North Pacific Fishery Management Council

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Certified: _Ila Bendf_
Date: _8/23/13_

SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
June 3rd –5th, 2013

The SSC met from June 3rd through 5th at Centennial Hall, Juneau, AK.

Members present were:

Robert Clark, Vice Chair
Alaska Department of Fish and Game

Jennifer Burns
University of Alaska Anchorage

Alison Dauble
Oregon Dept. of Fish and Wildlife

Sherri Dressel
Alaska Department of Fish and Game

Anne Hollowed
NOAA Fisheries—AFSC

George Hunt
University of Washington

Gordon Kruse
University of Alaska Fairbanks

Seth Macinko
University of Rhode Island

Steve Martell
Intl. Pacific Halibut Commission

Franz Mueter
University of Alaska Fairbanks

Lew Queirolo
NOAA Fisheries—Alaska Region

Terry Quinn
University of Alaska Fairbanks

Kate Reedy-Maschner
Idaho State University Pocatello

Farron Wallace
NOAA Fisheries—AFSC

Members absent were:

Pat Livingston
NOAA Fisheries—AFSC

B-1(b, c) Plan Team nominations

The SSC reviewed the Plan Team nominations of Jan Rumble to the Gulf of Alaska Groundfish Plan Team and Elizabeth Chilton to the Bering Sea and Aleutian Islands Groundfish Plan Team. The SSC finds both of these individuals to be well qualified, with appropriate expertise that will assist each of the Plan Teams. The SSC recommends that the Council approve these nominations.

B-7 SSL BiOp analytical methods

Doug DeMaster (NMFS AFSC) presented an update on the SSL BiOp methods, Brandee Gerke (NMFS AKR) presented a review of the preliminary analyses of the PPA and alternatives in the SSL EIS, and Melanie Brown (NMFS AKR) commented on how the process will move forward. Public testimony was received from John Gauvin (Alaska Seafood Cooperative).

At the April 2013 meeting, the SSC requested additional details on several methods that will be used in the 2014 BiOp. Documents on the methods were provided for our review and staff gave an overview at this meeting. In addition, staff presented an evaluation of the PPA identified by the Council at the April meeting, status quo (Alternative 1), and the protections in place prior to 2011 (Alternative 4). Staff also

addressed SSC concerns raised at the April 2013 meeting. The SSC greatly appreciates staff time taken to outline the methods and analyses at this meeting. The presentations were very clear, and helped the SSC to understand the new methods that will inform the BiOp and the Council as it moves to select an alternative that will not cause a JAM finding. The SSC acknowledged that the lack of clear guidelines and metrics, against which to judge the likelihood of a JAM finding, remains problematic. The time already invested in addressing prior comments by the SSC, Council, and external reviewers of the PDEIS and the 2010 BiOp is appreciated. The presentations and preliminary analyses have already improved the process relative to previous versions that have come before the Council.

BiOp Methods Update
Dr. DeMaster's presentation on the BiOp methods included a presentation of the agTrends (Johnson and Fritz, in press) method being used to estimate population trends and to inform PVAs and projections of future population size and extinction risk. This method allows for an analysis of trends over space and time, accounts for survey methodology changes, allows for post-hoc aggregations of different regions of interest, and facilitates forecasting population size and extinction risk. The methods and data are available as an online R package. The SSC had questions relative to the extent (temporal and spatial) of missing data, what changes in survey methodology occurred, why count variance was fixed at a very low value in the observation model when no estimate was available, and which environmental parameters were included in the model as covariates.

Relative to observed/reported trends in SSL populations in the various wDPS subregions, the SSC encourages the analysts to consider underlying ecosystem differences east and west of Samalga Pass, and whether there was a change in population trajectories in association with the environmental shift that occurred around 2005/2006 in the Bering Sea. The SSC also recommends consideration of killer whale predation, and of declines in other marine mammals and seabirds (e.g., harbor seals and cormorants), which may shed light on whether population trends are more closely associated with fisheries or ecosystem effects. **The SSC appreciates the difficulty of separating environmental and potential ecosystem effects from effects of recent management actions, but encourages a continued effort, particularly to the extent that these efforts inform projections of future SSL population abundance.**

More broadly, the SSC is interested in acquiring data needed for adequate testing of the null hypothesis, that fishing is not impacting the SSL population, and hearing what conditions would be required for authors to reach such a conclusion. To date, research results have failed to show significant correlations between regional fish biomass, fish catch, and SSL abundance and productivity, but power analyses of these results have not yet been conducted. The SSC is encouraged by the analysts' plans to use simulated data with a realistic correlation structure to evaluate the ability to detect an effect with current monitoring protocols, and looks forward to seeing such analyses in the BiOp.

The presentation on changes in frequency of occurrence (FO) of selected prey items (Sinclair et al. 2013) was also appreciated. The SSC agrees with the analysts that FO provides the most appropriate measure for the EIS and BiOp, due to its wider temporal and spatial coverage. The caveats pertaining to these data are clearly and concisely stated. Results from the planned comparison between scat and trawl FO data, in combination with reported changes in diet as judged from the scats, will be relevant to the BiOp's conclusions about overlap between SSL and fisheries. Updated information on the overlap between size classes in SSL diet and trawl catches is encouraged; such comparisons might provide insight into any expected lags between changes in fish biomass, SSL prey availability and trends, and harvest rates. **This effort would be strengthened if groundfish surveys were conducted within and outside of critical habitat at a spatial resolution that would provide sufficiently precise biomass estimates in both regions. The SSC notes that multiple requests for seasonal prey surveys within critical habitat have been made. We strongly encourage such surveys in the future.**

The new method for analyzing SSL movement patterns by interpolating position data and accounting for proportion of time hauled out will certainly improve habitat use models; however, the underlying dataset is based on only a few individuals and remains heavily biased towards nursing/dependent juveniles, with limited representation of the movement patterns of adult females. No data are available for adult males, subadult males and females, or newly independent juveniles. **Thus, extrapolating habitat use patterns for the overall population will remain problematic, and the limitations of the extant data must be clearly identified in the BiOp.**

Questions about the extent and impact of movement of individual sea lions between rookeries and haulouts within wDPS regions, and between the wDPS and the eastern DPS and Russian populations were raised in SSC discussions and in public testimony. These movements, as detected by brand resightings, appear to be undertaken mostly by juvenile animals, and the impact of such movements on stock structure and/or population trends was not clear in the presentation or in the documentation provided. **The SSC recommends that the discussion of such movements in the BiOp carefully consider the impact of whether such movements represent permanent emigration and/or temporary wanderings by juveniles.**

Initial evaluation of the Alternatives

Since April 2013, the Council has identified its PPA (now Alternative 5), and the EIS has been released for public comment. Due to the fast timeline, with the Council scheduled to take final action on the PPA at the October 2013 meeting, the Protected Resource Division (PRD) took this opportunity to discuss with the SSC their assessment of the potential impacts of the alternatives and the performance standards that will be used to assess JAM. Some of the identified performance standards have been modified in response to public comments and external reviews of the 2010 BiOp. These analyses are ongoing, and final impact assessments will be included in the 2014 BiOp.

The review of potential impacts of the alternatives focused on the differences in protections offered to SSLs in regions 541, 542, and 543 under Alternative 1 (status quo, protective measures put in place under the 2011 interim rule), Alternative 4 (roll back of protections to the pre-2011 status), and Alternative 5 (the PPA). The focus of the analysis was on the impact of the indirect effects of fisheries removal, which was qualitatively assessed as a relative increase/decrease in fish taken under different scenarios. The impact of the planned changes in harvest amounts, timing, and location was assessed for Atka mackerel, Pacific cod (trawl- and non-trawl) and pollock, separately. The BiOp will consider the cumulative effects of the combined changes in fishing policy, and will include a more qualitative assessment of whether policy changes are 'more' or 'less' protective relative to status quo. These analyses are not yet available for review. **The SSC looks forward to seeing the evaluation of the combined effects of all planned fishing changes under the PPA.**

Under alternatives that open currently closed areas to fishing, the PRD is assessing impacts by evaluating the proportion of the historical catch that came from the area, and assuming that a similar proportion of the future TAC would be similarly distributed. **The SSC notes that this metric may be less than optimal for species that have highly variable distributions in space and time, and catch may not reflect local exploitation rates, for species such as Atka mackerel. The SSC encourages the analysts to consider other data sources (such as fish tag data) that may be used to estimate stock biomass.** This is another area where appropriately designed surveys of fish abundance, inside and outside critical habitat, would assist management.

C-1 BSAI Crab

At this meeting, the SSC is providing the OFL/ABC recommendations for four crab stocks (Tables 1 and 2). We also provide modeling advice on EBS snow and Tanner crab, and Bristol Bay red king crab, and recommendations on a variety of other issues. Diana Stram (NPFMC) and Jack Turnock (NMFS AFSC) presented Crab Plan Team (CPT) recommendations for these four stocks, model reviews, and CPT

discussions on a variety of other issues. Public testimony was provided by Dave Fraser (Adak Community Development Corp.).

Handling Mortality

The CPT provided a summary of reflex action mortality predictor (RAMP) studies to estimate short-term handling mortality of snow, Tanner, and king crab in the eastern Bering Sea. The issue of handling mortality is of particular concern for the snow crab fishery, in which one crab is discarded for every three retained. The RAMP predicted that mean short-term handling mortalities for the 2010/11 and 2011/12 fisheries were 4.6% and 4.5%, respectively. Vessel-specific handling mortality was found to be negatively correlated with back-deck temperatures; for example, short-term mortality rates increase to 35% at -14 degrees C. Using St. Paul airport temperature as a proxy for back-deck conditions, the estimated mean mortality rate for the 1990/91 through 2010/11 fishing seasons was 4.0%; the highest seasonal estimate was 8.0% during one season in the early 1990s. However, these mortality rates do not address additional long-term mortality, so total handling mortality is unknown.

Based on these results and subsequent discussions, the CPT recommended reducing the current value used in calculations involving total handling mortality from 0.5 to 0.3, derived by adding the highest annual short-term estimate (0.08) to the highest injury rate (0.12), and multiplying this sum by 1.5 under the assumption that long-term mortality contributes an additional mortality equal to 50% of the short-term mortality rate. The CPT did not recommend any changes to the handling mortality estimates used for Tanner and king crabs because no new information was provided on Tanner crab and the RAMP approach does not appear to be useful for golden and red king crab.

When conducting the next snow crab assessment, **the SSC requests that the stock assessment authors present fits of the base model using (1) total handling mortality estimates of 0.5 (status quo), (2) 0.3 (Team recommendation), and (3) a "best" estimate of total handling mortality derived by adding the average annual short-term estimate (0.04) to the average injury rate, and multiplying this sum by a factor corresponding to the best guess of additional long-term mortality.** The SSC also requests inclusion of an appendix on recent RAMP studies in the snow crab SAFE chapter. The appendix should include a brief review of previous studies on handling mortality, including work by Carls and O'Clair, Warrenchuk and Shirley, and modeling by van Tamelen. Laboratory studies on red king crab and Tanner crab by Carls and O'Clair indicated that delayed mortality was experienced at relatively high rates during the molt following cold air exposure for one of these two species. Such delayed effects should be considered and discussed when judging the relative contribution of long-term vs. short-term handling mortality rates.

Finally, we encourage further research on long-term mortality of bycatch and a better evaluation of inter-vessel differences in mortality rates, including the potential use of vessel characteristics as covariates to explain these differences.

Norton Sound Mining

Upon request by the Council, the CPT considered potential effects of current and potential future mining activities on essential fish habitat for crab in Norton Sound. Owing to concerns that mining activity occurs in areas occupied by juvenile and adult red king crab, the CPT encouraged the Council to undertake immediate consultation on this issue with the Corps of Engineers and to provide information and express concerns to the Alaska Department of Environmental Conservation for consideration in the State permitting process. **The SSC supports the CPT's recommendation for these Council actions.**

Table 1. SSC OFL and ABC recommendations for four crab stocks on June 3rd, 2013. **The SSC recommendations agree with the Crab Plan Team recommendations.** (Note diagonal fill indicated parameters not applicable for that tier level while shaded sections are to be filled out for the final SAFE in September 2013).

Chapter	Stock	Tier	Status (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$ (kt)	Years[1] (biomass or catch)	2013[2][3] MMB (kt)	2013 MMB / MMB_{MSY}	γ	Mortality (M)	2013/14 OFL (kt)	2013/14 ABC (kt)
1	EBS snow crab	3										
2	BB red king crab	3										
3	EBS Tanner crab	4										
4	Pribilof Islands red king crab	4										
5	Pribilof Islands blue king crab	4										
6	St. Matthew Island blue king crab	4										
7	Norton Sound red king crab	4	a	0.18	1.86	1980-current [model estimate]	2.27	1.22	1.0	0.18 0.68 (>123 mm)	0.26	0.24
8	AI golden king crab	5				See intro chapter					5.69	5.12
9	Pribilof Island golden king crab	5				See intro chapter					0.09	0.08
10	Adak red king crab	5				1995/96– 2007/08					0.05	0.03

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[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 average catch for OFL is obtained.
[2] MMB as projected for 2/15/2014 at time of mating.
[3] Model mature biomass on 7/1/2013

8/23/2013

Table 2. Maximum permissible ABCs for 2013/14 and SSC recommended ABCs for those stocks where the SSC recommendation is below the maximum permissible ABC, as defined by Amendment 38 to the Crab FMP. Note that the rationale is provided in the individual introduction chapters for recommending an ABC less than the maximum permissible for these stocks. Values are in thousand metric tons.

Stock	Tier	2013/14 *Max*ABC	2013/14 ABC
Norton Sound red king crab	4a	0.26	0.24
Adak red king crab	5	0.05	0.03

Snow Crab

We received presentations on CPT discussions related to snow crab and on recent snow crab model explorations that focused on alternative ways for modeling growth of snow crab. In the 2012 base model, mean width after molting was estimated as a linear function of pre-molt width with priors based on limited growth data. In addition to the base model, a second model was explored that implemented a quadratic relationship between pre-molt and post-molt size. Priors for the parameters of the relationship were estimated by Dave Somerton, based on molting experiments. The CPT and SSC requested that the authors try to more fully and directly integrate results from recent growth-increment studies into the assessment.

In response to this request, the authors used growth increment data for a total of 35 crabs from four different studies that were suitable for informing growth in the assessment, and presented two additional model scenarios. Both scenarios fit a two-piece linear regression to model post-molt width as a function of pre-molt width, with separate slopes and intercepts for small and large crab. The break point at 36.1 mm was estimated by Somerton et al. (2013) and presumably corresponds to the point where pre-molt, immature crab develop their gonads and transition to adolescents. Parameter estimates were constrained using a prior with means and standard errors from Somerton et al. (2013). A separate prior was used to penalize differences in the estimated post-molt width at the break point between the two linear pieces. In Scenario 1, a single model was fitted to males and females, while Scenario 2 estimated separate parameters for males and females.

The SSC believes that the data identified as "consistent" by Somerton et al. (2013) constitute the best available data to inform growth of snow crab in the EBS and we offer the following recommendations regarding its use in the assessment:
- Although the number of animals with growth information is very limited, evidence from a number of assessment model fits suggest that growth differs between males and females, hence **the SSC concurs with the CPT to exclude females from the Somerton data set.**
- **The SSC also agrees with the CPT that the approach of penalizing the difference in size at the breakpoint is unnecessary and undesirable.** There is no biological or statistical reason why the two regression lines should not be forced to have the same post-molt size at the breakpoint.
- Although the analysis by Somerton et al. (2013) suggests a breakpoint, and there is some rationale for it, there is uncertainty about the existence of a breakpoint and at what pre-molt size it occurs. Much of this uncertainty relates to the fact that most of the datasets fall entirely on one side of the breakpoint, thus the breakpoint could be an artifact of mixing different datasets. **Therefore, the SSC recommends bringing forward two models in September that fit both a two-piece model and a simple linear model for growth, each with separate parameters for males and females (except initial intercept).**
- The SSC concurs with the CPT that the actual data should be incorporated in the assessment model instead of using priors to constrain parameters.

EBS Tanner Crab

The stock assessment author has been very responsive to SSC comments and requests that were provided in the October 2012 SSC report. The SSC appreciates the thoroughness of the recruitment analysis. For instance, the analyst addressed the SSC request to consider an appropriate time period of reasonably estimated recruitments and to conduct additional break-point analyses. One area that was not specifically addressed was the provision of new evidence for shifts in Tanner crab life history or ecology that support the choice of recruitment periods.

The analysis appears to provide justification for the SSC's previous interim advice to only use recruitment data subsequent to fertilization year 1977 (corresponding to recruitment in 1982). Also, an updated break-point analysis appears to continue to support a break point in fertilization year 1985 (recruitment in 1990). Jon Richar, a Ph.D. student of Dr. Gordon Kruse, has conducted research into Tanner crab recruitment using a ROMS model. That study suggested that the breakpoint may be due to a decline in larval retention in Bristol Bay in 1990.

The SSC supports future research plans identified by the stock assessment author. With respect to stock-recruit research, the SSC cautions the analyst that, when environmental conditions cause autocorrelated recruitment with a periodicity that is double the mean generation time, plots of stock-recruit data can suggest apparent strong density dependence (ln R/S vs. S) when none exists (see publications by Carl Walters and others). Research by Jon Richar suggests that this may be the case for Bering Sea Tanner crab. Moreover, mature male biomass is an uncertain measure of reproductive potential. The CPT may be interested to see a presentation by Jon Richar on his recruitment studies at their Fall 2013 meeting. The SSC looks forward to additional research on Tanner crab recruitment and its consequences for stock status determinations.

Norton Sound Red King Crab

The assessment of this stock has been greatly improved this year. It is a Tier 4 stock with an improved stock assessment model, but there has been concern about the data used in the model and the model configuration. Thus, it was one of two stock assessments reviewed at the February 2013 Crab Modeling Workshop, and the stock assessment authors, led by Toshihide Hamazaki, have incorporated results and implemented recommendations from the workshop. Data improvements include CPUE standardization and re-analysis of NMFS trawl survey using original data sources. The latter are not used in the current assessment pending further investigation (to be presented to the SSC in October 2013). The authors were very responsive to previous CPT and SSC comments.

Seven model scenarios in addition to the base scenario were considered, involving eliminating a couple of survey or CPUE series, investigating Q's for the NMFS and ADF&G surveys, and examining alternatives to the current value of M = 0.18. These models are summarized in an Appendix. The authors narrowed the choice of models to three (3-1, 3-6, and 3-7). These three models are evaluated in the main stock assessment document. The main differences between model 3-1 and the base model are elimination of the summer pot data, estimation of Q for the NMFS survey (with the ADF&G Q set to 1), and setting effective sample size to 20. The CPT discovered that there are convergence problems with models 3-6 and 3-7. The CPT also found that model 3-1 treated survey Qs in a more defensible manner than the base model. The SSC concurs with CPT that model 3-1 is the best choice. The SSC also agrees with CPT that further investigation of the NMFS trawl survey data is needed. **The SSC reviewed the CPT's recommendations for improving the SAFE chapter and the proposed model explorations, and agrees with these recommendations (see page 8 of the CPT report).**

The SSC agrees with the CPT recommendation to set the 2013/14 OFL at 260 t. Given the uncertainty with this model noted above, the SSC agrees with the CPT recommendation of a 10% buffer for the ABC, which results in a recommendation of 240 t. The stock is above the MSST and

thus, the stock is not overfished. The total catch in 2012/2013 did not exceed the OFL and thus, overfishing has not occurred.

Another topic discussed was the timing of the assessment year. **It was recommended that the assessment cycle be changed from July-June to October-September.** This change will provide harvest specifications well in advance of the summer fishery. **The SSC endorses this change.**

Bristol Bay Red King Crab

Seven model scenarios are evaluated in the draft SAFE report. These models explored the implications of different assumptions regarding effective sample sizes for surveys, truncating start years, elimination of new shell and old shell designation, and two levels of molting probabilities. The SSC appreciates the authors' effort to present constant M model options (Scenarios 2 and 3). **The SSC agrees with the CPT that Models 1 and 4 should be included for the final 2013/14 SAFE.**

The CPT made several recommendations for revisions to the model and the SAFE chapter. The SSC reviewed these recommendations and agrees that these requests are a high priority for the 2013/14 SAFE. In addition, **the SSC reiterates its concern that the authors have not specifically addressed why natural mortality was higher during the specific years selected for time blocks of additional mortality.** We recognize that improved model fit is a useful diagnostic; however, it would be helpful to know whether there was any corroborating data that would explain the temporary increase in mortality (such as groundfish or Pacific cod abundance).

The SSC notes that the arbitrary time blocking to fix poor fits to the data is conditional on the initial model set up. **Therefore the SSC requests that the authors explore a model that allows for interannual variations in M.** This could be accomplished with a random walk model for natural mortality or a model that allows independent deviations around the base M with the additional constraint that these deviations sum to 0. Results from this run could be used to explore objectively whether the time blocks selected for additional mortality were correctly specified. We recognize that there are tradeoffs with modeling M, survey Q, and survey selectivity; thus, we ask the authors to carefully consider which parameters should be fixed for this run to enable the desired temporal exploration of time varying M.

The SSC supports the idea of comparing the generic crab model (described in the 2013 Crab Workshop Report) with the authors' model for the 2014 CPT modeling workshop.

Aleutian Islands Golden King Crab

Trends in commercial CPUE have been relatively stable since the rationalization of this fishery and increased from 23.2 crabs per pot lift in 2010/11 to 29.0 in 2011/12. Work to standardize the commercial CPUE continues and this stock may be a candidate for a new Generic Crab Model being developed at the University of Washington. **The recommended OFL for 2013/14 is 5.69 kt. The CPT recommended, and the SSC agreed that the ABC should be set at 90% of the OFL, as is standard for Tier 5 crab stocks. The SSC accepts the CPT recommendation of setting the ABC at 5.12 kt for the 2013/14 Aleutian Island golden king crab fishery.**

Pribilof Islands Golden King Crab

The Pribilof Islands golden king crab fishery has supported a small and sporadic fishery that is concentrated in the Pribilof Canyon region. There was no fishing effort between 2006 and 2009 and only one or two vessels fished in 2010 through 2012, with 100% observer coverage. There is no state harvest strategy in regulation for this fishery and the GHL has been established at 150,000 pounds (68 t) since 2000.

This stock is currently managed at Tier 5, with a retained catch OFL based on average catches during the 1993 through 1998 time period, an estimate of bycatch rates in the directed fishery during 2001 through

2010, and average bycatch mortalities in the non-target crab fisheries and PSC in the groundfish fishery during 1994 through 1998 and 1992/93 through 1998/99, respectively. The short time series for computing average catches was chosen because it encompasses the longest continuous time period during which vessels participated in the fishery, and during which retained catch data are available and not constrained by a GHL. As in last year's assessment, and following the advice of the assessment author and CPT, **the SSC recommends a total catch OFL of 0.09 kt (91 t) and ABC (using the 10% buffer for Tier 5 stocks) of 0.08 kt (82 t) for the 2013/2014 fishery season.**

In previous meetings, the SSC recommended using data from the NMFS EBS biennial slope trawl survey with the goal of moving the stock to a Tier 4 assessment. The SSC received a report on a proposed approach to a Tier 4 assessment for Pribilof Islands golden king crab. The report presented area-swept estimates of biomass for the area of the fishery (Pribilof Canyon) and for the whole EBS slope survey region (200 m to1,200 m depth), as well as the size composition of male and female crab from the 2008, 2010 and 2012 surveys. The author listed a number of concerns with a Tier 4 approach, most notably the short length of the available time series and uncertainty about stock structure.

A true Tier 4 approach for PIGKC is precluded by the lack of a suitable proxy for B_{MSY}; hence, **the SSC concurs with the CPT to bring forward a modified Tier 5 calculation for this stock in September 2013.** This approach would use the average mature male biomass for 2008, 2010 and 2012 as an estimate of current biomass, with F=M applied to estimate an OFL and a suitable buffer applied to set ABC.

Because the stock structure is unknown, the SSC recommends that the authors examine maps of catch-per-unit-effort by survey year to identify natural breaks in the spatial distribution of golden king crab along the slope. If no obvious breaks exist, the SSC recommends that the authors bring forward biomass estimates for the Pribilof canyon region and for the slope as a whole. However, we note that the Pribilof Canyon stations do not encompass the historical catches, which occurred inside and to the north of Pribilof Canyon. Therefore, the authors should consider a biomass estimate for an area that encompasses the majority of historical catches.

Adak Red King Crab

The SSC reviewed the 2013 SAFE chapter for Adak red king crab (RKC). There is no assessment model for this stock. The fishery has had limited openings since 1995/96 and was closed for the 2013/14 season. **The CPT recommended, and the SSC agrees that this stock should be managed as a Tier 5 stock.** The SSC agrees that the OFL should be estimated as average total catch, using the same base period recommended last year (1995/96 through 2007/08). **Based on this designation, the SSC recommends that the OFL for 2013/14 be set at 54 t.**

The SSC considered options for setting the ABC. The maximum permissible ABC is 49 t, based on the 10% Tier 5 buffer. The minimal data available suggest that the Adak RKC stock continues to be at a very low stock size. The SSC agrees with the CPT recommendation that the directed fishery for Adak RKC should remain closed and that the ABC should be based on an amount sufficient to address bycatch in other crab fisheries and PSC in groundfish fisheries. The SSC considered the amount of Adak RKC needed to prosecute a test fishery, and to allow for groundfish PSC and bycatch in non-target crab fisheries. In previous years, the CPT reported that industry has expressed an interest in conducting a test fishery around the Adak area. ADF&G estimated that 20 t would be needed to prosecute this test fishery. The SSC continues to be concerned about the paucity of data for Adak RKC and places a high priority on the collection of survey data for this stock. **Therefore, the SSC recommends an ABC of 34 t for 2013/14.** This amount should be sufficient to cover PSC, bycatch in non-target crab fisheries and the proposed test fishery catch.

The SSC received public testimony regarding a petition from the Adak Community Development Corporation to break the Adak Red King Crab stock into east and west components and return

management of the eastern component to the State of Alaska. **The SSC agrees with the concerns raised by the CPT, and if the NPMFC elects to formally explore this option, we request that the amendment package provide a thorough discussion (e.g., white paper) of those issues.**

C-5(b) Initial review on GOA Trawl Data Collection
The SSC received a presentation of the initial draft RIR/IRFA from Darrell Brannan (NPFMC Consultant). Public comment was offered by Denby Lloyd (Advisor for the City of Kodiak).

The SSC recommends that the draft document not be released for public review at this time. The SSC expresses its appreciation to Mr. Brannan for the professional way in which he approached this analysis and the thoroughness of the presentation. The Council tasked staff with preparing a "fast-track", streamlined data collection program that would minimize the burden on industry and assure use of all the existing sources of economic data. As a result of this broad request, the analysis appears to wander, posing questions that can only be finally addressed by further Council guidance. The SSC encourages the Council to more clearly articulate its purpose and objectives for the proposed data collection action. Specifically, successful development of the data collection program pivots on the questions that these data would be expected to help answer.

The current draft document notes that the Council intends for this data collection program to facilitate "before and after" assessments of a catch share program presumed to be in the immediate offing. Additionally, the presentation before the SSC included mention of a draft discussion paper focused on several aspects of a trawl PSC avoidance program that, in turn, is related to the anticipated future catch share program. However, the SSC was not asked to review that discussion paper at this time, even though our brief perusal identified numerous social issues, economic issues, and baseline assumptions, each of which would benefit from a thorough scientific review. Incorporation of previous research findings on catch share programs should also be critically evaluated. **The SSC encourages the Council to consider the interdependency of these anticipated events (data collection, PSC avoidance management, catch share programs) to present the analysts with more clearly defined objectives.** Other specific concerns the SSC has with the current draft document are discussed below.

Community impacts are identified as important concerns, motivating the Council's proposed action, but there is no apparent plan to collect information that would permit assessment of likely impacts on communities. The document is silent on this gap. Mr. Brannan reported that he has consulted with social scientists at the AFSC and they have agreed to develop and administer a 'voluntary' community survey, if the Council expresses supports for this idea; however, the document itself does not even mention this potentiality. It is unclear whether the timing of this effort would capture temporally equivalent community data to those pre- and post-catch shares program data compiled from the proposed harvester and processor submissions.

On another issue, the SSC is previously on record expressing its strong concern about inclusion of data identity masking aspects of Council data collection programs; the SSC reiterates these concerns in the present proposal. These requirements impose complexity, delays, and cost to data use by Council staff and agency analysts, with no evidence that such provisions are needed, useful, or effective (either in enhancing data security or program cost effectiveness). Imposing an unnecessary and burdensome barrier to full and effective use of these data calls into question whether the full cost of such a data masked program can be justified on the basis of the analytical benefits these restricted data may support.

The SSC also questions the value of collecting highly aggregated economic data. The degree of data aggregation is contextually specific to the questions being analyzed, and is best determined by the analysts employing these data. The greater the aggregation of the raw data collected, the less value it represents for local impact analyses, and the greater the constraints it imposes on the Council's and the public's ability to describe, understand and evaluate fisheries management performance.

The SSC also wishes to call the Council's attention to the treatment of crew compensation within the context of the proposed data collection action. Specifically, we recall that the question of how crew are treated under Federal labor law (i.e., employees or co-venturers) may have significant implications for how crew compensation questions under the proposed data collection program are phrased and subsequently interpreted. As this action moves forward, the SSC suggests that all concerned take this matter into consideration.

C-7 Bering Sea Canyons
Michael Sigler (NMFS-AFSC) provided a presentation on the uniqueness of the Bering Sea canyons, accompanied by Christopher Rooper (NMFS-AFSC) and Robert Stone (NMFS-AFSC). Diana Stram (NPFMC) presented the discussion paper on fishing effects on canyon habitats. Public testimony was provided by: Merrick Burden (Marine Conservation Council), Jon Warrenchuk (Oceana), Donna Parker (Arctic Storm), John Hocevar (Greenpeace), Vernor Wilson III (World Wildlife Fund), Chad See (Freezer Longline Coalition), and John Gauvin (Alaska Seafood Cooperative). The SSC thanks the authors, Council staff, and those who provided public testimony on this issue.

The SSC found these presentations to be careful and thorough attempts to answer the Council's questions regarding the Bering Sea canyons, including the two focal canyons, Pribilof and Zhemchug canyons. The presentation by Dr. Sigler provided much new information on the physical and biological characteristics of the Bering Sea canyons and surrounding habitats. The focal question was whether the Bering Sea canyons are unique habitats within the Eastern Bering Sea (EBS) shelf and slope. The authors used multivariate analyses with physical habitat characteristics and fish and invertebrate distributions to determine whether Pribilof and Zhemchug canyons differed from each other or from adjacent slope and shelf habitats. The paper assessed the potential for fishing to damage corals and sponges. The evaluation was conducted through spatial modeling and an index of vulnerability to physical damage from fishing. The analyses to identify differences among the canyons and slope habitats, and to predict coral and sponge habitats, were well-executed. The assignment of susceptibility to each of the coral taxa appeared to be relatively subjective and additional detail on the methodology utilized to assign susceptibility is needed.

The results suggest that while Pribilof and Zhemchug canyons can be distinguished physically from surrounding habitats; their fish and invertebrate communities (to the extent they were included in the analysis) do not differ significantly from other areas of the shelf-slope between the canyons. It was concluded that these two canyons are not biologically unique and that the primary factors structuring the shelf-slope fish and invertebrate communities are depth and latitude. Regions of relatively high coral and sponge vulnerability were predicted to occur both inside and outside canyons. There was substantial spatial overlap between fishing effort and predicted coral and sponge habitats. The authors were careful to state that the overlap does not explain the relative impact of fishing effects, and only that these effects were likely to be greater in overlapped areas compared to other areas.

While the paper does an excellent job of showing the physical differences among the habitat areas, the SSC feels that the analyses of biological attributes could be improved. Use of the top 20 species from each of the EBS slope, shelf, and the AFSC longline surveys, while providing information on the most common species, was less likely to detect differences in the uniqueness of the biota in these areas. The SSC notes that the inclusion of more rarely encountered species could be useful in identifying whether the canyon habitats support a unique mix of unusual species. Inclusion of biodiversity indices would also help to demonstrate whether these canyons were biologically differentiated from the rest of the shelf-slope.

This paper did not respond to the Council's need to understand the dependence of managed species on the habitat features of the canyons (April 2012 Council action regarding Bering Sea canyons).

The analysis focused on more specific questions, such as uniqueness and heterogeneity, which may contribute indirectly to dependence. The SSC does not believe that the data currently exist to quantify the importance of the canyons to the population dynamics of managed species.

The SSC questioned whether the comparison between coral densities in the focal canyons and those in the Aleutian Islands was appropriate because of the substantial differences in the physical habitats of the two regions. The SSC suggested that comparisons between the canyons and adjacent slope habitats or the Gulf of Alaska might be more meaningful. The SSC recognized the need for visual surveys outside Pribilof and Zhemchug canyons that would allow for direct comparisons to data collected inside the canyons. The SSC supports additional visual surveys to validate model results.

Incorporation of information on the population dynamics of corals and the role of corals (and other structure-forming invertebrates) in fish populations would strengthen the description of ecological connections among biota present in these habitats. This should include information on generation time and longevity of these structure-forming invertebrates to provide insights into the persistence of fishing effects, the time frame for future recovery, and the level of mortality these species can withstand. At present, the analysis only considers vulnerability scores that do not consider recovery rates. The SSC suggests that in future studies the analysts consider defining vulnerability as a function of exposure, susceptibility and adaptability. Additionally, the SSC notes a need for information on the potential for damage of corals and sponges by the various types of fishing gear that have bottom contact. Additional detail on the methodology utilized to assign susceptibility is also needed.

In general, this paper is informative and should help guide Council decisions on whether and how to move forward with future research and management measures specific to the two focal canyons and in slope habitats, in general. The SSC recognizes the wide range of potential options for the Council to take on this issue. Clear statements of purpose by the Council would guide the alternatives, if the Council does decide to take action to protect these areas as Essential Fish Habitat or as Habitats of Particular Concern.

The SSC also received a presentation of a discussion paper presented by Council staff that summarized fishing activities, characterized by average catch from 2004 through 2012, within the Pribilof and Zhemchug canyons. Fishing activity was summarized by gear type and by target fishery, and PSC; incidental and observed invertebrate bycatch was also summarized. Management measures potentially affecting the canyons were described, including the various types of area closures, fishing cooperatives, and gear modifications.

D-1(c) Research Priorities
The SSC considered research priorities for inclusion in the annual NPFMC list of Research Priorities. Per the policy adopted at the June 2012 Council meeting, the SSC asked the Plan Teams to provide their research priorities to the SSC. Research priority lists were provided by the Plan Teams in their Plan Team report and were entered in "Track Changes" in the Council's list of Research Priorities, as "published" in the minutes of the previous year's June Council meeting. Using this input, the SSC then updated a working copy of the Research Priorities, using the new database format developed by Council staff in consultation with a subcommittee of the SSC over the past year. **The SSC provides its recommended list of research priorities to the Council in Appendix A.** The appendix is organized from high to medium to low priority, with the status of each research project noted (No Action, Partially Underway, Underway).

D-1(d) Pacific cod model presentation
Grant Thompson (NMFS-AFSC, and Pacific cod stock assessment author) presented Groundfish Plan Teams' (Team) recommendations for models to consider in the 2013 preliminary Pacific cod assessment. Public testimony was given by Kenny Down (Blue North). These recommendations were based on

proposals by the senior assessment author, the Plan Teams, the SSC, and the public. Following the process established in recent years, all proposed models were evaluated and a reduced set of models was recommended for the 2014 assessment. Given the increasingly technical nature of the review and the declining number of participants of Team members, the Team is considering tasking this review to a subcommittee. This might have the benefit of reducing the number of meetings for many Team members. The SSC endorses Team recommended changes to the review process.

The Team also reviewed and provided comments on a study that compared Pacific cod catches from survey bottom trawls with low and high vertical openings (summary of 2012 pilot field study, by Robert Lauth and Cynthia Yeung). This study did not identify a statistically significant difference in catchability of the nets used in the EBS and GOA surveys for Pacific cod in the 60 cm to 81 cm size range. However, the pilot study was conducted in a small area, which may not necessarily represent the survey catchability across the entire Pacific cod distribution. The Program Manager for the Groundfish Assessment Program felt that the results were inconclusive, and the Team and SSC agreed. The SSC concurs with the Plan Team that studies investigating Pacific cod catchability receive high priority. The SSC encourages gear researchers to consider designing a comprehensive, cooperative study to obtain improved estimates of survey catchability across a range of habitats (depth, substrate, etc.), conducted at the time of the summer survey to control for seasonal differences in catchability. The SSC requested to see designs for future paired studies prior to implementation. Given funding limitations, cooperative research with the industry could be explored.

For the preliminary EBS assessment, the Team recommended including the following models:
- Last year's final model (Model 1), which is the same as the 2011 final model
- Last year's "exploratory" model (Model 4), but with the logarithm of survey catchability estimated internally, using a non-constraining uniform prior
- Last year's "exploratory" model (Model 4), but with the logarithm of survey catchability estimated internally, using a normal prior derived from the archival tagging data used by Nichol et al. (2007), and with asymptotic trawl survey selectivity

The SSC concurs with author and Team's EBS model development for this coming year. The SSC recommends that model changes be kept to a minimum to ensure that we can track model sensitivities to specific changes in model structure. In addition to the recommended models, the assessment author reported that he will likely bring forward an EBS model similar to last year's Model 4, which the SSC supports. The SSC encourages the author to investigate annually changing fishery selectivity, for example modeled as a random walk process. The SSC concurs with the Team recommendation to discontinue models with no age data.

For the preliminary GOA assessment, the Teams recommend including the following models:
- The 2011 final model
- Last year's final model (Model 2)
- Last year's Model 4, but with all selectivities forced to equal zero at age zero, growth parameters fixed at the values from Model 2, and time-invariant survey selectivity for the 27-plus cm sized fish

The SSC concurs with these recommendations and with the Team's recommendation to not re-tune survey catchability for the 27-plus sized fish in the GOA models, unless the average of the product of catchability and selectivity across the 60 cm to 81 cm size range departs appreciably from the value of 0.92 estimated by Nichol et al. (2007). The SSC also recommends that the author(s) investigate a more parsimonious model for comparison.

For the preliminary AI assessment, the SSC has no additional suggestions at this time and is looking forward to a revised and updated assessment model. The SSC agrees with the Team and the AI authors

that pre-1991 survey data should be omitted from the assessment. To improve biomass estimates in the Aleutians, we further encourage an examination of existing longline survey data (sablefish and IPHC) to determine if a cooperative, cost-effective longline survey could be developed in the Aleutians, and to determine if these data should be incorporated into the AI Assessment.

Appendix A.

SSC's Five-Year Research Priorities: 2013 through 2017 (as proposed in June 2013)

The Scientific and Statistical Committee (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 funding agencies.

Five-Year Research Priorities: 2013-2017

2013 Research Priorities - High Priorities

Res_Title

101 Life history research on non-recovering crab stocks

   Status: No Action

Why certain stocks have declined and failed to recover as anticipated is a pressing issue (e.g., Pribilof Island blue king crab, Adak red king crab). Research into all life history components, including predation by groundfish on juvenile crab in nearshore areas, is needed to identify population bottlenecks, an aspect that is critically needed to develop and implement rebuilding plans.

105 Spatial distribution of male snow crab

   Status: Partially Underway

There is a need to characterize the spatial distribution of male snow crab relative to reproductive output of females in the middle domain of the EBS shelf.

107 Improve handling mortality rate estimates for crab

   Status: Partially Underway

Improve estimate of discarded crab handling mortality rate. This will require improving understanding of the post-release mortality rate of discarded crab from directed and non-directed crab pot fisheries, and principal groundfish (trawl, pot, and hook and line) fisheries. The magnitude of post-release mortality is an essential parameter in the determination of the overfishing level used to evaluate overfishing in stock assessment and projection modeling. Empirical data exist for snow crab, so new handling mortality data are needed for Tanner and king crab by size, sex, and fishery type with consideration of temperature.

110 Maintain the core biological and oceanographic data (e.g., biophysical moorings, stomach data, zooplankton, age 0 surveys) necessary to support integrated ecosystem assessment

Status: Underway

Maintain the core data needed to support integrated ecosystem assessments. Core data include inputs for single- or multi-species management strategy evaluations, food web, and coupled biophysical end-to-end ecosystem models (e.g., biophysical moorings, stomach data, zooplankton, age 0 surveys).

114 Develop a spatially-explicit model for BSAI pollock

Status: Underway

Conduct studies to determine stock structure and potential spatial management for BSAI pollock (e.g., movement). Evaluate interactions of BSAI pollock with those in Russian waters. These studies should lead to a detailed spatial age-structured stock assessment model with at least 3 regions (Russia, NW EBS, SE EBS].

115 District-wide survey for demersal shelf rockfish in Southeast Alaska

Status: No Action

Conduct a district-wide survey for demersal shelf rockfish in Southeast Alaska on a biennial or triennial basis. Survey information is becoming extremely dated.

116 Studies to identify crab stock boundaries

Status: No Action

Conduct studies to evaluate stock boundaries (e.g., Bristol Bay red king crab, Adak red king crab, Pribilof blue king crab). Studies are needed in the areas of genetics, reproductive biology, larval distribution, and advection. Mark-recapture studies are needed, as well.

117 Study vertical distribution of Pacific cod to better understand catchability

Status: Underway

Research is needed on the vertical distribution of Pacific cod relative to the EBS bottom trawl, and comparisons of gear between the EBS and GOA trawl gear. This is because there is controversy about fishery and survey catchability.

118 Pacific cod stock assessment for the Aleutian Islands

Status: Underway

Develop Pacific cod stock assessment for the Aleutian Islands region. The Aleutian Islands and eastern Bering Sea regions' cod stocks will soon be split and get their own ABC's and OFL's. Therefore, there is need to develop an assessment model for cod in the Aleutians.

119 Evaluation of salmon PSC mitigation measures

Status: Underway

Develop a research program that will facilitate evaluation of salmon (both Chinook and non-Chinook) PSC mitigation measures in the BSAI and GOA. This includes updated estimates of the amounts reasonably necessary for subsistence, timing of runs and openings relative to subsistence requirements, and access to cost data for the commercial pollock and salmon industries so that impacts on profits (not simply gross revenues) can be calculated.

120 Improve knowledge for salmon PSC impact assessment

Status: Underway

Improve the resolution of Chinook and chum salmon genetic stock identification methods (e.g., baseline development, marker development), improve precision of salmon run size estimates in western Alaska, and initiate investigations of biotic and abiotic factors influencing natural mortality rate during ocean migration in the GOA and BSAI. Baseline development is nearing completion, but more work on Cook Inlet chum stocks is needed.

122 Improve methods of monitoring fishery interactions

Status: Underway

Develop improved catch monitoring methods of fishery interactions, including direct and alternative options (e.g., electronic logbooks, video monitoring), particularly on smaller groundfish, halibut, and commercially guided recreational fishing vessels, including an assessment of feasibility for small vessels.

125 Research ecosystem indicators and their thresholds for inclusion in ecosystem-level management strategy evaluation

Status: Underway

Initiate/continue research on the synthesis of ecosystem indicators, developing and evaluating thresholds for ecosystem indicators, and ecosystem-level management strategy evaluation.

126 Evaluate interactions between fisheries and pinnipeds

Status: Underway

Studies of the interactions between fisheries and protected species, such as Steller sea lions in the Central and Western Aleutian Islands (areas 541, 542, 543) and northern fur seals on the eastern Bering Sea shelf are needed. These studies should be conducted at appropriate spatial and temporal scales, with an emphasis on seasonal prey fields, diet, and movement of fisheries and pinnipeds.

127 Assess vital rates of Steller sea lions

Status: Underway

Assess vital rates (i.e., reproduction and survival) of Steller sea lions in the western DPS (including Russia) at sufficient frequency to track population dynamics.

128 **Assess the health of Stellar sea lions**

Status: Underway

Assess possible indirect effects of fisheries removals via periodic health assessments, indices of body condition, survival of pups and juveniles, and natality of Steller sea lions in the western DPS.

129 **Quantify killer whale predation of Steller sea lions**

Status: Underway

Quantify killer whale predation of Steller sea lions, particularly in the western and central Aleutian Islands.

135 **Conduct routine fish, crab, and oceanographic surveys in the northern Bering Sea and Arctic Ocean**

Status: Partially Underway

Dynamic ecosystem and environmental changes in the northern Bering Sea and Arctic are occurring. Assessment of the current baseline conditions and trophic interactions is important. This effort should not supplant the regular surveys in the BSAI and GOA, which are of critical importance to science and management.

136 **Effects of trawling on female red king crab and subsequent recruitment**

Status: Partially Underway

Research is needed on the effects of trawling on the distribution of breeding and ovigerous female red king crab and subsequent recruitment. Relevant studies include effects of potential habitat modifications on the distribution of females, particularly in nearshore areas of southwest Bristol Bay (partially underway), and environmental effects (e.g., trawling overlap in warm vs. cold years). Retrospective studies, the use of pop-up tags to identify larval release locations, and larval advection using Regional Ocean Modeling System would help address this need.

138 **Continuation of State and Federal annual and biennial surveys**

Status: Underway

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 Federal budgets in which funding may not be sufficient to conduct these surveys. Loss of funding for days at sea for NOAA ships jeopardizes these programs. Budgetary concerns have resulted in cuts to not only days at sea, which increases uncertainty, but also sampling the deepest strata, which threatens the value of trawl surveys as a synoptic ecological survey. 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. Although an ongoing need, these surveys are considered the highest priority research activity, contributing to assessment of commercial groundfish and crab fisheries off Alaska.

139 **Conduct routine surveys of subsistence in the northern Bering Sea and Arctic Ocean**

Status: Partially Underway

Conduct routine surveys of subsistence use of marine resources in the northern Bering Sea and Arctic Ocean. These surveys will become increasingly important under ongoing warming ocean temperatures because range expansions of harvested fishery resources may occur. If range expansions or shifts occur, data will be needed to adjust standard survey time series for availability.

141 **Estimate scallop stock abundance**

Status: No Action

Estimate scallop stock abundance in unsurveyed areas using fishery independent methods.

143 **Alternative approaches to acquire fishery-independent abundance data for Aleutian Islands golden king crab**

Status: No Action

Explore alternative approaches to the triennial ADF&G Aleutian Islands golden king crab pot survey to acquire fishery-independent abundance data on stock distribution and recruitment of Aleutian Islands golden king crab, including the potential for future cooperative research efforts with Industry.

144 **Assess seasonal diets and movements of fish and shellfish**

Status: No Action

Assess seasonal or species-specific information for use in improved assessment and management (e.g., expand or continue cooperative research). The data would be useful in studies of species interactions in spatially explicit stock assessments.

147 **Studies on factors that affect catchability, particularly for Tanner crab and Aleutian Islands golden king crab**

Status: Partially Underway

For groundfish and crabs, studies are needed on factors that affect catchability, as they directly bear on estimates of the stock assessment. 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 Tanner crab, because of recent trends in stock status, and on fishery and fishing gear selectivity for Aleutian Island golden king crab to improve the stock assessment model.

149 **Quantitative reproductive index for the surveyed BSAI crab stocks**

Status: Underway

Advance research towards developing a quantitative reproductive index for the surveyed BSAI crab stocks. 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.

151   **Acquire basic life history information (e.g., natural mortality, growth, size at maturity) for data-poor stocks.**

    Status: Partially Underway

Acquire basic life history information needed for stock assessment, PSC, and bycatch management of data-poor stocks, such as scallops, sharks, skates, sculpins, octopus, grenadiers, squid, and blue king crab (Bering Sea), golden king crabs (Aleutian Islands), and red king crab (Norton Sound). Specifically, information is needed on natural mortality, growth, size at maturity, and other basic indicators of stock production/productivity).

157   **Develop and validate aging methods for crabs.**

    Status: No Action

Develop and validate aging methods for crabs to improve estimates of M for stock assessments.

163   **Expanded studies to identify stock and management boundaries**

    Status: Underway

To identify stock boundaries, expanded studies are needed in the areas of genetics, mark-recapture, reproductive biology, larval distribution, and advection. Such boundaries are to be evaluated so that consequences of management and risks are clear. Verify stock structure and source/sink dynamics, including physical oceanographic, genetic and life-history studies.

164   **Develop spatially explicit stock assessment models**

    Status: Partially Underway

Develop spatially explicit stock assessment models. High priority species for spatially explicit models include: walleye pollock, snow crab, Pacific cod, sablefish, yellowfin sole, rock sole, arrowtooth flounder, Pacific ocean perch, black spotted rockfish, rougheye rockfish, and Atka mackerel.

166   **Develop age-structured models for scallop assessment**

    Status: Partially Underway

Age structured models for scallop are needed to increase understanding of population dynamics and harvestable surpluses.

167   **Refine methods to incorporate uncertainty into harvest strategies for groundfish**

    Status: Underway

Refine P* and decision theoretic methods to incorporate uncertainty into harvest strategies for groundfish for ACL estimation. Continue existing management strategy evaluations at the stock level.

168   **Conduct prospective and retrospective analyses of changes in the spatial and temporal distribution of fishing effort in response to management change**

     Status: Underway

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, PSC and other bycatch restrictions, co-ops, IFQs).

169   **Develop a framework for collection of economic information**

     Status: Partially Underway

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.

179   **Conduct pre- and post-implementation studies of the benefits and costs, and their distribution, associated with dedicated access privileges**

     Status: Partially Underway

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, AFA pollock, and crab fisheries. "Benefits and costs" include both economic and social dimensions.

181   **Economic, social, and cultural valuation research on protected species**

     Status: Underway

Economic, social, and cultural valuation research on protected species is needed (i.e., non-market consumptive use, passive use, non-consumptive use).

182   **Foraging ecology studies of Steller sea lions**

     Status: Underway

Foraging ecology studies of Steller sea lions in the Gulf of Alaska, Aleutian Islands, and Russia are needed, including at-sea tracking of older animals, and diet composition of sea lions throughout the region.

188   **Evaluate current and alternative Council PSC/bycatch reduction initiatives**

     Status: Partially Underway

Analyze the effects of recent Council actions on PSC and bycatch, including the interaction among PSC and bycatch reduction initiatives (e.g., halibut, salmon, crab). Attention should be given to different incentives that have the potential to cost-effectively reduce PSC.

194 **Research the role of habitat in fish population dynamics, fish production (growth, reproduction), and ecosystem processes**

  Status: Partially Underway

Research is needed on the role of habitat in fish population dynamics, fish production, and ecosystem processes. Specifically, studies are needed to evaluate how habitat-forming species (e.g., corals) influence life history parameters (e.g., mortality, growth, movement) of FMP species and their preferred prey. Such research will identify key habitats (including essential fish habitat and habitat areas of particular concern), improve the design and management of marine protected areas, and ultimately improve stock assessments and restoration efforts.

195 **Evaluate efficacy of habitat closure areas and habitat recovery**

  Status: Partially Underway

Establish a scientific research and monitoring program to understand the degree to which impacts on habitat, benthic infauna, etc., have been reduced within habitat closure areas, and to understand how benthic habitat recovery of key species is occurring. (This is an objective of EFH research approach for the Council FMPs).

198 **Maintain moorings and develop/maintain sea ice formation, sea ice retreat, and spring bloom indices for the EBS**

  Status: Partially Underway

Develop and maintain indices of sea ice formation, sea ice retreat, and timing/extent of the spring bloom for the EBS. For this, maintenance of moorings, especially M-2, is essential. If recent changes in ice cover and temperatures in the Bering Sea persist, these may have profound effects on marine communities.

200 **Collect and maintain zooplankton biomass and community composition time series**

  Status: Partially Underway

Collect and maintain zooplankton biomass and community composition time series in the eastern Bering Sea. Develop, collect and maintain time series of zooplankton biomass and community composition for the GOA, AI, Arctic.

203 **Maintain indicator-based ecosystem assessment for EBS.**

  Status: Underway

Maintain indicator-based ecosystem assessment for EBS.

204 **Develop indicator-based ecosystem assessments for AI (in progress), GOA, Arctic.**

  Status: Partially Underway

Develop indicator-based ecosystem assessments for AI (in progress), GOA, and the Arctic.

205 **Develop stock-specific ecosystem indicators and incorporate into stock assessments**

  Status: Partially Underway

Develop stock-specific ecosystem indicators and incorporate into stock assessments. (in progress)

216 Collect and maintain time series of ocean pH

Status: Partially Underway

Collect and maintain time series of ocean pH in the major water masses off Alaska to improve understanding of ocean acidification and its effects on managed species, upper level predators and lower trophic levels

217 Assess whether changes in pH would affect managed species, upper level predators, and lower trophic levels.

Status: Partially Underway

Assess whether changes in pH would affect managed species, upper level predators, and lower trophic levels.

220 Collect, analyze, and monitor diet information

Status: Underway

Collect, analyze, and monitor diet information (species, biomass, energetics), from seasons in addition to summer, 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.

301 Investigate ecosystem effects and inter-species interactions of halibut

Status: Underway

Investigate potential ecosystem effects and inter-species interactions on Pacific halibut recruitment and size-at-age. Includes integration of existing IPHC and NOAA trawl survey observations of size-at-age, diet, and population distribution and trends for multiple species in the GOA and BS.

302 Study temporal and spatial patterns in size-at-age of Pacific halibut

Status: Underway

Reanalyze historical records of Pacific halibut size-at-age. Requires identifying samples from consistent spatial areas, as well as re-ageing of older samples that utilized differing methods for age determination. Relate observed patterns to somatic growth via otolith increment analysis and development of bioenergetics model relating long-term environmental and ecological drivers to halibut size-at-age. Continue to explore the potential role of fishing in observed size-at-age trends via direct or evolutionary pathways and the interaction with size-selective fishing. Include these analyses in harvest policy analyses.

305 Study Pacific halibut PSC, bycatch, and discard behavior in fisheries

Status: Underway

Continue to explore management actions that reduce the incentives for PSC-, bycatch- and discard-related mortality of Pacific halibut. Evaluation of observer coverage, accuracy, and representativeness of PSC and bycatch estimates should be included.

306 **Effects of changes to the observer program**

Status: Partially Underway

Evaluate the effects on biological parameter estimates and on estimated catch, bycatch, and PSC from changes to data collection protocols that occur because of the observer restructuring. Ensure that data can be compared easily to the previous data collection methods so that time series remain intact. Improve biological data collection, including representative length and age samples from all sectors of the fleet. Attempt to separate temporal changes from sampling design effects.

310 **Develop a simulation model of Steller sea lion and commercial fishery interactions**

Status: No Action

__Management strategy evaluation tools based on coupled bio-physical models with fishing and top trophic level foragers (e.g., Steller sea lions) should be developed to evaluate the performance of different fishing strategies, to inform future management decisions, and to prioritize field studies.

311 **Continue to improve stock assessment methodology with respect to uncertainty**

Status: Underway

Recent studies have made advances in determining effective sample size, effective number of parameters, Bayesian parameterizations, and weighting of datasets in assessments with multiple datasets. However, results appear to vary from paper to paper, and no general rules have emerged. Thus, our ability to characterize uncertainty remains elusive and efforts to develop and improve characterizations should continue.

312 **Continue to investigate time variation and the shape of fishery and survey selectivity models**

Status: Underway

There is considerable controversy about (1) whether selectivity should be dome-shaped or asymptotic, and (2) whether selectivity should be time-varying by default. Using a dome-shaped curve can create a large increase in biomass that may not be real. Treating selectivity as time-varying increases the number of model parameters greatly, which may lead to confounding among parameters. Better scientific guidance through research studies is needed to address these two problems.

314 **Updated sperm whale stock assessment**

Status: No Action

Updated sperm whale abundance estimates are needed. Sperm whale depredation interactions with longline fisheries have increased, but little is known about sperm whale populations. Updated population estimates and defined PBR's are needed to effectively respond if a take occurs in the longline fishery

2013 Research Priorities - Medium Priorities

102   Catch accounting of crab sex and size

Status: Partially Underway

Improvements are needed for catch accounting by sex and size for crab in non-directed fisheries with high bycatch or PSC rates, particularly for blue king crab in the Pacific cod pot fishery in the Pribilof Islands.

103   Methods for reliable estimation of total removals

Status: Underway

Develop methods for reliable estimation of total removals (e.g., surveys, poorly observed fisheries) to meet requirements of total removals under ACLs. Catch Accounting System now provides total removals annually. Improved reporting on some data, such as subsistence catches and Pacific cod bait in crab fisheries is needed.

106   Improve discard mortality rate estimates for weathervane scallops

Status: Partially Underway

Conduct field studies estimating weathervane scallop discard mortality: relationship between capture, release condition and survival of scallops

108   Tagging studies of Aleutian Islands Pacific cod and Atka mackerel

Status: Partially Underway

Tagging studies of Aleutian Islands Pacific cod, Atka mackerel, Alaska skate, and walleye pollock are needed to create models of short-term movement of fish relative to critical habitat (tagging for Atka mackerel and skates are partly underway).

109   Age determination methods for Pacific cod, Pacific sleeper sharks, and spiny dogfish

Status: Partially Underway

Studies are needed to validate and improve age determination methods for Pacific cod, Pacific sleeper sharks, and spiny dogfish. Conventional tagging studies of young of the year and/or one-year old Pacific cod would be useful in this regard; vertebrae are currently being evaluated for aging of spiny dogfish (partially underway for cod and dogfish).

111   Biomass indices and alternate methodologies for lowest tier species

Status: Partially Underway

Develop biomass indices for lowest tier species (Tier 5 for crab, Tier 6 for groundfish), such as sharks and octopus . Explore alternative methodologies for Tier 5 and 6 stocks, such as length-based methods, catchability experiments (e.g., net selectivity), or biomass dynamics models.

112 **Analyses of fishery effort and observer data for scallop fisheries**

    Status: No Action

Assess impacts of temporal and spatial distribution of effort by the few vessels participating in the fishery on CPUE and observer data for management purposes.

113 **Research on stock- recruit relationships**

    Status: Underway

New information and data are needed that would inform our understanding of the stock-recruit relationship for groundfish, Pacific halibut, and crab to project year-class strength.

121 **Investigate factors affecting the guided angler sector of the halibut fishery**

    Status: Underway

Continue to investigate factors that affect angler demand in the guided angler sector of the halibut fishery resulting from regulatory changes under consideration by the North Pacific Management Council and/or general economic conditions.

123 **Develop bioeconomic models**

    Status: Partially Underway

Develop bioeconomic models with explicit age- or size-structured population dynamics for BSAI and GOA groundfish fisheries to estimate maximum economic yield and other bioeconomic reference points under uncertainty.

124 **Benefits and costs of directed halibut catch and halibut PSC utilization**

    Status: Underway

Research the benefits and costs of directed halibut catch and halibut PSC utilization in different fishing sectors. For halibut and other PSC and bycatch species, conduct research to better identify where regulations restrict the utilization of fish from its most beneficial use, and evaluate how changes in existing regulations would affect different sectors and fisheries.

130 **Develop methods to estimate sea lion abundance**

    Status: Underway

Develop new methods to estimate sea lion abundance, such as the use of unmanned aerial vehicles, which could increase the probability of acquiring abundance estimates in remote areas.

131 **Assess the impact of the displacement of the groundfish fleet on Northern fur seals**

    Status: Partially Underway

Assess the impact of the displacement of the groundfish fleet due to Steller sea lion protection measures on the prey availability, foraging ecology, diet, movements, and vital rates for Northern fur seals.

132   Evaluate the impact of seabird bycatch in fisheries on bird populations, and methods to reduce takes

Status: Underway

Assess the extent and impact of seabird bycatch in fisheries on bird populations, and develop methods to reduce seabird bycatch, particularly protected species, such as short-tailed albatross.

133   Determine potential impacts of fishing activities on marine mammals

Status: No Action

Determine potential impacts of fishing activities on marine mammals (e.g., state managed gillnet fisheries), and in particular on North Pacific right whales and the Eastern North Pacific blue whales, particularly in identified critical (NPRW) or essential (NPBW) habitat.

134   Assess whether Bering Sea canyons are habitats of particular concern

Status: Partially Underway

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 a comparison of mid-level and apex predators to neighboring shelf/slope ecosystems.

137   Impact of fisheries on benthic habitat and trophic interactions

Status: Underway

Assess the impact of bottom trawl fisheries on invertebrate abundance and species composition in benthic habitats. This is especially relevant to the foraging ecology of walrus (candidate species for listing under ESA), but also bearded seals, and gray whales.

142   Survey capability for forage fish

Status: Partially Underway

Develop a long-term survey capability for monitoring forage fish (partially underway). The NPRB funded GOA and Bering Sea projects are currently describing the spatial and temporal variability in the structure of forage fish communities and the effect of this variability on predators. This work should be continued and methods for long-term monitoring should be developed.

145   Monitor skate egg case concentration sites

Status: No Action

The HAPC action for skate egg case concentration sites included two recommendations that the Council suggested should be addressed during the annual research priority discussion: (a) skate egg case concentrations should be monitored every 2 to 3 years using non-invasive research design, such as in situ observation; and (b) skate conservation and skate egg concentration areas remain a priority for EFH and HAPC management and within Council and NMFS research plans.

146 **Improve surveys in untrawlable habitat, particularly for rockfish, Atka mackerel, and sculpins**

Status: Partially Underway

For groundfish in general, and rockfish and Atka mackerel 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 that are found in untrawlable habitat or are semi-pelagic species, such as northern and dusky rockfish. A number of publications specific to untrawlable grounds and rockfish sampling have been published recently, but have not been incorporated directly into stock assessment or routine survey designs.

148 **Research on survey analysis techniques for species that exhibit patchy distributions**

Status: No Action

Continue research on the design and implementation of appropriate survey analysis techniques, to aid the Council in assessing species (e.g., some crabs and rockfish) that exhibit patchy distributions and, thus, may not be adequately represented (either over- or under-estimated) in the annual or biennial groundfish surveys.

150 **Collect maturity scans during fisheries that target spawning fish**

Status: Underway

Expand existing efforts to collect maturity scans during fisheries that target spawning fish (e.g., pollock). Time series of maturity at age should be collected to facilitate the assessment of the effects of density-dependence and environmental conditions on maturity. Maturity information for pollock and Pacific cod is collected by observers and should be analyzed. Maturity information for rockfish species near Kodiak has been collected recently, both during the fishery and dedicated scientific cruises, and should be analyzed. A dedicated survey to examine spawning sablefish has also been conducted. Efforts to collect maturity data, and then analyze for rockfish and other species should continue. In particular, retrospective studies to identify factors (e.g., fishing, climate, prey quality and quantity) influencing the maturity schedule should be conducted.

156 **Improve estimates of natural mortality (M) for Pacific cod and crab stocks.**

Status: Partially Underway

Improve estimates of natural mortality (M) for several stocks, including Pacific cod and BSAI crab stocks.

160 **Develop and evaluate global climate change models (GCM) or downscaled climate variability scenarios on recruitment, growth, spatial distribution**

Status: Underway

Quantify the effects of historical climate variability and climate change on recruitment, growth, and spatial distribution, develop standard environmental scenarios (e.g., from GCMs) for present and future variability based on observed patterns.

161 **Climate and oceanographic information covering a wider range of seasons is needed**

Status: Partially Underway

There is also a need for climate and oceanographic information that covers a wider range of seasons than is presently available.

162 **Development of projection models to evaluate (a) the robustness and resilience of different management strategies under varying environmental and ecological conditions and (b) to forecast seasonal and climate related population shifts**

Status: Partially Underway

There is a need for the development of projection models to evaluate the robustness and resilience of different management strategies under varying environmental and ecological conditions. Projection models are also needed to forecast seasonal and climate related shifts in the spatial distribution and abundance of commercial fish and shellfish.

170 **Continue to evaluate the economic effects from crab rationalization programs on coastal communities.**

Status: Underway

Continue to evaluate the economic effects from crab rationalization programs on coastal communities. This includes understanding economic impacts (both direct and indirect), and how the impacts are distributed among communities and economic sectors.

171 **Improve estimation of fishery interactions with non-target groundfish, and prohibited species.**

Status: No Action

Improve estimation of fishery interactions (including catch) and non-target groundfish (e.g., sharks, skates), and prohibited species.

172 **Conduct studies documenting the subsistence harvest (patterns, norms, quantities) in communities affected by Council actions.**

Status: Partially Underway

Conduct studies documenting the subsistence harvest patterns, norms and quantities in communities that depend upon resources that may be affected by Council action.

173 **Evaluate the effectiveness of setting ABC and OFL levels for data-poor stocks**

Status: Partially Underway

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.

174 **Examine interactions between coastal communities and commercial fisheries**

Status: Underway

Examine interactions between coastal communities and commercial fisheries (e.g., subsistence-commercial linkages, adaptations to changes in resource use, economic opportunities for coastal communities).

175   **Retrospective analysis of the impact of Chinook salmon PSC avoidance measures on the BSAI pollock fishery**

   Status: Partially Underway

   Conduct retrospective analyses to assess the impact of Chinook salmon PSC avoidance measures on the BSAI pollock fishery. Analyses should include an evaluation 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 how pollock harvesters have adapted their behavior to avoid Chinook and "other" salmon, under various economic and environmental conditions and incentive mechanisms.

176   **Develop management strategy evaluations that incorporate changing climate and market economic conditions.**

   Status: Partially Underway

   Develop management strategy evaluations under differing assumptions regarding climate and economic conditions. Promote the standardization of "future scenarios" from different models to promote comparability of model outputs.

177   **Develop an ongoing database of product inventories**

   Status: No Action

   Development of an ongoing database of product inventories (and trade volume and prices) for principal shellfish, groundfish, Pacific halibut, and salmon harvested by U.S. fisheries in the North Pacific and eastern Bering Sea.

178   **Analyze current determinants of demand for principal seafood products**

   Status: Partially Underway

   Analyze current determinants of ex vessel, wholesale, international, and domestic retail demand for principal seafood products from the GOA and BSAI.

184   **Investigate gear modifications and changes in fishing practices to reduce bycatch and PSC**

   Status: Partially Underway

   Gear modifications and changes in fishing practices to reduce bycatch and PSC are necessary. Studies of efficacy and cost of adopting these changes are needed.

185   **Conduct studies of sperm whale and killer whale depredation of catch in long-line fisheries and surveys**

   Status: Underway

   Studies of sperm and killer whale depredation of catch in long-line fisheries and surveys are needed to improve the quality of abundance estimates derived from long-line surveys.

191   **Improved habitat maps**

   Status: Partially Underway

   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 in the GOA, BS, and Aleutian Islands.

192 **Develop a GIS relational database for habitat, to include a historical time series of the spatial intensity of interactions between commercial fisheries and habitat.**

    Status: Partially Underway

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. Such time series are needed to evaluate the impacts of changes in fishing effort and type on EFH.

193 **Assess the extent of the distribution of corals**

    Status: Partially Underway

Assess the extent of the spatial distribution of deep-sea corals off Alaska and conduct routine monitoring of these areas.

196 **Develop a multivariate index of the climate forcing of the Bering Sea shelf**

    Status: Partially Underway

Develop a multivariate index of the climate forcing of the Bering Sea shelf. Three biologically significant avenues for climate index predictions include advection, setup for primary production, and partitioning of habitat with oceanographic fronts and temperature preferences.

197 **Develop bottom and water column temperature databases and indices**

    Status: Partially Underway

Develop bottom and water column temperature databases and indices for use in EBS, GOA, and AI stock assessments.

199 **Collect and maintain primary production time series**

    Status: No Action

Collect and maintain primary production time series in the EBS, AI, GOA, and Arctic; particularly in relationship to key climate and oceanographic variables.

201 **Collect and maintain data on forage fish community composition and abundance**

    Status: Partially Underway

Collect and maintain data on forage fish community composition and abundance in the Bering Sea, GOA, AI, Arctic.

202 **Collect and maintain time-series data on the community composition, production, and biomass of benthic invertebrate and vertebrate fauna**

    Status: Partially Underway

Collect and maintain time-series data on the community composition, production, and biomass of benthic invertebrate and vertebrate fauna.

207 **Assess the impact of increases in recovering whale populations on lower trophic level energy pathways**

Status: No Action

Assess the impact of increases in recovering whale populations (e.g., gray, humpback and fin) on lower trophic level energy pathways.

209 **Cooperative research efforts to supplement existing at-sea surveys that provide seasonal, species-specific information on upper trophic levels**

Status: Partially Underway

Continue and expand cooperative research efforts to supplement existing at-sea surveys that provide seasonal, species-specific information on upper trophic levels (seabirds and marine mammals). Updated surveys to monitor distribution and abundance of seabirds and marine mammals are needed to assess impacts of fisheries on apex predators, improve the usefulness of apex predators as ecosystem indicators, and to improve ecosystem management.

211 **Assess the relative importance of non-commercially exploited species to human communities**

Status: Partially Underway

Assess the relative importance of non-commercially exploited species (invertebrates, fish, marine mammals, and seabirds) to human communities, particularly in Arctic.

214 **Measure and monitor fish composition**

Status: No Action

Measure and monitor fish composition: evaluate 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, monitor changes in the distribution of assemblages, and understand the spatial importance of predator-prey interactions in response to environmental variability. Additional monitoring may be necessary in the Aleutian Islands, northern Bering Sea, and areas of the Gulf of Alaska.

215 **Assess the movement of fish to understand the spatial importance of predator-prey interactions in response to environmental variability**

Status: Partially Underway

Assess the movement of fish in response to environmental variability to understand the spatial changes of predator-prey interactions.

221 **Conduct ecosystem structure studies**

Status: Underway

Studies are needed to evaluate the effects of global warming, ocean acidification, and selective fishing on food webs. For instance, studies are needed to evaluate differential exploitation of some components of the ecosystem (e.g., Pacific cod, pollock, and crab) relative to others (e.g., arrowtooth flounder).

223 **Modeling studies of ecosystem productivity**

    Status: Underway

Modeling studies of ecosystem productivity in different regions (EBS, GOA, and AI). For example, studies could evaluate the appropriateness of the 2 million t OY cap.

300 **Assess the population status of harbor seals in the Aleutian Islands and determine factors affecting their population trajectories**

    Status: No Action

Assess the population status of harbor seals in the Aleutian Islands and determine factors affecting their population trajectories

307 **Determine quantitative indicators of spatial structure, particular for walleye pollock and Pacific cod**

    Status: No Action

The next generation of stock assessment models will be spatial age- and length-structured assessment models, in line with the goal of ecosystem-based fishery management. Current distributions of spatial location have been empirically summarized, but methods should be explored to convert these to movement patterns for biological and/or management regions.

308 **Investigate in situ methods of tagging species that experience barotrauma**

    Status: No Action

Species with swim bladders experience barotrauma, so that tagging studies result in high mortality and little information. Icelandic and Norwegian scientists have developed in situ methods for tagging, so that these fish never change depth. This could provide precise estimates of movement rates from tagging studies needed for spatial stock assessments. Such a recommendation for walleye pollock is found in a 2011 Report of a Workshop on Spatial Structure and Dynamics of Walleye Pollock (AFSC Processed Report 2011-04).

309 **Effects of changes to the observer program**

    Status: No Action

Evaluate the effects of changes to data collection protocols that occur because of observer restructuring. Ensure that data can be compared easily to the previous data collection methods and time series remain intact.

313 **Retrospective analysis of the impact of Chinook PSC avoidance measures on communities of western Alaska**

    Status: No Action

Conduct retrospective analysis, using qualitative and quantitative methods, of salmon dependent communities of western Alaska that may be affected by Chinook salmon PSC avoidance measures in the BSAI. Analysis should evaluate long-term changes in local Chinook abundance and uses, and provide detailed ethnographic work, exploring the meaning of salmon to these communities in the context of industrialized offshore fisheries.

315 **Area-specific variability in scallop population processes**

    Status: No Action

_____ Investigate area-specific variability in vital population processes, including growth, recruitment, natural mortality and movement.

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Res_Title

104 **Improve species identification**

Status: Partially Underway

Improve species identification, by both processors and observers, for priority species within species complexes in catches, to meet requirements of total removals under ACLs. Methods that quantify and correct for misidentifications are also desired.

140 **Identification and integration of archived data**

Status: Partially Underway

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. Some archival acoustic data have been cataloged, and most trawl surveys have been included in databases. Some one-time research surveys remain neglected.

154 **Conduct multivariate analysis of bycatch data from the scallop observer program**

Status: Underway

Conduct multivariate analysis of bycatch data from the scallop observer program (haul composition data) and camera sled data. The analysis should include an investigation of localized depletion of scallops relative to fishing effort.

159 **Evaluate hybridization of snow and Tanner crabs.**

Status: No Action

Evaluate the assessment and management implications of hybridization of snow and Tanner crabs.

206 **Develop methodologies to monitor for new/emerging diseases and/or parasites among exploited species and higher trophic levels**

Status: No Action

Develop methodologies to monitor for new/emerging diseases and/or parasites among exploited species and higher trophic levels.

210 **Initiate and expand non-market valuation research of habitat, ecosystem services, and passive use considerations**

Status: No Action

Initiate and expand non-market valuation research of habitat, ecosystem services, and passive use considerations.

218 **Assess the synergistic effects of ocean acidification, oil, dispersants, and changes in temperature on productivity of marine species.**

Status: No Action

Laboratory studies are needed to assess the synergistic effects of ocean acidification, oil, dispersants, and changes in temperature on productivity of marine species.

219 **Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates.**

Status: No Action

Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates.

303 **Determine effects of migration on the Pacific halibut population and management**

Status: Underway

Extend existing analyses of tagging studies to include age-specific components. Continue to evaluate the role of migration in contributing to population dynamics and trends associated with area-specific catch, PSC levels, and downstream effects.

304 **Investigate long term effects of fishing on Pacific halibut**

Status: Underway

Collect genetic samples for future comparison.

316 **Ocean Acidification and Scallops: monitoring water quality**

Status: No Action

Seasonal water quality monitoring in known scallop areas is desired.

317 **Effects of Ocean Acidification on Scallops**

Status: No Action

Studies to understand the mineralization of scallop shells through life cycle and across spatial variability should be undertaken.