suitable for more general designs than simple random sampling.

The SSC notes that sampling and analysis should account for temporal (seasonal, inter-annual) differences in stock composition. It was also noted that there may be some implementation problems, as sampling is likely to work differently depending on vessel type: in some instances, it may be difficult to identify spatial and temporal strata when catches are mixed prior to genetic sampling. Finally, this sampling design and implementation will also need to be considered later in the context of characterizing chum salmon bycatch geographic origins.

D-2 (a) Annual Catch Limit (ACL) Requirements

Diana Stram (NPFMC) reviewed the process required to bring crab, scallop, and groundfish Fishery Management Plans into compliance with new Annual Catch Limit (ACL) requirements in the revised Magnuson-Stevens Reauthorization Act (MSRA). Grant Thompson (NMFS, AFSC) and Jack Turnock (NMFS, AFSC) presented overviews of technical analyses of two approaches that could be used to provide a buffer between ABCs and OFLs, based on scientific uncertainty in the estimate of OFL. Public testimony was provided by Leonard Herzog (Alaska King Crab Harvesters Cooperative).

The SSC reviewed three approaches to providing buffers between ABC and OFL in June 2009, but had insufficient lead time to provide meaningful recommendations on the technical analyses presented. Further analyses were conducted over the summer on two possible approaches. The SSC reviewed written documents and received summary presentations on the probability only (P*) approach and the decision-theoretic (DT) approach.

The P* approach is relatively simple and could be applied to any stock for which a reasonable estimate of the uncertainty in OFL is available. The challenge with this approach is to determine which sources of

uncertainty to include and how to properly quantify uncertainty. Once a probability distribution for OFL is constructed, ABC is simply selected such that the probability of overfishing (ABC > OFL) is less than some pre-specified probability P*, where P* must be less than 50%. The choice of an appropriate P* is a policy decision, but the SSC notes that several possible choices were explored in the analyses. First, analysts estimated the average value of P* that is implied by the current harvest control rules for groundfish. The estimated groundfish average (P* = 0.12) could provide a baseline for establishing an appropriate buffer between ABC and OFL in the crab and scallop FMPs, given that groundfish have been sustainably managed under these control rules. Second, the draft paper on *Setting Annual Catch Limits (ACLs) for BSAI and GOA Groundfish* presents a simple choice for P* that is based on past performance of the ABC-setting system (section 1.2.3 of the document). Third, the decision-theoretic approach (described below) could provide guidance on a suitable choice of P*, if a desired level of risk aversion can be specified.

The decision-theoretic approach is considerably more complex and much more challenging to implement. The approach finds the optimum fishing mortality F_{ABC} (and the corresponding buffer between F_{ABC} and F_{OFL}) given a pre-specified level of risk aversion. The required policy choice in this approach is the choice of a desired level of risk aversion. Similar to the P* approach, the choice of an appropriate level of risk aversion could be based on the level implied by our current groundfish harvest control rules (estimated average absolute risk aversion = 0.4). Alternatively, methods exist to identify the level of risk that managers or the public may be willing to take. The SSC appreciates the clear description of this approach and the examples provided by the analyst.

In addition, presentations were received on applications of both the P* approach and the DT approach to several data-rich crab stocks (paper by Punt, et al.), and an application of the P* approach to several Tier 4 crab stocks (i.e., stocks without an assessment). The application of the DT approach to Bristol Bay and Norton Sound red king crab and St. Matthew Island blue king crab resulted in an optimum fishing mortality that was very close to F_{OFL} ($0.95*F_{OFL}$ or larger, implying a very small buffer) under three very different levels of risk aversion. The small buffer size (in spite of considerably uncertainty in the assessments) and the fact that the same buffer size was chosen regardless of the level of risk aversion seems counterintuitive. Moreover, these results appear to be at odds with analytical results (using a simpler and less realistic model), which show much larger optimal buffer sizes, in spite of comparable levels of uncertainty. The small buffer sizes of the Punt, et al. analysis may be a result of using the sloping control rule within the model simulations, and the particular recruitment assumptions made in the model (Andre Punt, pers. comm.). Clearly, additional simulations would be needed to evaluate the use of the DT approach with "typical" assessment models.

A presentation was given on sources of uncertainty in Tier 4 crab stocks and an application using the P* approach to evaluate (1) buffer sizes implied by a pre-specified P* and (2) P* values implied by fixed buffer sizes. Results suggested considerable variability in the probabilities of exceeding OFL (P*) corresponding to a fixed buffer (ABC = 0.75*OFL), ranging from 0.3 to 0.7 under different assumptions about the levels of uncertainty in biomass estimates and M. The results for blue king crab imply a probability of exceeding OFL that is larger than 50%, even with ABC = 0.75*OFL. This implies a highly skewed distribution of OFL, with a specified OFL that is much higher than the median. The SSC suggested that, for these Tier 4 stocks, it may be most appropriate to set the OFL equal to the median of its distribution, to ensure that any ACL set below the OFL has less than a 50% chance of exceeding OFL (by definition).

The SSC concurs with the crab plan team (CPT) recommendation that analyses for the upcoming crab FMP amendments should focus on the P* approach. Our rationale for this recommendation is as follows:

- The P* approach is more readily understood than the DT approach by stock assessment scientists, managers, and the general public.
- The P* is easily implemented for both data-rich and data-poor stocks, while the DT approach may be impracticable for many of our stocks with complex, age-structured assessments.

- The DT approach may be inconsistent with NS1 guide lines as written, which seem to imply an approach similar to the P* approach: *"ABC should be based, when possible, on the probability that an actual catch equal to the stock's ABC would result in overfishing. This probability that overfishing will occur cannot exceed 50 percent and should be a lower value."*

The joint groundfish/crab plan team made a number of additional recommendations regarding ACL compliance. The SSC concurs with these recommendations, as reflected in the joint plan team minutes, and offers these additional recommendations and comments:

- For groundfish, the SSC recommends that the FMPs be modified to document how current buffers built into each Tier are adequate to meet the requirements of the NS1 guidelines. However, additional improvements that explicitly link uncertainty to the buffer between ABCs and OFLs should be explored in the future.

- As recommended by the teams, a range of P* values and buffer sizes should be considered in the crab ACL analysis (i.e., P* values corresponding to a fixed buffer size and buffer sizes corresponding to a given P*). The SSC notes that a constant buffer approach, while intuitively appealing and easier to implement, does not explicitly link the buffer to scientific uncertainty specific to a given stock assessment, and may not fully satisfy the requirements of the National Standard 1 guidelines.
- Where possible, for Tier 1-3 stocks, key sources of uncertainty should be considered. For example, uncertainty in natural mortality M, if it is estimated independently, could be included in the model by specifying a CV for M or using a set of alternative M values with pre-specified probabilities in the assessment.

- Uncertainty about model structure should be considered for Tier 1-3 stocks. While a model averaging or similar approach is beyond the scope of the SSC's review, a number of stocks exhibit consistent retrospective patterns, such as a consistent overestimation of current biomass in Bristol Bay red king crab and Norton Sound red king crab. This introduces additional uncertainty (and bias) in the model-generated estimates of B, which should be accounted for when determining an appropriate buffer. The PT minutes reported that the PFMC plans to estimate uncertainty in model structure by conducting a retrospective analysis of spawning stock biomass on a common date (5 years ago).

- The SSC recommends that the ACL uncertainty adjustment should be based on sources of uncertainty that the authors have a reasonable chance of quantifying. The NPFMC has always promoted the use of clear and transparent analytical approaches to management. Attempting to add unspecified adjustments, based on the Delphi method (a structured process for collecting and distilling knowledge from a group of experts, in this case the PT), could lead to confusion and debates about methodology and the size of the proposed adjustment. The SSC suggests development of a process for bringing forward proposals for initial or additional uncertainty adjustments that includes a repeatable, quantitative method to making the estimate. If an added buffer for unquantifiable sources of uncertainty is considered, then a method for estimating the buffer should be derived that does not only rely on the analyst's or PT's opinion.

- The SSC re-iterates our June 2009 recommendation to stock assessment authors that, if harvest strategies are modified to explicitly incorporate uncertainty in the buffer between OFL and ABC, then authors should strive to select the "best estimate" for parameterizing models and not precautionary estimates.

- With regard to Tier 4 crab stocks, the SSC notes that sources of uncertainty that affect the estimation of uncertainty in OFL may not be independent, for example, natural mortality estimates may be confounded with estimates of biomass and biomass reference points. In such cases, appropriate multivariate distributions should be specified for the joint distribution of these parameters.

- As a check on the Tier 4 approach for crab stocks, the SSC suggests comparing results from the P*-based approach to determining buffer sizes between a Tier-4 type analysis and a Tier-3 type analysis for at least one of the Tier 3 stocks.
- For Tier 5 crab stocks, only catch series are available. Uncertainty in the average catch (e.g., a function of the SE of mean), as well as uncertainty in the time period over which catches are averaged should be considered. For example, different periods in the time series could be weighted differently to arrive at an appropriate average of the stocks productive capacity as a proxy for OFL and the associated uncertainty.
- With respect to the scallop FMP, a Tier 5-type approach, as described above for crab, could be used to determine an appropriate level of uncertainty in OFL.
- For scallop and other species where an overall OFL is set with area-specific ABC apportionments, some clarification may be needed on the relationship between the area-specific ABCs and the overall buffer between total ABC and OFL.
- Regarding the analyses of different options to consider by the Council, the SSC suggests that a simplified management strategy evaluation (MSE) approach could be implemented. Simplified stock dynamics could be simulated as a basis for assessing different buffers and P* values. For example, stock dynamics could be simulated using a simple surplus production approach as described in Appendix 3 of the Pribilof Island Blue King Crab assessment.

Vulnerability analysis

Paul Spencer (NMFS AFSC) and Jane DiCosimo (NPFMC) presented a report on a vulnerability analysis authored by O. Ormseth (NMFS AFSC). The report summarized results from a 2008 NOAA work group on preparation for the ACL-related amendment to the BSAI and GOA FMPs. The report provides an analysis of vulnerability, based on rankings for stock productivity and susceptibility to fishing. The purpose of the analysis was to identify those stocks currently in the FMP that may be candidates for assignment to the "ecosystem component" category and, alternatively, to identify stocks not in the FMP that may best be categorized as "in the fishery." Public testimony was provided by Jon Warrenchuk (Oceana).

The SSC supports the groundfish plan teams' recommendation that the Council's ACL analysis consider:

1) listing all present target stocks, as well as sharks, skates, squids, sculpins, and octopods as "in the fishery", so as to be subject to ACL and status determination criteria; alternatively, consider listing those same stocks as in the fishery, with the exception that squid and octopods be placed in the ecosystem component category;
2) placing all prohibited species and forage fish in the ecosystem component category.

The SSC also supports delaying consideration of grenadier species, because a follow-on FMP amendment is already scheduled and will require a more complicated consideration of management measures in the analysis than would be practical to include in the current amendment.

The SSC suggests that the analysis for the immediate groundfish FMP amendment package for ACLs:

1. Include an analysis of potential impacts on stocks moved to the EC category, and provide clarification on the conservation measures (i.e., catch controls) that would be in place for EC stocks.
2. Include consideration of management measures, such as "allowable incidental catch" thresholds, for EC stocks.
3. Consider adding a 3rd axis to the vulnerability analysis to incorporate a ranking of ecosystem importance. For example, stocks might be ranked on the basis of whether they play a keystone

role, form habitat (e.g., corals and sponges), or are an essential component in the trophic structure. The SSC noted that mean trophic level was a factor under "productivity attributes." Potentially, trophic level could be moved to the list of attributes that might form the 3rd axis.

D-2 (d) Five-Year Research Priorities: 2010-2014

The SSC has identified priorities for research in the next 1 to 5 years as those activities that are the most important for the conservation and management of fisheries in the Gulf of Alaska, Aleutian Islands, eastern Bering Sea, and Arctic. This listing of priorities is intended for two purposes: 1) to meet the requirements of the revised Magnuson-Stevens Act for the Councils to identify research that is needed in the next 5 years, and 2) to provide guidance on research priorities to the research community and to funding agencies.

The research priorities are separated into two categories: immediate concerns and ongoing needs. Immediate concerns include activities that must be addressed to satisfy federal requirements and to address pressing fishery management and ecosystem issues related to fishery management. Ongoing needs include research to advance the Council's fisheries management goals, as defined in the Groundfish PSEIS, other strategic documents of the Council (i.e., FMPs, AI FEP, and EFH, crab, salmon bycatch, and other EISs) and NMFS. Ongoing needs also include efforts on which the assessment models depend for their annual updates. For example, without the survey information, the annual process of setting ABCs and OFLs for the managed stocks would be compromised. The SSC sees these efforts as needed on an ongoing basis, and constituting the time series on which management is based. It should be recognized that research in these categories is being conducted or may be conducted through Federal, State of Alaska, North Pacific Research Board, and other funding sources.

The research priorities are listed in an appendix to this report.

Public testimony was provided by Dorothy Childers (AMCC).

D-2 (e) HAPC Evaluation Criteria

Diana Evans (NPFMC) gave an overview of the HAPC process and concerns raised on the HAPC Criteria used to rank proposed HAPC sites. In an effort to address these concerns, a working group was formed and HAPC criteria were revised. The SSC commends the working group for identifying concerns with the ranking process and revising the HAPC criteria. The SSC agrees with the Plan Team that the criteria for habitat 'Sensitivity' will require refinement and clarification. The SSC supports the plan teams' suggestion that "structure" should be clarified as referring to three–dimensional structure. The SSC workgroup will integrate Plan Team comments and examine the draft document in greater detail to provide comments at the February 2010 Council meeting.

D-3 Three-year Charter Halibut Logbook Review

Jane DiCosimo (NPFMC) introduced this agenda item. Scott Meyer (ADF&G) provided a review of the charter logbook data evaluation report. There was no public testimony.

The SSC commends the analysts for an excellent report that address several questions raised by the SSC in our previous review of the charter logbook program. Agreement between the charter logbook data, Statewide Harvest Survey (SWHS), creel survey, and end-of-season surveys has improved through time. This lends confidence to information derived from the charter logbooks. **The SSC concurs that the logbook data offers clear advantages, relative to the SWHS, for timeliness and trip-level linkages between charter vessels and individual anglers, while the other data sources identified supplement and provide context for effective management.** The SSC encourages additional research into the significance in differences between logbook records that are submitted with required deadlines and late records. We look forward to reviewing updates of this report, as they become available.

Appendix A. Five-Year Research Priorities: 2010-2014

The SSC has identified priorities for research in the next 1 to 5 years as those activities that are the most important for the conservation and management of fisheries in the Gulf of Alaska, Aleutian Islands, eastern Bering Sea, and the Arctic. This listing of priorities has two purposes: 1) to meet the requirements of the revised Magnuson-Stevens Act for the Councils to identify research that is needed in the next 5 years, and 2) to provide guidance on research priorities to the research community and to funding agencies.

The research priorities the SSC has identified are separated into two categories: immediate concerns and ongoing needs. Immediate concerns include activities that must be addressed to satisfy federal requirements and to address pressing fishery management and ecosystem issues related to fishery management. Ongoing needs include research to advance the Council's fisheries management goals as defined in the Groundfish PSEIS, other strategic documents of the Council (i.e., FMPs, AI FEP, and EFH, crab, salmon bycatch, and other EISs) and NMFS. Ongoing needs include efforts on which the assessment models depend for their annual updates. For example, without the survey information, the annual process of setting ABCs and OFLs for the managed stocks would be compromised. The SSC sees these efforts as needed on an ongoing basis, and constituting the time series on which management is based. It should be recognized that research in these categories is being conducted or may be conducted through Federal, State of Alaska, North Pacific Research Board and other funding sources.

Immediate Concerns

I. Fisheries

A. Fish and Fisheries Monitoring

1. Non-recovering stocks. A pressing issue is why stocks have declined and failed to recover as anticipated (e.g., Pribilof Island blue king crab, Adak red king crab). Research into all life history components is needed to identify population bottlenecks, an aspect that is critically needed to develop and implement rebuilding plans.
2. Continue efforts to design and implement an improved observer delivery program that allows accurate and precise estimation of the catch by season and sector, including expansion of the program to previously unobserved vessels. (Also see Strategic Priority II.A.1).
3. Improvements are needed in in-season catch accounting for crab in non-directed fisheries with high incidental catch rates.
4. Improve species identification in catches by both processors and observers for priority species within species complexes. Methods that quantify and correct for misidentifications are desired.

B. Stock Assessment

1. Develop a size-based stock assessment model of Tanner crab, in order to provide appropriate scenarios for evaluating and selecting a rebuilding strategy.

C. Fishery Management

1. Analyses are needed of the magnitude and distribution of economic effects of salmon avoidance measures for the Bering Sea pollock fishery. In this case, it is important to understand the ability of pollock harvesters to adapt their behavior to avoid Chinook and “other” salmon PSCs, under various economic and environmental conditions and incentive mechanisms.
2. An evaluation is needed of economic effects from the recently adopted crab rationalization program on Gulf of Alaska coastal communities, including Kodiak. This includes understanding

the economic impacts (both direct and indirect impacts) and how the impacts are distributed among communities and economic sectors; conducting qualitative research to assess changes in community participation and effort in fisheries; and estimating net economic benefits.

3. As Kodiak is likely to be at the center of controversy over the probable consequences of Gulf rationalization, research should be designed to use Kodiak, in addition to other Gulf communities, as a case study in prospective analyses of the potential effects of Gulf rationalization options on fishing behavior, participation, and economic impacts.

II. Fisheries Interactions

A. Protected species

1. There is a need for studies of localized fishery-protected species interactions. 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, ice seals, northern fur seals, spectacled eider, Steller's eider, and 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, seabirds, and the impact on benthic habitat and fauna) by bottom contact gear.

2. Further research is needed on gear modifications and fishing practices for reducing bycatch, particularly of PSC species (e.g., salmon).

III. Habitats

A. Evaluate habitats of particular concern:

1. Assess whether Bering Sea canyons are habitats of particular concern, by assessing the distribution and prevalence of coral and sponge habitat, and comparing marine communities within and above the canyon areas, including mid-level and apex predators (such as, short-tailed albatrosses) to neighboring shelf/slope ecosystems.

2. Assess the extent, distribution, and abundance of important skate nursery areas in the EBS, to evaluate the need for designation of new HAPCs.

B. Baseline Habitat Assessment

1. Dynamic ecosystem and environmental changes in the northern Bering Sea and Arctic are occurring on a pace not observed in recorded time . Given the potential for fishery expansion into the northern Bering Sea, as well as considerations associated with the new FMP for the Arctic, assessment of the current baseline conditions is imperative. This effort, while of great scientific importance, should not supplant the regular surveys in the BSAI and GOA, which are of critical importance to science and management.

Ongoing Needs

I. Fisheries

A. Fish and Fishery Monitoring

1. Continuation of State and Federal annual and biennial surveys in the GOA, AI, and EBS, including BASIS surveys and crab pot surveys, is a critical aspect of fishery management off Alaska. It is important to give priority to 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, abundance, and life history 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 commercial groundfish fisheries off Alaska.

2. Plan and implement routine surveys into the northern Bering Sea and conduct baseline surveys of the Arctic Ocean. These surveys will become increasingly important under ongoing warming ocean temperatures, because range expansions of harvested fishery resources are anticipated. If range expansions occur, data will be needed to adjust standard survey time series for availability.
3. Continue and expand cooperative research efforts to supplement existing surveys, to provide seasonal or species-specific information for use in improved assessment and management. The SSC places a high priority on studies that provide data to assess seasonal diets and movements of fish and shellfish, for use in studies of species interactions in spatially explicit stock assessments.
4. For groundfish in general, and rockfish in particular, continue and expand research on trawlable and untrawlable habitat, to improve resource assessment surveys. For example, improved surveys, such as, hydro-acoustic surveys, are needed to better assess pelagic rockfish species, including GOA POP stocks.
5. Studies are needed to evaluate the effects of environment on survey catchability. For crabs, studies are needed on catchability as it directly bears on estimates of the stock size for setting of catch quotas. Research to refine the estimates of survey catchability, q, used to infer absolute, rather than relative abundance would substantially improve the quality of management advice. Particular emphasis should be placed on snow and Tanner crab, because of recent trends in stock status.
6. Continue research on the design and implementation of appropriate survey analysis techniques, to aid the Council in assessing species that exhibit patchy distributions and, thus, may not be adequately represented (either over or under estimated) in the annual or biannual groundfish surveys.
7. There are needs to improve biological data collection (e.g., age, size, maturity, and sex) of some bycatch species (e.g., sharks, skates, octopus, squid, sculpins, and grenadiers) to better quantify potential effects of bycatch on these stocks.
8. Advance research towards developing a quantitative female reproductive index for the surveyed BSAI crab stocks. The current stock-status assessment process for surveyed BSAI crab stocks uses the estimated mature male biomass at the presumed time of mating as the best available proxy for fertilized egg production. Research on mating, fecundity, fertilization rates, and, for snow and Tanner crab, sperm reserves and biennial spawning, is needed to develop annual indices of fertilized egg production that can be incorporated into the stock assessment process and to model the effects of sex ratios, stock distribution, and environmental change on stock productivity. Priority stocks for study are eastern Being Sea snow and Tanner crab and Bristol Bay red king crab.
9. Continue and expand existing efforts to collect maturity scans during fisheries that target spawning fish.
10. Identification and recovery of archived data (e.g., historical agency groundfish and shellfish surveys) should be pursued. Investigate integrating these data into stock and ecosystem assessments.

B. Stock Assessment

1. Refine methods to incorporate uncertainty into harvest strategies for groundfish, crab, and scallops for ACL estimation.
2. Improve handling mortality rate estimates. Improved understanding on the post-release mortality rate of discarded crab from directed and non-directed crab pot fisheries, and from principal

groundfish (trawl, pot and hook and line) fisheries is required. The magnitude of post-release mortality is an essential parameter in the determination of total annual catch, used to evaluate overfishing and in stock assessment and projection modeling (e.g., assessing discard mortality rates of Tanner crab by size, month, sex, and fishery type).

3. Improve information (specifically, natural mortality, size at maturity, and other basic indicators of stock production/productivity) for "other species" and data-poor stocks of crab, to allow application of Tier 5 or Tier 4 assessment criteria. Two possibilities that would 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. Little information is available, especially for sculpins, skates, octopuses, squids, grenadiers, and some sharks.
4. Collect data to improve natural mortality (M) estimates. Estimates of M (obtained independently from models) are needed for several stocks, including Pacific cod and BSAI crab stocks.
5. Studies are needed to validate and improve age determination methods for Pacific cod and spiny dogfish.
6. Quantify the effects of historical climate variability and climate change on recruitment and growth and develop standard environmental scenarios for present and future variability, based on observed patterns. There is also a clear need for information that covers a wider range of seasons than is presently available.
7. There is a need for the development of advanced stock assessment modeling techniques. Specifically, there is a pressing need to develop techniques for linking uncertainty into stock assessments, including both scientific uncertainty (measurement error, process error or model misspecification) and implementation error (enforcement and catch monitoring).
8. There is a need for the development of projection models to evaluate the performance of different management strategies, relative to the Council's goals for ecosystem approaches to management. Projection models are also needed to forecast seasonal and climate related shifts in the spatial distribution and abundance of commercial fish and shellfish (see Strategic Priority IV.A.1.a "Climate variability" below for more detail).
9. 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, arrowtooth flounder, Pacific ocean perch, black spotted rockfish, and rougheye rockfish, and Atka mackerel (see element 5 in Expanded Ecosystem Studies below). Specific issues include: a) an evaluation of the location of potential boundaries for an AI – EBS split that would be needed to assess the implications of the creation of a separate Aleutian Island management area, and b) stock delineation for estimation of adult equivalence, to appropriately account for the impact of salmon PSCs in pollock fisheries on salmon populations.
10. Determine if discrete scallop beds along the GOA coast from Lituya Bay to Kodiak Island are reproductively isolated units or if upstream areas are a significant source of scallop recruitment via larval advection and subsequent settlement in downstream areas.
11. Continue whale depredation studies to improve the quality of longline survey estimates.

C. Fishery Management

1. Evaluate the effectiveness (e.g., potential for overharvest or unnecessarily limiting other fisheries) of setting ABC and OFL levels for data-poor stocks (Tier 5 and 6 for groundfish and Tiers 4 and 5 for crab) (e.g., squid, octopus, shark, sculpins, other flatfish, other rockfish, skates, grenadier, and crab). Research is needed to refine the basis for setting gamma for Tier 4 crab stocks.

2. Develop forecasting tools that incorporate ecosystem indicators into single or multispecies 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.
3. Development of an ongoing database of product inventories (and trade volume and prices) for principal shellfish, groundfish, and salmon harvested by U.S. fisheries in the North Pacific and Eastern Bering Sea.
4. Analyze current determinants of ex vessel, wholesale, international, and retail demands for principal seafood products from the GOA and BSAI;
5. Conduct pre- and post-implementation studies of the benefits and costs, and their distribution, 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.
6. Conduct prospective analyses of the robustness and resilience of alternative management strategies under varying environmental and ecological conditions.
7. Conduct 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).
8. Develop a framework for collection of economic information on commercial, recreational, and charter fishing, as well as fish processing, to meet the requirements of the MSFCMA sections 303(a)(5, 9, 13), 303(b)(6), and 303A.

II. Fisheries Interactions

A. Catch Estimation Issues

1. Improve estimation of catch of, and other fishery interactions with, marine mammals (e.g., state-managed gillnet fisheries), seabirds, non-target crab and groundfish (e.g., sharks, skates), and protected species. Improved methods should include direct and alternative monitoring options (e.g., electronic logbooks, video monitoring), particularly on smaller groundfish, halibut, and commercially guided recreational fishing vessels.

B. Protected Species Interactions

1. Population dynamics, life history, and assessment of protected species, particularly Steller sea lions and northern fur seals, are a high priority. In particular, investigation of factors contributing to changes in natality of Steller sea lions is an important area of research.
2. Economic, social, and cultural valuation research on protected species (i.e., non-market consumptive use, passive use, non-consumptive use).

III. Habitat

A. Habitat Mapping

1. Improved habitat maps (especially, benthic habitats) are required to identify essential fish habitat and distributions of various substrates and habitat types, including habitat-forming biota, infauna, and epifauna.
2. Begin to develop a GIS relational database for habitat, including development of a historical time series of the spatial intensity of interactions between commercial fisheries and habitat, which will

be needed to evaluate impacts of changes in EFH on the growth, reproduction, and distribution of fish and shellfish.

3. Assess the extent of the distribution of Primnoa corals in the GOA.

B. Function of Habitat

1. Evaluate relationships between, and functional importance of, habitat-forming living substrates to commercially important species, including juveniles.
2. Develop a time series of the impact of fishing on GOA, AI, and EBS habitats that could be used to assess: a) the impact of changes in management on the rate of habitat disturbance, and b) the impact of habitat disturbance on the growth, distribution, and reproductive success of managed species.
3. Evaluate effects of fishing closures on benthic habitats and fish production. There are many closures that have been in effect for various periods of time, for which evaluations have not been conducted. A recent example includes slope HAPCs designated in the western Gulf of Alaska.

IV. Other areas of Research Necessary for Management

A. Expanded Ecosystem Studies

1. Environmental influences on ecosystem processes

a) Climate variability: Changes in ocean temperature may affect managed species, upper level predators, and lower trophic levels.

(1) Sea ice: If recent changes in ice cover and temperatures in the Bering Sea persist, they may have profound effects on marine communities. Development and maintenance of indices of the timing and extent of the spring bloom is a high priority. For this, maintenance of moorings, especially M-2, is essential.

(2) Zooplankton production: 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 commercial species, such as pollock, as well as the ESA listed North Pacific right whale.

(3) NMFS and BSIERP scientists should evaluate EBS survey data collected in 2008 during the summer trawl survey, acoustic surveys, and the BASIS cruises to assess whether these surveys will provide reliable estimates of zooplankton species composition and abundance for the Eastern Bering Sea. Evaluate the potential of collaborative research with Japanese and Russian investigators, to assess species composition and abundance in samples archived abroad.

(4) Fish composition: NMFS and BSIERP scientists should complete proposed analysis of existing data sets (bottom trawl surveys, acoustic trawl surveys, and BASIS surveys) 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.

(5) Assess the movement of fish, to understand the spatial importance of predator-prey interactions in response to environmental variability.

b) Ocean acidification: changes in pH may affect managed species, upper level predators, and lower trophic levels.

2. Trophic interactions.

   a) Diet information, from seasons in addition to summer, is needed to assess spatial and temporal changes in predator-prey interactions, including marine mammals and seabirds. The diet information should be collected on the appropriate spatial scales for key predators and prey to determine how food webs may be changing, in response to shifts in the range of crab and groundfish.

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