DRAFT REPORT
of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
August 16-17, 2010

The SSC met during August 16-17, 2010 at the Captain Cook Hotel, Anchorage, Alaska. Members present were:

Pat Livingston, Chair *NOAA Fisheries—AFSC*	Farron Wallace, Vice Chair *Washington Depart of Fish and Wildlife*	Robin Brown *Oregon Department of Fish and Wildlife*
Robert Clark *Alaska Department of Fish and Game*	Keith Criddle *University of Alaska Fairbanks*	Sue Hills *University of Alaska Fairbanks*
Anne Hollowed *NOAA Fisheries—AFSC*	George Hunt *University of Washington*	Kathy Kuletz *US Fish and Wildlife Service*
Seth Macinko *University of Rhode Island*	Franz Mueter *University of Alaska Fairbanks*	Lew Queirolo *NOAA Fisheries—Alaska Region*
Terry Quinn II *University of Alaska Fairbanks*	Doug Woodby *Alaska Department of Fish and Game*	

Members absent were:

Gordon Kruse *University of Alaska Fairbanks*	Ray Webster *International Pacific Halibut Commission*

B-1 (a) Steller Sea Lion Biological Opinion and EA/RIR

The draft Steller sea lion (SSL) biological opinion (BiOp) and supporting white papers were presented by Libby Logerwell (white papers, NMFS-AFSC) and the BiOp team of Doug DeMaster (NMFS-AFSC), Bill Wilson (contractor), and Brandee Gerke (NMFS-AKR).

Public testimony was given by John Gauvin (Alaska Seafood Coop), Jay Stern (Alaska Longline Company), Dave Fraser (Adak Community Development Corporation), Kenny Down (Freezer Longline Coalition), and Rudy Tsukata (Aleut Enterprises).

The 2010 Endangered Species Act- Section 7 Consultation, Draft Biological Opinion (BiOp), is a well written, clear document that summarizes the potential impact of authorizing federal and state parallel groundfish fisheries in the BSAI and GOA on the status and recovery of three endangered species, the western and eastern distinct population segments (DPS) of the Steller sea lion (SSL, *Eumetopias jubatus*), the North Pacific humpback whale (*Megapgtera novaeangliae*) and the North Pacific sperm whale (*Physeter macrocephalus*). The document has relatively little discussion of the whales or the eastern DPS of SSL; none are found to be adversely affected by the federal action under review.

The Endangered Species Act puts the burden of proof on the action agency to show that the proposed action is not likely to jeopardize the continued existence of any listed species or destroy or adversely modify their designated critical habitat. This draft BiOp finds that the federal action under review, the Alaska groundfish fisheries for Atka mackerel and Pacific cod "is likely to jeopardize the existence of the western DPS of Steller sea lions" and is "likely to adversely modify the designated critical habitat."

The BiOp provides a wide-ranging and thorough discussion of the various hypotheses that have been put forward to explain the decline and slow recovery of the western DPS of the Steller sea lion. Available data are presented and evaluated in an impartial and careful analysis of what has been learned about the

biology and ecology of Steller sea lions in the North Pacific in general, and in Alaska in particular. This evidence is used to draw a number of important conclusions.

The BiOp clearly documents that the Steller sea lion has declined substantially from historic high population levels and has at least two genetically distinct population segments (DPS). Although the western DPS as a whole has increased at a low rate over the last decade, counts in the western and central AI subregions have continued to decline. The limited SSL diet data in those regions show that Atka mackerel and Pacific cod comprise substantial portions of the diet. Commercial fishing for those two species continues in the region, including areas inside critical habitat.

Although the data do not exist to definitively answer some key questions in the BiOp, the SSC focused comments on the use of the best scientific evidence, appropriateness of the analyses, and the performance standards for the RPA. The SSC also provides research recommendations to better support future analyses and to track the effectiveness of the reasonable and prudent alternatives (RPAs).

Overall, this BiOp much improved from earlier ones. Previously, the SSC has commented on lack of balance and tone of advocacy. The current document has a more balanced, neutral presentation of the scientific information in the background chapters although the conclusion chapter has retained some tone of advocacy, stating as fact some conclusions that still have a great deal of uncertainty about them. The document is a useful compilation of the history of the various actions and consultations and legal definitions with references.

Detailed comments on sections of the BiOp and associated white papers are presented below.

Chapter 3 Status of Species and Critical Habitat

The reference for the method of determining the RCA boundaries is given as AFSC 2010a, an untitled manuscript. At a minimum, a summary of the methods and criteria for determining these boundaries should be included in the chapter. In particular, a more detailed justification for grouping the eastern Bering Sea with a portion of the Aleutian Islands in RCA6 should be provided.

The SSC suggests that the document include comparable data on fisheries, bathymetry, diet, prey diversity/densities in the area immediately west of the western Aleutians where SSL are showing a lack of recovery.

Chapter 4 Environmental Baseline.

It appears that this chapter is somewhat dated and needs to be revised with more recent literature. Sections that need updating are: Section 4.1.2 Climate and biological regime shifts, Section 4.1.4.2 Response of Major Pollock Spawning Aggregations, Section 4.1.4.4 Changes in the distribution of important prey and Section 4.1.6.1 Global climate change.

Chapter 5, Effects of the action.

This chapter uses the Ianelli et al white papers that present historical AI trawl survey biomass estimates and projections of the Aleutian Islands Atka mackerel and Pacific cod population trends in areas 542 and 543 under the fishing restrictions proposed in the RPA. The projections are a straightforward application of the projection methodology used in the groundfish SAFE, but require additional assumptions (independence of areas, same population dynamics as in the SAFE). Not surprisingly, the populations are expected to grow over the next ten years under reduced fishing scenarios, thus providing more prey for Steller sea lions in those areas.

The SSC recommends that the authors include a brief summary of the projection methodology in the Methods section. This will allow readers to understand or remember details, such as which population parameters are fixed and which ones are stochastic. The values of F_{ABC} and which assessment tiers they are derived from should also be provided. The SSC also requests that the authors provide a rationale for why other species were in the projection tables but were assumed to be constant instead of projecting them as was done for Atka mackerel and Pacific cod.

Although the SSC understands that the "footprint analysis" (AFSC 2010a) was not used to arrive at the main conclusions of the BiOp, this chapter includes a lengthy and critical discussion of the results from this footprint analysis (Section 5.1.2.2). This section ends with the conclusion that a "reasonable interpretation of these data is that the conservation measures implemented in the 2000s have had a positive impact on reducing the impacts of the fishery exploitation strategy on Steller sea lions". The authors should re-evaluate this conclusion in light of the detailed SSC comments on this white paper provided further below in our report.

Chapter 6, Cumulative effects.
This chapter presents a complete and even-handed treatment of cumulative effects on SSL.

Chapter 7: Synthesis and conclusions
This chapter maintained continuity with the recovery plan criteria but could be improved with cross-references to previous tables to provide the reader with better access to the data used to make the conclusions.

Chapter 8, RPA.
This chapter is generally well-constructed, allowing the reader to follow the rationale, evidence, and proposed solution. However, it would be helpful to provide references to the pages, tables, or figures of BiOp where the evidence is discussed, or the paper with the source of data.. In addition, this chapter reverts to a tone of advocacy and certainty about fairly uncertain biological issues that was present in previous BiOps. The SSC suggests that this language be revised to the more appropriate scientifically neutral language.

There were questions about the global scale of the RPA and whether a more local scale solution could be found that would also satisfy the fishery management performance measures. The scale of the areas in the RPA that are fished compared to the scale of the area closed seemed to be mismatched. As noted in the SSC comments on the EA, the performance standards lack clarity with respect to the precise measures that would need to be attained to satisfy the intent. It was questioned whether it might be possible to have a more "surgical" RPA that could achieve the same conservation goal.

Adaptive management and research recommendations.
The SSC has commented many times on the need for coordinated, specific monitoring of SSL and fish responses to management actions taken. If the proposed RPA is put in place, it is imperative to conduct adequate monitoring as soon as possible to track responses and recovery. Many times during the presentations we heard phrases such as "we couldn't get out to the western Aleutians," or "we have little data from that area so extrapolated," or we used summer data" although most of the fishery takes place in the winter. The SSC appreciates that the western Aleutian Islands is a difficult place to work especially in winter and that work there is expensive. However, those are not adequate reasons not to collect the data needed.

Research is needed to help resolve effects of harvesting on population growth rates of SSL. The RPA put forward in the BiOp would have major impacts on the fisheries and communities of the Aleutians and has potential ripple effects on the management of Bering Sea and Gulf of Alaska fisheries. Therefore, it is

essential that adequate research effort for resolving issues of fisheries harvest rates, SSL prey requirements, seasonal diets of SSL, and SSL demographics in the western AI regions be obtained in a timely fashion to allow assessment of the effectiveness of any measures that may be taken to improve population growth trends in the western-most sub-populations of the western DPS.

Coordinated SSL and fisheries projects are needed for seasonal distribution and local density of prey, diets of SSL and their competitors, foraging behavior of SSL, and brand-resight studies for vital rates. Methods used to date have not produced data at the appropriate time and space scales necessary to accept or reject key hypotheses posed. It may be necessary to change the data acquisition strategy. For example, more frequent pup and non-pup counts may need to be conducted in these areas. It might be useful to consider establishing a field station in the western AI to give more flexibility to respond to windows of good weather. The SSC urges AFSC and others to focus resources on this area to evaluate the efficacy of the measures and to better understand the western AI ecosystem relative to SSL. Previous work has examined the response of fish to fishing, and diet and movement data for SSL but it would be particularly useful to have these coordinated to investigate the response of the SSL to changes in the prey field.

- There is a need for more precise biomass estimates by sub-regions for Atka mackerel, particularly in the central and western Aleutians. Additional tagging studies should be considered for this area to be able to document significant changes in Atka mackerel over time.
- Studies to assess prey availability during winter should be a high priority.
- Additional data on the diet of SSL in the western Aleutians (summer & winter) are needed.
- The low pup to non-pup ratio in the western and central Aleutians suggests low natality in this area. Focused, small scale studies in the western Aleutians should be considered to address this issue, in addition to conducting more frequent SSL pup counts.

EA/RIR – Revisions to the Steller Sea Lion Protection Measures for the Aleutian Islands Atka Mackerel and Pacific Cod Fisheries

Melanie Brown (NMFS-AKR) and Ben Muse (NMFS-AKR) presented the draft Steller sea lion EA/RIR. Public testimony was given by Jon Warrenchuk (Oceana), Dave Fraser (Adak Community Development Corporation, ACDC), Kenny Down (Freezer Longline Coalition), John Gauvin (Alaska Seafood Cooperative) and Frank Kelty (City of Unalaska).

The SSC recognizes that the EA/RIR was developed under a compressed timeframe and therefore several sections were incomplete (e.g., placeholder text on ecosystem considerations and cost and earnings data presented during the staff presentation are not incorporated in analysis). **Consequently, the SSC finds that the draft analysis does not presently provide a fully sufficient basis for public review of the likely environmental, economic, or social impacts of the alternatives.** During staff presentations, the analysts indicated their intention to replace placeholder text, backfill missing sections, clarify labels and legends on figures and tables and to rewrite some sections. Moreover, we note that other alternatives could be constructed that might achieve the intent of the RPA provided in the draft FMP BiOp. The SSC anticipates that the EA-RIR will undergo a substantial revision prior to final action in October and therefore **the SSC requests to review this document again at the October meeting.**

To assist the authors in their revisions we offer the following specific comments and suggestions.

Section 1.1.1. The SSC recognizes that additional alternatives may be submitted during the comment period. To assist the public, it would be useful to provide some guidance on how to interpret

performance standards for fishery management measures used to develop the RPA in the FMP BiOp (listed on page 1-2). In particular, it would be useful to provide instructions on how the public should interpret the term "*conserve*" used in bullets 2, 3, and 5. Alternatives 2 and 3 use the standard of "*at least as protective as the RPA in the FMP BiOp*". The authors should clarify whether this standard would require all alternatives to prohibit all targeted fishing for Atka mackerel and Pacific cod in area 543 or whether other alternatives that would "conserve" Steller sea lion forage in area 543 would be considered. Likewise it would be useful to clarify in section 1.1.1 whether NMFS will consider any proposal that allowed fishing for Atka mackerel within critical habitat.

Section 3.3.1.2 – 3.3.1.3. These sections focus on direct impacts on Atka mackerel and Pacific cod. The impact of the action on Pacific cod abundance could also impact Atka mackerel abundance through predation effects and should be incorporated into the analysis and discussion. These impacts are discussed in Doug Kinzey's dissertation (University of Washington, School of Aquatic and Fisheries Science) and other papers by the same author. Likewise, Ivonne Ortiz (University of Washington, School of Aquatic and Fisheries Science) addresses the species interactions of fish found in the Aleutian Islands.

Section 3.4.3. The document should include a discussion of the impact of the action if the NPFMC finds sufficient evidence that Pacific cod in the AI and EBS are separate stocks and should be managed as such for conservation purposes. The SSC has reviewed several white papers on the subject of Pacific cod stock structure and the SSC and Groundfish Plan Teams have formed a working group to provide guidance on stock structure of BSAI/GOA groundfish stocks.

Section 4.4. This section addresses direct impacts of the action on forage fish; however, indirect impacts could occur through changes in the foodweb, particularly the expected biomass increase in Pacific cod and arrowtooth flounder, both are major predators of Atka mackerel. Some consideration of indirect impacts of the action should be included in this section.

Section 8. The Ecosystem Impacts section needs considerable improvement. The SSC was informed that this section was a placeholder and will be revised in the final version. When considering revisions, the SSC encourages the authors to utilize the FEP framework for risk assessment.

The current version of the EA contains sections of the 2009 Ecosystem Considerations. Several bullets refer to changes from 2008 and 2009. These are not particularly relevant to assessing the impacts of this action. The authors should strive to focus their discussion of climate and environmental trends that are within a time frame relevant to the action.

With specific respect to the RIR, the SSC wishes to acknowledge the efforts of all the Alaska Region and Alaska Fisheries Science Center staff who contributed to this analysis. With the timely data support by Terry Hiatt (AFSC), the analyst has prepared a broad-based economic and socioeconomic assessment, addressing critical considerations that are often overlooked or incompletely treated. Specifically, the SSC appreciates efforts to draw on recent published research on: (1) option and bequest values associated with alternative SSL rebuilding trajectories (Lew, Layton, Rowe, Garber-Yonts); (2) direct, indirect, and induced regional impacts (Seung, Waters); and (3) fishing site choice models (Haynie, Layton). While these models did not lend themselves to direct application in this analysis, they did provide a useful underpinning for the qualitative analyses that are presented. The SSC is particularly pleased that the analysts intend to incorporate cost-earnings survey data in the next draft RIR.

While the SSC acknowledges limitations in data available for analysis and limitations associated with confidentiality of some of the data that is available, there is nevertheless a need to provide a more detailed discussion of the likely impacts of the alternatives on the communities of Adak, Atka, and Unalaska. The impacts on these communities are distinct from impacts on the four fishing fleets discussed in the RIR.

Additional discussion is also needed on how MRA's, PSC's and possible fishing ground interactions may be factor precluding sectors from re-deploying elsewhere in an effort to maximize catch and minimize losses.

The SSC urges the analysts to carefully qualify the values reported for changes in revenues, costs, and nonmarket values so that the public is not misled into inappropriate direct comparisons of these values. Where possible, the values should be expressed in similar time frames. Similar care should be given to community-level impacts, such as employment and income multipliers.

Critical to understanding the context under which this SSL management action will be implemented is a recognition that Amendments 79/80 (GRS and Co-ops) have been, and are presently in the process of being, amended (e.g., FMP A.93). While the Amendment 93 analyses supporting the proposed structural changes in Amendment 80 cooperative formation criteria are substantially advanced, that action is not final. Therefore, Amendment 93 will very likely be delayed until the amendment analysis is brought into agreement with the SSL action.

White Paper Comments

<u>"Fooprint" White paper Comments</u>

The SSC received a report titled "Steller Sea Lion Fishery and Oceanographic Analysis BiOp2010 (February 11, 2010)", summarized for us by Elizabeth Logerwell (NMFS, AFSC). The SSC appreciates the efforts to analyze population trends for Steller sea lions relative to harvest rates and oceanographic factors. We had a number of comments in regards to the data used in the report and the analyses that were conducted:

Data issues:

- The report attempts to evaluate harvest rates within 11 geographic regions (referred to as RCAs in the Biological Opinion). The SSC believes that the available data, particularly for patchily distributed Atka mackerel, do not support apportionments at the scale of the RCAs. The apportionment of Atka mackerel surveys did not include years that had "unrealistic" biomass estimates but linearly interpolated between survey years, thereby creating artificial data with unknown accuracy. Given the high variability in survey biomass, interpolated values may be could be both inaccurate and serially correlated.
- Because only decadal-scale averages are used in the analysis, the SSC suggests that analysts test for significant differences in the proportions of biomass by area across survey years. If no significant differences are found, averaged proportions (by decade or over the entire time period) should be used.
- While the use of harvest rates as a measure of potential impacts is preferable to the use of absolute catches, highly variable biomass estimates introduce large uncertainties in the ratio of Catch/Biomass. If reasonable biomass estimates can be obtained (say from a model), the use of biomass density as a measure of prey availability could be considered. However, if survey biomass is used as a proxy for prey availability, some discussion of the overlap between the size of SSL prey and the size of fish retained in the survey needs to be included. If adequate length-frequency data from the survey are available, it may be possible to estimate biomass for the appropriate SSL prey size range.

- There is an obvious mismatch between the season when survey data are collected (summer, particularly for Atka mackerel and Pacific cod) and when the fisheries occur (winter). The assumption that proportions by area do not change through the season needs to be clearly stated and the associated large uncertainty should be acknowledged.

Analysis issues:

- As noted above, survey data were interpolated between some years and the interpolated points were subsequently used to calculate harvest rates. These rates were then averaged across decades to produce single points for each area for the regression analysis with SSL population growth. The statistical properties of these average rates are unknown but are likely overly precise due to artificially increased sample sizes. Consequently, the significance of the regression in likely overstated.
- Furthermore, linear regression analysis is not appropriate for relating population growth rates to estimated harvest rates given the large errors in the independent variable (harvest rates, which depend on highly uncertain biomass estimates). This will overstate the significance of the regression. The author should consider a simple parametric or non-parametric correlation analysis that makes fewer assumptions or an error-in-variables analysis.
- Use of a p-value of 0.25 for tests of significance of the slope of a regression is not a commonly accepted scientific practice and should be lowered to at least 0.10 (as was done in the BiOp) or additional justification for this level of p-value provided.
- Each of the spatially defined data series used in the regressions (SSL population growth rates and fishery harvest rates) is strongly auto-correlated (strong east to west trends). This reduces the effective sample size and will increase the effective type I error rate. The effect of spatial autocorrelation could explain the larger number of significant relationships between population growth rates and oceanographic variables in the Aleutians because both display strong east to west spatial gradients in this area, hence the probability of finding significant relationships is inflated. To evaluate correlations between auto-correlated time series, methods to compute the effective sample size have been developed (see, e.g., Pyper and Peterman 1998, Can. J. Fish. Aquat. Sci. 55: 2127–2140). The same method could be used in this spatial context if equal spacing between adjacent regions is assumed.
- The authors acknowledged the potential for getting significant results by chance due to conducting multiple statistical tests but do not attempt to adjust p-values (Bonferroni or similar adjustments) or to evaluate the probability of getting a significant result in a certain number of tests (e.g. sign test). However, such adjustments are only justified for groups of independent tests, whereas the authors aggregated results across tests that are clearly not independent. For example, tests based on data from the 1991-2008 time period are not independent of tests using data from 2000-2008.
- The use of decadal time periods, rather than shorter periods, may mask relationships between SSL counts and fisheries or oceanographic observations. For example, the 2000-2008 time period aggregates across well-known warm and cold periods. There may also be lag times between fishery harvests or oceanographic factors and observable effects on SSL numbers that could be incorporated in the analysis if appropriate lags can be identified. One alternative would be to use individual data points for years with both survey and SSL population growth rates and treat area as a categorical variable in a general linear model or random effects model.

- Arrowtooth flounder are not included in the analysis of population growth rates in the Aleutian Islands because of low abundances and low frequency of occurrence in SSL stomachs. The SSC encourages the authors to include arrowtooth flounder in this region because of their increasing population trend and their important role as prey in other regions and as potential competitors for SSL prey.
- To avoid confusion, the authors should use 'population growth' instead of 'growth' throughout the document.

White Papers by Ianelli et al.

These two papers present projections of the Aleutian Islands Atka mackerel and Pacific cod populations into the future under the fishing restrictions in areas 542 and 543 proposed in the RPA. The projections are a straightforward application of the projection methodology used in the SAFE, but require additional assumptions (independence of areas, same population dynamics as in the SAFE). Not surprisingly, the populations are expected to grow over the next ten years, thus providing more prey for Steller sea lions in those areas.

The SSC recommends that the authors include a brief summary of the projection methodology in the Methods section. This will allow readers to understand or remember details, such as which population parameters are used and which ones are stochastic. The values of F_{ABC} and which assessment tiers these were derived from should also be given.

The SSC also requests that the authors provide a rationale for why they included other species in the projection tables but then left them constant instead of projecting them analogously to Atka mackerel and Pacific cod. One would not expect the other species to stay constant, even if fishing mortality and all other population parameters were constant.

Detailed Editorial Suggestions

SSL BiOp edits, questions and suggestions

1) page xxvi, middle paragraph: eastern or central Bering Sea? Where is the broad shelf in the central Bering, or the Gulf, for that matter?

2) page xxix, bottom: define FO on first use

3) Page xxxiii, third paragraph, line 2: remove extraneous "of"

4) page xxxiii, lower third: It might be useful to specify the location of the critical habitat for P. cod and Atka mackerel, as done for the Groundfish fishery

5) page 5, line 17: jeopardize not jeopardized

6) page 78, 3rd paragraph: Although we recognize that estimates of the total population are not used for the findings in the BiOp, the SSC questions the method for such an estimate that is given on Page 78. Estimates use estimates of birth rate and sex and age structure of a stable SSL population from the Gulf of Alaska in the 1980s (based on Calkins and Pitcher 1982). The SSC concurs with the statement "estimates…are highly uncertain since the accuracy of the pup count multiplier is affected by temporal and spatial variation in natality and survival rates, sex rations and age structure" and suggests that the

method be brought up to date. Elsewhere (e.g., top of p. 83, it is said that the pup to non-pup is varying through time.

7) Page 89, 2nd paragraph: weaning usually occurs

8) page 89,4th full paragraph, third line from bottom: is maternal dependence meant rather than independence?

9) page 90, Summary Section: The shift between the 70s to the 80s in SSL parameters is the same period when there were major shifts in population parameters and diets of seabirds and possibly fur seals at the Pribilofs. It might be useful to incorporate more information from other predators in the system such as fur seals and seabirds.

10) page 91, line 10: "and" rather than "but"

11) Page 92, 2nd paragraph: The statement re Hennen et al.'s findings needs to be softened. They found a correlation between the timing of implementation of regulations and the start of SSL recovery, but were not able to rule out the possible role of a regime shift that was reputed to have occurred in the same time frame.

12) Page 96, last paragraph: It would be useful to give some more information as to the types of prey involved. Could they relate dive types to prey types?

13) Page 97, middle paragraph: What are the light levels at night in summer? Are the SSL shifting the types of prey taken during summer and winter?

14) Page 100, 4th paragraph: Given the emphasis on arrowtooth flounder in the GOA, trends in arrowtooth flounder in the Aleutian Islands should also be discussed.

15) page 101, paragraph 2: There is a comment that the proportion of pollock in the diet may have changed, but it does not indicate whether the proportion increased or decreased.

16) page 105, 2nd paragraph: The discussion emphasizes stress hormones in the eastern DPS of the SSL. Consider adding a discussion of work that has been done on stress hormones in the western DPS such as corticosteriod levels (a stress indicator).

17) page 107, 2nd to bottom line: Remove s in SSLs.

18) page 108, middle: On what factors should research focus, and why, at least relative to SSL problems?

20) page 110, top full paragraph: Consider adding a discussion of corticosteroids as a measure of food stress? Hunt et al., 2008 show significantly different corticosteroid levels in fur seal scats at the Pribilofs and at Bogoslof.

21) page 111: Is it possible to develop a graph of rates of decline vs an indicator (s) of stress?

22) page 112, middle to bottom: There seems to be some conflicts in results here. On the one hand, growth rates of juveniles suggest no nutritional stress, though a paragraph later there is conflicting data on haptoglobin levels. Is this because of a difference in the timing of the studies or in methods?

23) page 112, bottom: The idea that the relative availability of prey increased with decreasing population size depends on the assumption that the prey field remained constant. This seems unlikely.

24) page 113, middle: capelin are often described as high energy density. It would be useful to have a short table giving the energy density of the four or five most important prey types by season and age class.

25) page 119, near top. Adopt a consistent name for these islands. Kormandorskiye here, Commander Is elsewhere.

27) page 120-121: The section on arrowtooth flounder should include a discussion of trends in the Aleutians. It should include a discussion of the potential role of them as competitors as well as prey including their area-specific diets.

28) page 126, also page 128, top: Baretta and Hunt have published data on changes in Humpback whale incounters near the Pribilof Islands; Hunt has also submitted data on observations of humpback whales along the north of the Alaska Peninsula. These data would seem to be relevant here.

29) page 131, near bottom: How does this statement that killer whales are a significant source of humpback whale mortality square with the arguments that killer whales did not prey on the great whales to a significant extent (see discussion of Sequential Megafaunal Collapse hypothesis page 164).

Suggested references for consideration for use in updating Chapter 4:

A'Mar, Z., Punt, A.E., & Dorn, M.W. (2009) The impact of regime shifts on the performance of management strategies for the Gulf of Alaska walleye pollock (Theragra chalcogramma) fishery. *Canadian Journal of Fisheries and Aquatic Sciences [Can. J. Fish. Aquat. Sci.]. Vol. 66*, no. 12.

Ciannelli, L., K. M. Bailey, K. Chan, A. Belgrano and N. Stenseth, 2005 Climate change causing phase transitions of walleye pollock (Theragra chalcogramma) recruitment dynamics. Proc. R. Soc. B (2005) 272, 1735–1743

Ciannelli, L., G. E. Dingsør, B. Bogstad, G. Ottersen, K.Chan, H. Gjøsaeter, J. E. Stiansen, and N. C. Stenseth, 2007a. Spatial anatomy of species survival effects of predation and climate-driven environmental variability. Ecology, 88(3), 2007, pp. 635–646

Cianelli, L., K. M. Bailey, K. Chan, N. C. Stenth. 2007. Phenological and geographical patterns of walleye pollock (*Theragra chalcogramma*) spawning in the western Gulf of Alaska. Canadian Journal of Fish and Aquatic Sciences 64: 713-722.

Gaichas, S. PhD Dissertation, University of Washington, School of Aquatic and Fisheries Sciences, Seattle, WA

Hollowed, A. B., Z. T. A'mar, R. Beamish, N. Bond, J. Overland, M. Schirripa, T. Wilderbuer. 2009. A Framework for Modeling Living Marine Resource Response to Future Climate Change. ICES J. Mar. Sci. 66(7):1584-1594.

Hunt, G.L, Jr., Allen, B.M., Angliss, R.P., Baker, T., Bond, N., Buck, G., Byrd, G.V., Coyle, K.O., Devol, A., Eggers, D.M., Eisner, L., Feely, R., Fitzgerald, S., Fritz, L.W. Gritsay, E.V., Ladd, C., Lewis, W., Mathis, J., Mordy, C.W., Mueter, F., Napp, J., Sherr, E., Shull, D., Stabeno, P., Stepanenko, M.A., Strom, S. 2010. Status and trends of the Bering Sea region, 2003-2008, In S.M. McKinnell and M.J. Dagg [Eds.] Marine Ecosystems of the North Pacific Ocean, 2003-2008. PICES Special Publication 4.

Moss, J.H., E.V. Farley, Jr., and A.M. Feldmann, J.N. Ianelli. 2009. Spatial Distribution, Energetic Status, and Food Habits of Eastern Bering Sea Age-0 Walleye Pollock. Transactions of the American Fisheries Society 138:497–505.

Mueter, F. J. and M. A. Litztzow, 2008. Sea ice retreat alters the biogeography of the Bering Sea continental shelf. Ecological Applications, 18(2): 309–320

Overland, J. E., Alheit, J., Bakun, A., Hurrell, J.W., Mackas, D. L., and Miller, A. J. 2010. Climate controls on marine ecosystems and fish populations. Journal of Marine Systems, 79: 305-315.

Ortiz, I. PhD dissertation, University of Washington, School of Aquatic and Fisheries Sciences. Seattle, WA.

Spencer,P. D., 2008. Density-independent and density-dependent factors affecting temporal changes in spatial distributions of eastern Bering Sea flatfish. Fish. Oceanogr. 17:5, 396–410.

Wang, M., Overland, J. E., and Bond, N. A. 2010. Climate projections for selected large marine ecosystems. Journal of Marine Systems, 79: 258-266.

Section 4.1.1 last paragraph. delete "*at least hypothetically*"
Section 4.5.1 6th paragraph, page 194, last sentence. Delete " – *check*"

30) page 136, 2nd paragraph: More references on predation could be added.

31) page 140, near bottom and page 142, near bottom: Hunt et al., 2008 (Pribilof volume of DSRII and the recent review of Status and Trends in the Bering Sea in the PICES update of the North Pacific Ecosystem Status Report would be useful here.

32) page 141, top: What passes are referred to here? Give names.

33) page 145 "table": EBS- what about 76-77? In GOA 1988-1989 why the italics for in?

34) page 147, middle: conducted not conduced.

35) page 148, middle: The observation that the pollock became more concentrated as the fishery progressed is interesting and possibly at odds with what was seen in Barnabus canyon

36) page 148-149: It would seem that a discussion of changes in arrowtooth flounder would be appropriate here, as they are important prey, at least in the GOA.

37) page 152: consider adding a reference for higher potential for trophic cascades at high latitudes.

38) page 154, 1st full paragraph: See Hunt et al., 2008 and request slides from Hunt et al.,in prep re changes in prey use at the Pribilofs and evidence for competition with arrowtooth flounder there. In sum, for fur seals and seabirds there is considerable evidence for a local change in carrying capacity in the vicinity of the Pribilofs.

39) page 156, top: The Fritz and Hinkley paper did not take into account the data on changes in prey use by seabirds at the Pribilofs and was too quick to dismiss data on food habits in fur seals there. Capelin

used to spawn on the beaches of the Pribilofs, and would have been an excellent, easily caught prey for fur seals and juvenile SSL. Likewise age-1 pollock used to be plentiful in the surface waters and were used by surface-feeding kittiwakes. After 1976, there was a major reorganizqation of the food webs in the eastern Bering Sea which almost certainly affected the prey fields used by sea lions. What may have happened in the Aleutians remains unknown.

40) page 161, near bottom: Where is the "headquarters" of the AT1 group?

41) page 162, bottom: If knowing the diets of transient killer whales is important for assessing their consumption of SSL, the SSC encourages collection of more stable isotope samples to resolve this question.

42) Page 169: there is much new information on pollock recruitment and what may control it. See Coyle et al., 2008, Hunt, et al., 2008; Hunt et al., submitted; Coyle et al., submitted.; The linkages to late ice retreat, production of large zooplankton and survival of age-0 pollock seem quite strong.

43) page 169, bottom: Elsewhere, pollock are said to be a weedy species with short life-spans; ten years or so does not seem long compared to many rockfish species, etc.

45) page 170, middle: At least in the Bering Sea, large juvenile and adult pollock are significant predators on small juvenile pollock

46) page 170, bottom: Hunt et al., 2002 would also be an appropriate citation here

47) page 171, middle: what was the TAC for 2009?

48) page 173, middle: How is the increased groundfish predation density-dependent?

9) page 175, middle: Drop the word "speculated" since the idea of Cooney et al. was a well thought-out hypothesis with a considerable suite of data to support it.

50) page 179, middle: There appears to be some text missing at the end of the first complete paragraph.

51) page 181, Disturbance: Although there is little doubt that approach of a remote, seldom-visited rookery will result in animals fleeing, it is also true that SSL hang out in Kodiak Harbor and most likely a number of other spots. It might be worth trying to learn more about habituation to people.

52) page 185: bottom of second paragraph repeated in first lines of last paragraph.

53) page 193, top: A discussion of corticosteroid levels and the effects of elevated corticosteroid might be appropriate here.

54) page 193, middle: Perhaps a table of energy density and total energy content of selected prey of different sizes and seasons might be appropriate, as some say capelin and Atka mackerel are high energy foods whereas others say they are low energy. Perhaps this is a matter of reference points or size/age classes and seasons when a prey was sampled. This seems to be a recurring issue in the literature.

55) page 195, bottom: Hunt et al. In prep (arrowtooth and fur seals at the Pribilof Islands) would be useful here; also one might put in (predators after competitors in the fourth line from the bottom.

56) page 196, middle: It seems contradictory to say that the preponderance of evidence does not support the nutritional stress hypothesis and then two lines down to suggest that the was important evidence for nutritional stress. Under i) and ii) specify which DPS is being referred to.

57) page 207, top: This work on salmon suggests that there is a need for a much closer look at the importance of salmon to SSL and whether salmon abundance has changed in areas where SSL continue to decline or have failed to recover. See also 3rd paragraph on page 216.

58) Page 214, lower third: Sigler and colleagues as well as others have shown that herring are an important prey of SSL in SE Alaska, as well as Prince William Sound. What has happened to herring in the Aleutians? They are present in considerable numbers around Akutan Pass and Unimak Pass in summer, but what about farther out the Chain?

59) page 215, second line: What types or species of birds?

60) page 218, middle: It is not clear how much can be learned from where "wandering" juveniles from other regions can tell us about the use of critical Habitat in RCA-1. Visitors from elsewhere will have no ties to RCA-1 rookeries or haulouts, and may even stay away if there is any territoriality among groups of sea lions. There is need for tagging and concerted effort on SSL biology in the western-most Aleutians. The same issue applies in RCA-1 (page 219, bottom). See also page 326, lower third.

61) page 218, bottom: Knowing what SSL are eating now may tell us little about what they ate when their population was healthy, or what they would prefer to eat.

62) page 230- 233 are very useful, but they do not put the fishery takes and localized depletion possibilities into the context of what is needed by the SSL. It is of interest that despite draw-downs of cod near Amak Island (top of page 233), SSL on Sea Lion Rocks have consistently done better than SSL elsewhere in the Aleutians. In a way Amak Island is similar to islands in SE Alaska, in that it has multiple large salmon runs passing by, herring are seasonally plentiful, and forage fish also occur- thereby providing a rich variety of seasonally abundant lipid-rich forage fish in addition to seasonal plentiful stocks of cod and pollock.

63) page 235, middle and bottom: These comments suggest that predictability is important and that the SSL of a region may have "traditional" foraging areas where they have come too expect prey concentrations. Disruptions of these traditional foraging areas may have a disproportional impact on the SSL. Thus, it would be of value to try to map those areas which are most regularly used for foraging as well as just estimating the distances from the rookeries at which dives are made.

64) page 239, bottom of second paragraph: Discussion of pollock and SSL in the GOA should include mention of the role of arrowtooth in the recruitment and availability of pollock, as on page 245, 2nd paragraph.

65) page 240, paragraph 3: The size spectrum of groundfish in the EBS may be influenced strongly by the growing numbers of large arrowtooth. Using a community size-spectrum measure seems problematic, as not all community members have equal value as prey, and the sizes of pollock probably play a disproportionate role in the community metric, given their huge biomass relative to other fish. Since the size spectrum of pollock depends on the distribution of year classes and changes radically over a few year time frame, it may be hard to detect a trend in the size spectrum of critical prey species.

page 240, section 4.5.4.3. Additional information about prey school distribution changes can be cited. From analysis of pollock acoustic data from commercial fishing vessels during the A season, it has been

shown that pollock school descriptors change during a fishing season (Shen et al. 2008). Conversely, changes in pollock school distribution alter fishing behavior (Shen et al 2009).

Shen, H., Quinn, T.J., II, Wespestad, V., Dorn, M.W., and Kookesh, M. 2008. Using acoustics to evaluate the effect of fishing on school characteristics of walleye pollock. Pages 125 – 140 In Resiliency of Gadid Stocks to Fishing and Climate Change, Alaska Sea Grant College Program, AK-SG-08-01, Fairbanks AK.

Shen, H., Dorn, M.W., Wespestad, V., and Quinn, T.J., II. 2009. Schooling pattern of eastern Bering Sea walleye pollock and its effect on fishing behaviour. ICES J. Mar. Sci. 66: 1284-1288.

66) Page 248, second paragraph: Note that large pollock may be an important predator of larval and early juvenile arrowtooth.

67) page 250, 2nd paragraph: It may be incorrect to assume that discards and offal discharged at sea is detrimental to the ecosystem. Such material contains considerable nitrogen, which is a limiting nutrient in the marine ecosystem. When discharged at sea from moving vessels, it is most unlikely that the sort of refuse piles seen in harbors off shore-based processing plants, which create dead zones. Also, in the Barents Sea, there is evidence that red-king crab forage on fishery discards in areas of heavy fishing.

68) page 250, third paragraph: Superscripts needed.

69) page 253, 4th paragraph: There is evidence for a considerable shift in diets of SSL and in the fish community of the EBS and possibly Aleutians between the pre- and post-regime shift periods (the change in community structure is one of the changes defining the regime shift (Sinclair 2008).

70) page 255, bottom 2nd paragraph: "And so the debate continues"… is not appropriate.

71) page 256, bottom paragraph: It is often said that adult females have lower loads of lipophilic toxins because they off-load these toxins in their milk. Males on the other hand may accumulate toxins over a life time and may have concentrations spike when they draw down fat reserves during territorial occupancy in the breeding season.

page 293, section 5.1.6.4. For additional support, Battaile and Quinn (2006) can be cited. This paper showed that some areas of the eastern Bering Sea experienced local depletion due to fishing and investigated some factors to explain this.

Battaile, B.C., and Quinn, T.J., II. 2006. A DeLury depletion estimator for walleye pollock (*Theragra chalcogramma*) in the eastern Bering Sea. Natural Resources Modeling 19: 655-674.

72) Figures III-2 to II-15: while of interest to see whether the catch has moved out of critical habitat, for a foraging SSL, that proportion of of little interest- what counts is how much of the fish available within the critical habitat is removed by the fishery and how the remaining biomass of fish relates to the needs of the SSL, as discussed in AFSC 2010a and Logerwell and McDermott. This analysis requires detailed sampling of fish in critical habitat to see what is there before the fishery and what remains for the SSL afterwards.

73) Figure III-18: This is at wrong scale to evaluate impact on SSL foraging.

74) Tables III-1-III-3: While these are helpful in giving the amounts of prey removed from critical habitat, they provide no means for detecting the impact of these removals relative to what prey were available.

Detailed EA/RIR editorial suggestions

Table 2-2. Column headings and units are missing.

Figures 2-1 through 2-5 and 2-7. Headings need to be revised to make them legible.

Section 3.2.2 and Section 3.4.2. There should be parallel construction of these sections. Information from Mike Canino (NMFS) on the genetics of Atka mackerel should be added to the discussion and referenced in Section 3.2.2.

Section 5.3.3. Figures 5-2, 5-3 and 5-4. The units of measure are not stated and need to be consistently applied.

Section 5.3.3, Page 5-21, second paragraph 2. The lead statement in the paragraph indicates that one cannot unequivocally show causation, yet in the second clause of this statement it indicates that analysis of available data indicates adverse relationships may exist based on biomass levels of prey species in certain areas of the Aleutians. We suggest that "analysis of available data indicates that these" be changed to "however," in this statement.

Section 5.3.3.1.1 Page 5-22, last paragraph. The lead sentence of this paragraph reads as if it is a foregone conclusion that "...restrictions under Alternative 2 mitigate the potential adverse affects of..." We suggest that the sentence read that restrictions under Alternative 2 "are thought to mitigate" instead of "mitigate"

Section 5.3.5. Several sentences in this section contain jargon that is not correct and should be revised.

Section 6. The Seabirds section needs to be updated and improved including:

- Adding species to Table 6-1 if the list is meant to be complete.
- Adding yellow-billed loon (YBLO) to Table 6-2; it is a new Candidate species and recent telemetry studies indicate use of the Aleutian Islands in the fall, and possibly the winter. Also add a YBLO section under 6.1.4.
- Update brief section on the N. Pacific Pelagic Seabird Database and recent surveys therein.
- Update the Kittlitz's Murrelet section; include new Agattu studies and population trends.
- Develop section 6.2.8 and include potential impacts or changes to prey (especially forage fish) along with oceanographic changes.
- Expand and improve Table 6-9 so it is similar to Table 5-9.
- Revise figures to make them readable, especially distribution maps (e.g. Fig. 6-2).

Section 7.5. It would be useful to provide a map of the region where fisheries are likely to experience concentrated fishing effort following implementation of the RPA's.