

North Pacific Fishery Management Council

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August 10, 2007

Kaja Brix
Assistant Regional Administrator
Protected Resources Division, Alaska Region
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802

Dear Ms. Brix,

The North Pacific Fishery Management Council appreciates the opportunity to review and provide comments on the May 2007 draft Revised Steller Sea Lion (SSL) Recovery Plan (Plan). The Council and its Scientific and Statistical Committee (SSC) received a briefing on the Plan during the Council's special August 1-3, 2007 meeting in Anchorage. During that meeting, the Council and SSC also heard presentations of three Center for Independent Experts (CIE) peer reviews of the plan requested by the National Marine Fisheries Service (NMFS), a peer review of the plan requested by the Council and conducted by the North Pacific Research Board (NPRB), a review of recovery criteria in other endangered or threatened populations, comments from the State of Alaska, comments from fishing industry representatives and the public, and comments from other scientists involved in SSL research. This letter appends the comments of our SSC, and this letter also highlights specific suggestions which were included in the Council motion. However, we also include below some general comments which we believe significantly reflect a general unease with this Plan, and which are based on the full administrative record of our discussions last week.

NMFS has responded to some of the Council's and SSC's comments on the earlier May 2006 version of the Plan, and has revised the document in many areas, particularly by clarifying how Population Viability Analysis modeling was used to help guide development of the recovery criteria. However, the Council is disappointed that other Council and SSC comments and suggestions were not addressed in the May 2007 draft recovery plan, and we request that NMFS re-visit the Council's and SSC's comments on the May 2006 version of the recovery plan (enclosed). Moreover, the Council is particularly concerned with the greatly divergent views expressed within the scientific community over several key issues associated with the May 2007 draft recovery plan, including the lack of support for the plan by several members of the SSL Recovery Team. The most pervasive criticism, and one which was raised by Council members as well as members of the scientific community, is a perceived disparate treatment of available scientific information relative to a few key issues. Given the reliance of our process on sound and credible science, coupled with the existing great reputation of NMFS as the primary provider of that science to our process, the Council is most concerned and believes that NMFS should take a serious look at the treatment of available information on these key issues before finalizing the Plan.

First, the Council is concerned over the conspicuous lack of consensus among members of the SSL Recovery Team on how scientific information was used to support some of the recommendations in the Plan. This is especially notable for two hypotheses of factors that may be affecting SSL recovery:

transient killer whale predation and low female SSL natality or pup production (and the attendant link to chronic nutritional stress). This particular example was discussed during Council deliberations, and serves as a primary example of the perceived disparate treatment of information. Relative to the killer whale information, and subsequent reclassification to 'Medium' threat level, the Plan misquotes information from key published studies on potential levels of predation, embraces information which indicates a potentially lower predation level (wherein the author of the publication cautioned against extrapolation of the results to broader areas), and ignores information which could be relevant to this hypothesis (for example, the incident of one killer whale found dead with 14 pup flipper tags in its stomach). Then, noting that killer whale predation is the single greatest source of natural mortality, the Plan downgrades killer whale predation to a medium threat level. Alternatively, relative to nutritional stress and potential fishery interactions, the Plan describes numerous studies which clearly refute the hypothesis of acute nutritional stress, offers no proof of chronic nutritional stress (citing only one limited study relative to reduced natality, which is extrapolated to broader areas), and based on the natality study and the *lack* of acute nutritional stress, the Plan asserts that chronic nutritional stress must be occurring. Further, the Plan maintains a 'Potentially High' threat level for fisheries interactions, based on the relatively thin evidence of chronic nutritional stress. During Council discussions and public comment it was opined that, based on the available scientific information, these two threats (killer whale predation and fisheries interactions) should have equal threat level classifications.

It is clear from both public comment and from peer reviews that scientific discord on these two issues is very strong. The Plan lays out a strategy for SSL recovery based on interpretations of scientific information, but the strong disagreement among scientists, including several members of the SSL Recovery Team, diminishes public confidence in the recommendations stated in the Plan and raises doubt over the efficacy of the proposed recovery strategy. The Council is particularly disturbed that several distinguished scientists who were members of the SSL Recovery Team have been so alarmed over its content that they are renouncing the Plan, or have requested removal from the list of Team members who prepared the draft document from which this current plan has been developed.

The Council is faced with a confusing array of disagreements over the status of SSLs in the North Pacific from well respected scientists with significant publication track records. CIE reviewer Goldsworthy pointed out the lack of consensus on SSL threats, leaving the reader "... to evaluate a series of contradictory opinions." The Council similarly is left with a strong sense of uncertainty, not only over the current status and health of the SSL population in the North Pacific, but also with the recovery strategy as outlined in this recovery plan (which is apparently based on this lack of consensus). The Council and the public are receiving mixed scientific messages on SSL natality and pup production, impacts of transient killer whales on the SSL population, the carrying capacity of the North Pacific for increased numbers of SSLs, and the overall population structure of the wSSL. Some of these disagreements are focused on some of the key recommendations in the Plan, and this obvious strong dispute among scientists and the uncertainty it engenders suggests that much more work is required to assemble a plan that will evoke reasonable scientific concurrence and in turn public support.

Exacerbating the above concern is the appearance of bias in the Plan. The SSC noted the need to guard against the perception of unbalanced treatment of the scientific data, and noted that the Plan presents arguments on certain issues but does not reference other scientific studies that offer alternative arguments, and finally, the SSC asserts that it is "...important to maintain balance in the presentation of alternate hypotheses." As part of written public testimony, recognized marine mammal expert Dr. Ian Boyd pointed out several instances where the Plan favors one argument over another, and notes that NMFS appears to be selectively quoting from the literature to support a certain point of view or arguing to the level of advocacy for a preferred hypothesis (e.g. the killer whale threat issue or the sequential megafaunal collapse hypothesis). Some public testimony and written comments received by the Council asserted bias in the Plan. Comments on apparent bias in the Plan from the State of Alaska state that the

Plan does not present an objective description of research on killer whales and the Plan's narrative seems combative, the uncertainty over nutritional stress on SSLs should be fairly and fully evaluated, and the Plan should provide an objective accounting of the Fishery Interaction Team field test results rather than attempting to discredit these field studies. These comments raise grave concerns with the Council over the Plan's objectivity in the presentation of the available scientific information and the recovery criteria developed from the information contained in the Plan. We also believe that some of the recovery criteria are based only partly on scientific guidance, and are more policy positions which should be re-evaluated.

Therefore, based on a careful review of the Plan; a series of reports and presentations from NMFS, the State of Alaska, and the Council's Scientific and Statistical Committee (SSC); and comments from other scientists, the fishing industry, and the public, the Council recommends that NMFS consider the comments above, as well as the following more specific comments, before finalizing the Plan. The following numbering system corresponds with the motion passed by the Council at its August 2007 meeting (see attached). For each of these recommendations, the Council provides additional rationale in brackets.

1 a & b. The Plan currently provides criteria for downlisting and delisting the wSSL that include requirements for population increase and for increasing subregional trends. **The Council requests that these criteria be modified to allow downlisting of the wSSL if this population continues to remain stable or increases in abundance over a period of 15 years commencing with the year 2000, and to allow delisting of the wSSL if this population continues to remain stable or increases in abundance over a period of 30 years commencing with year 2000.** The Council requests that the population trends be an average of all of the U.S. subpopulations only, specifically **excluding the Russia/Asia subregion** group of SSLs. The Council also recommends that the recovery criteria be reevaluated and revised every five years or as new information becomes available.

[The Council has received comments from scientists and its SSC that the North Pacific currently could be at optimal carrying capacity for SSLs, and that an additional increase in the eSSL or wSSL may not be possible without reductions in vital rates or other responses that could adversely affect SSLs. Thus, under such a scenario, a stable or moderately increasing population would be appropriate. The SSC noted the possibility that carrying capacity for SSLs might be at equilibrium and additional population increase could be problematic, and thus the SSC recommended that the Plan discuss how a modified carrying capacity might affect the appropriateness of the proposed recovery criteria. The Council does not believe current science supports a hard and fast goal of increasing the wSSL to over 100,000 individuals. The Council also believes that including the Russia/Asia subregion may compromise the future management of SSLs in the U.S. The U.S. has no control over SSL management in Russia/Asia, and therefore it is inappropriate to hinge recovery actions taken in U.S. waters on the performance of SSLs in a subregion outside the U.S. The Council also received testimony that subregional abundance of the wSSL population could fluctuate naturally across the many subgroups of wSSL across its range, and the criterion that requires that no two adjacent subregions decline may be nearly impossible to assure; note that only three rookeries occur in the western Aleutian Islands, which is adjacent to the Russia/Asia subregion which is beyond any management authority of the U.S. The measure in the Plan requiring that no two subregions be declining was noted by CIE reviewer Hindell as possibly being too restrictive. The Council recommends that any reference to subregional trends be excluded from the final recovery plan.]

1 c. The Council requests that the Plan allow flexibility in adjusting SSL protection measures in fishery regulations to respond to changing environmental conditions, fishery stocks, and new SSL information. The current Plan recommends maintaining *current* regulations; **the Council requests that the Plan allow for appropriate measures that reflect changing conditions.**

[The Plan recommends conducting adaptive management experiments to gather additional information on how SSLs interact with fisheries. However, the Council has heard considerable criticism of this measure, suggesting that both maintaining current fishery regulations and conducting adaptive studies may be difficult or impossible. The Council supports the general concept of adaptive management, but requires the flexibility to adjust SSL protection measures to allow for such experiments. The Council also requires some flexibility in adjusting SSL protection measures, partly to reflect new scientific information but also partly to offer opportunities to test the efficacy of some of these measures in the conservation of SSLs while allowing sustainable fisheries. Finally, the Plan should clarify that the Council retains the flexibility to adjust the current management measures within the constraints of the ESA.]

2. The Plan used Population Viability Analysis (PVA) to inform the development of recovery criteria. The Plan's PVA assumed a threshold risk of extinction of 1% over 100 years (i.e. the species will no longer be considered endangered when the probability of quasi-extinction is less than 1 % in 100 years). NMFS based this standard on the Quantitative Working Group (QWG) guidelines. **The Council requests that NMFS consider a 10% risk of extinction in 30 years**, and reevaluate and discuss in the final recovery plan how this might affect the development of recovery criteria.

[The 1 % risk of extinction in 100 years standard was taken from the QWG guidelines which were developed by NMFS as a preliminary recommendation for developing recovery criteria for ESA-listed species under management authority of NMFS. The Council heard testimony that this threshold of 1% over 100 years was at least partly based on risks appropriate for much longer lived animals such as large cetaceans (which could go through two generations in that period of time), and that a more appropriate risk standard for SSLs, that recognizes their shorter life span, should be used to develop recovery criteria. The SSC notes that this risk threshold needs to be reexamined and more justification provided for using the 100-year timeframe for sea lions that have a shorter generation time than is characteristic for large cetaceans for which the 100-year timeframe was developed. The Council finds it more reasonable to use a time frame appropriate to SSLs which may live to be 10 years or older, and over 30 years SSLs would on average likely go through about three generations. The Council notes that some organizations such as the IUCN suggest that a 10 % or a 20 % risk is an appropriate threshold for risk-of-extinction standards. CIE reviewer Goldsworthy also made this recommendation, suggesting that the IUCN criteria be evaluated; Dr. Goldsworthy stated that, based on the extinction risk framework in the Plan, "...what is presented does not leave me feeling confident that the criteria developed are entirely appropriate."]

3. The Plan lists killer whales as a medium threat to recovery of the wSSL, which is a downgrading of this threat from potentially high in the May 2006 draft recovery plan. The Council believes that transient killer whales pose a far greater threat to the wSSL and requests that NMFS reconsider and **rank killer whale predation as a potentially high threat**. In addition, the Council requests that NMFS conduct more research on killer whale population dynamics in the North Pacific, and convene one or more workshops to discuss and resolve issues with assessment of effects of transient killer whales on the wSSL and how killer whales may affect recovery of the wSSL. The Council requests that this process of gathering scientific information and hosting workshops include a broad spectrum of scientists who hold various views on the issue of killer whale effects on SSLs.

[The Council received many comments from peer reviewers, other scientists, its SSC, and the public on how transient killer whales may be affecting SSLs in the North Pacific. Some comments indicate that the analysis in the Plan extrapolates inappropriately killer whale feeding dynamics observed in small areas to the larger range of the entire wSSL population. Others object to the apparent one-sided treatment of this issue in the Plan, and disagree with the Plan's denigration of alternative hypotheses. Considerable disagreement exists in the scientific community over this issue, and as a result there is

considerable uncertainty over any one hypothesis. The case has not been made that managers can dismiss the threat killer whales have over portions of or the entire range of wSSL. The Council believes that a more even-handed treatment of this issue is necessary, including fair discussion of alternative hypotheses for how killer whales may have in the past or are currently affecting the wSSL.]

4. The Council concurs with the Plan's recommendation to **reexamine the designation of critical habitat for SSLs**. Listed as Recovery Action 2.1, the Plan gives this a priority ranking of 3. **The Council requests that the priority for this recovery action be changed to 2a**, an action that must be taken as a first priority action.

[Critical habitat was designated for SSLs about 15 years ago. Since that time, scientists have gathered considerable amounts of new information on how, and the extent to which, SSLs use their habitat on a seasonal and a spatial basis. The SSC has recommended that, based on this new information, this recovery action be given a higher priority; the SSC recommends Priority 2a. Other scientists have made similar recommendations, and the Council believes that, based on the many millions of dollars spent on SSL research in the past decade, we now have a far better understanding of how SSLs use their habitat. Since critical habitat was used as a basis for many of the current SSL protection measures, changes in critical habitat designation could benefit not only SSLs but also fishery management.]

5. The Plan sets forth a Recovery Action entitled Develop an Implementation Plan (action 1.5). This action calls for establishing priorities among the individual actions and developing a strategy for their implementation. **The Council requests that NMFS adopt the SSC's recommendation to develop the Implementation Plan and prioritize actions around a multiple hypothesis testing framework**. One of the scenarios should include an assumption of a lower carrying capacity for SSLs in the North Pacific.

[The Council heard testimony that NMFS appears to have used a sequential testing technique in developing the threats assessment in the Plan. That is, NMFS appears to have examined threats individually, dismissing threats one after another that individually do not appear to solely account for the SSL decline, and continuing in a sequential process until arriving at a threat that, in their opinion, may be the only viable hypothesis left. Some reviewers, including the SSC, believe a more appropriate process is a multiple hypothesis approach.

The Council also received comments from scientists, the SSC, and the public that the Plan should consider future conservation of SSLs in light of a changed carrying capacity of the North Pacific. The NPRB review team stated that it is fundamentally important to expect changes in the marine ecosystem and to design research and recovery actions in light of these changes, noting that human effects in the North Pacific have occurred over centuries and have undoubtedly changed the environment that supports SSLs. The State of Alaska pointed out Dr. Doug DeMaster's comment to the SSL Mitigation Committee that SSLs seem to be acting like a population above carrying capacity, and the State recommends research on density dependent effects and the carrying capacity of the ecosystem to support SSLs. The Plan should recognize this possibility and explore consequences to long-term viability of SSLs in light of the carrying capacity dimension.]

6. The Plan's recovery strategy was informed by the use of a PVA. One of the assumptions in the PVA was that the recorded history of the wSSL represents both natural and anthropogenic effects on the population, some of which are unlikely to occur again in the future. The Council believes that the Plan may have understated the influence of humans in the historic declines of the wSSL, and therefore the model projections may be overly pessimistic. **The Council disagrees that the conditions leading to the steep decline through the 1980s will occur again, and requests that NMFS reevaluate the assumptions used in the PVA to project future population growth under current conditions.**

[Factors other than intentional take and unregulated incidental take in fisheries during the 70s through 80s are largely unknown, but the Council believes these are unlikely to reoccur. The Council received comments from scientists and fishermen indicating the intentional take by shooting or mortality in fishing activities was high in the past, particularly in the 1980s, and these conditions will likely never be experienced again in the future. Some have suggested that the intentional killing resulted in a possible differentially high mortality on female SSLs, which would not only reduce female abundance but also affect mortality of attending pups or juveniles. And new analyses have been recently completed (e.g. Turek et al. 2007), and others are anticipated in the near future (e.g. Dr. Gordon Kruse's study of intentional shooting will be available in late 2007), and should be consulted for additional information on events that are unlikely to occur again, and rerun the PVA with more up-to-date assumptions on anthropogenic influences on the wSSL in the past. Also the Council received testimony and comments from scientists that recommend considering density dependence more prominently in the PVA; the Council believes that, again, carrying capacity issues need to be considered as an important factor in retrospective analyses of the wSSL population.]

7. The Council requests that NMFS provide to the Council and the public an annual report on the status of SSLs in the North Pacific. This report would discuss new scientific information, summarize new trends in the population, summarize any actions taken pursuant to the revised recovery plan, and provide information on the status of the population relative to recovery factors and the listing criteria.

[Concerns have been raised by past members of the Recovery Team, the State of Alaska, some independent scientific peer reviewers, other scientists, the seafood industry, and members of the public about the perception of bias in the Plan and selective use of scientific information and hypotheses. The Council shares those concerns, especially since this perception undermines the credibility of the scientific process in the management of fisheries in the North Pacific. The Council believes that the foundation of our system of management is the confidence all parties have in the scientific process. To that end, the Council recommends more opportunity for sharing information, and an annual report could facilitate that process and enhance increased dialogue on implementation of the final recovery plan.]

8. The Council requests that the paragraph under Recovery Action 2.6.6 that discusses the need to account for SSL food requirements when setting acceptable biological catches of groundfish be deleted. The Plan needs to be rewritten to clearly note that the Council does account for these needs, and indeed the needs of the entire ecosystem, when it approves Acceptable Biological Catch (ABC), Total Allowable Catch (TAC), and other harvest limits. **The Council also requests that Recovery Action 2.6.7 be given a priority 3 ranking;** it is currently ranked as priority 2b.

[The Council is concerned that the narrative under Recovery Action 2.6.6 infers that fishery management does not account for the nutritional needs of species that utilize fish targeted in commercial fisheries. The Council in fact deliberately and consciously does account for other ecosystem needs in setting ABC and TAC levels for all target species. This is an integral part of the annual specifications process, and the Council considers other ecosystem issues during its annual review of the ecosystem considerations appendix to the SAFE reports for both the GOA and BSAI groundfish fisheries. The Plan appears to ignore this important step in the annual TAC-setting process, and as currently written, the Plan seems to call for another level of accounting for other ecosystem needs. In that regard, the Plan is misleading.]

Recovery Action 2.6.7 is given a priority 2b designation in the Plan, which mandates this action be accomplished as a second order priority, yet this action is already being done in the normal course of the Council process. As currently written, this action implies that the Council does not consider other ecosystem needs when setting ABC and harvest limits. This is not correct, as the Council indeed does explicitly evaluate the status of the ecosystem in its annual specifications process, as discussed above.

This recovery action should be rewritten to reflect current practice, and be given a lower priority or removed from the Plan.]

9. The Council recommends that NMFS summarize and discuss recent field work on localized depletion in the final recovery plan. As currently written, the Plan largely ignores important work accomplished by NMFS' Fisheries Interaction Team (FIT) whose research in the past several years has focused explicitly on how fisheries may affect the prey field for SSLs.

[The Council received testimony from the public and reviewed minutes of the June 2007 SSL Mitigation Committee that expressed concern that important FIT research results were largely absent from the Plan. Of all the SSL research accomplished by NMFS, the State of Alaska, and other scientists in the past decade, the Council believes that the FIT studies were some of the most directly applicable to the issue of fishery effects on SSLs. The FIT studies were designed to evaluate localized depletion and the effectiveness of fishing exclusion zones around SSL sites, and have produced many reports, papers, and scientific presentations that summarize important information on how fisheries may affect the SSL prey fields. Yet NMFS has not summarized and included in the Plan the results of this important research. The Council concurs with comments it has received, and requests that NMFS document in the final recovery plan the results of the Atka mackerel, Pacific cod and pollock prey field studies.]

In summary, the above recommendations are very important to the Council, and we request that NMFS seriously consider these comments as it finalizes the recovery plan. The Council believes that finalizing the recovery plan should be completed as a high priority task for NMFS, and we look forward to an update on progress at our October 2008 meeting.

Sincerely,



Stephanie D. Madsen
Chair

Cc: Doug Mecum, Sue Salvesson, Jim Balsiger, Doug DeMaster, Bill Hogarth

Attachments:

Council and SSC comments on May 2006 draft Revised SSL Recovery Plan
SSC Minutes from August 1-2, 2007 Meeting (review of May 2007 draft Revised SSL Recovery Plan)
Council Motion from August 2-3, 2007 Meeting (on May 2007 draft Revised SSL Recovery Plan)

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August 28, 2006

Kaja Brix
Assistant Regional Administrator – Protected Resources Division
Alaska Region – National Marine Fisheries Service
709 West 9th Street – Room 461
Juneau, AK 99802

ATTN: Ellen Walsh

Dear Ms. Brix:

The North Pacific Fishery Management Council appreciates the opportunity to review and provide comments on the draft revised Steller Sea Lion Recovery Plan (Plan) prepared by the Steller Sea Lion Recovery Team for the National Marine Fisheries Service. Thank you for extending the comment period to September 1, 2006. The Council and its Scientific and Statistical Committee (SSC) and Advisory Panel (AP) received a briefing on the Plan during the Council's June 2006 meeting in Kodiak. Given the importance of this Plan, the Council asked its SSC to make a thorough review of the document. The SSC met August 15-16, 2006 to conduct this review.

The Council convened on August 25, 2006 to review the SSC comments and to formulate recommendations to NMFS on the Plan. The SSC raises a number of concerns and recommendations for improving the Plan. The Council endorses these recommendations, and we ask that NMFS consider all of the SSC comments which are attached to this letter. Below we highlight some of our more pressing concerns:

1. The Recovery Team's Population Viability Analysis (PVA) provided in the Plan has raised concerns. The Council generally concurs with the use of a PVA as an analytic tool, but not necessarily the specific model used by the Recovery Team. **We recommend that the Recovery Team's PVA should be placed in an appendix and specifically referred to as an example, among other available PVA models, of how a PVA can be used to quantitatively evaluate risk to the SSL population.**
2. The SSC has identified a number of weaknesses and desirable improvements to the Plan's PVA model, and recommends that sources of uncertainty in the input parameters be explored. **The Council recommends that the Plan's PVA be rerun using the input parameters outlined in the SSC letter.** Using alternative assumptions and iteratively rerunning the PVA would test its sensitivity to these input parameters.
3. Given the number and the nature of SSC comments on this Plan, **we recommend that NMFS prepare a revision of the Plan and circulate this new draft for public review.** We recognize

that this may require additional time, and perhaps reconvening the Recovery Team, but this effort should produce an improved and more flexible framework for SSL recovery that is more consistent with the best available science.

4. The Plan should eliminate rigid recovery criteria, especially those that may be unattainable. We believe that the future management of SSLs in context with a changing environment evokes a need for a less rigid set of recovery actions; a process for measuring recovery should be dynamic and responsive to new scientific information. **The Council recommends that NMFS consider the following: (a) retain the 15 year time period for down-listing but expand the rationale for this criterion, (b) eliminate the measurement of vital rates as down-listing and delisting criteria, (c) remove the requirement that significant declines not be occurring in two adjacent sub regions, and (d) delete the 50 percent criterion for delisting.**
5. The Plan does not provide a clear rationale for the requirement for an adaptive management program as a needed recovery action for the western DPS. **While an adaptive management experiment could provide helpful insights into effects of fishing on the environment and sea lion response to these effects, we do not believe such an experiment is an appropriate high priority action before the western population is considered recovered, and we recommend this action be removed.**

The Council considers SSL management a high priority issue, and for many years has worked closely with the NMFS Alaska Region to implement fishery management measures to assure protection for this marine mammal while at the same time providing for sustainable fisheries in the Alaskan EEZ. The Council appreciates the work that NMFS and the Recovery Team have put in this draft revised SSL recovery plan, and we look forward to continued work with NMFS on SSL issues in the future.

Sincerely,

Stephanie Madsen
Chair

Cc: Dr. Jim Balsiger, Doug Mecum, Sue Salveson, Shane Capron, Chris Oliver, Bill Wilson

DRAFT REPORT
of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
August 15-16, 2006

The Scientific and Statistical Committee met during August 15-16 at the Federal Building, Juneau, AK. The meeting was teleconferenced to sites in Seattle and Anchorage and by dial-in from other locations. Members present were:

Gordon Kruse, Chair
University of Alaska Fairbanks

Pat Livingston, Vice Chair
NOAA Fisheries—AFSC

Keith Criddle
University of Alaska Fairbanks

Sue Hills
University of Alaska Fairbanks

George Hunt
University of Washington

Franz Mueter
Sigma Plus Consulting

Steve Parker
Oregon Department of Fish and Wildlife

Terry Quinn II
University of Alaska Fairbanks

Doug Woodby
Alaska Department of Fish and Game

Members absent:

Steven Hare
International Pacific Halibut Commission

Mark Herrmann
University of Alaska Fairbanks

Anne Hollowed
NOAA Fisheries—AFSC

Seth Macinko
University of Rhode Island

Ken Pitcher
Alaska Department of Fish and Game

Farron Wallace
Washington Department of Fish and Wildlife

Population Viability Analysis (PVA) Model

Prof. Dan Goodman gave an overview of the development of a model to conduct Population Viability Analysis (PVA) for the western and eastern DPS segments of Steller sea lions, under the auspices of the Steller Sea Lion Recovery Team (SSLRT). Public comments on the PVA were provided by Dave Fraser (Adak Enterprises Inc.), Kevin Duffy (MCA), and Donna Parker (Arctic Storm).

The PVA model is described in Appendix 3 in the current draft of the Steller Sea Lion Recovery Plan. This model is used in a decision theory framework to derive recovery criteria that satisfy ESA for the western DPS segment of Steller sea lion. **This approach, based on the best science available, helps to formulate a structured and technically defensible approach that offers a quantitative and biologically relevant basis for evaluating risk.** Although the ESA does not provide explicit standards for recovery criteria, it does require that recovery criteria be measurable and objective.) **The SSC recommends that the PVA be moved from the appendix and included in the main body of the recovery plan as a subchapter in the threats assessment section.**

A sub-panel of the SSLRT provided expert opinion for quantification of policy elements, specification on uncertain data elements needed for modeling, and specification of the probability of essential correctness of the core assumptions. The quantitative standard adopted in the PVA was that a quasi-extinction probability of more than 1% in 100 years would leave the western DPS in the endangered category; although another standard could have been specified, this standard has some support in the scientific literature. The reference point for quasi-extinction was assumed to be an effective population size of 1,000, which when adjusted to account for population demographics, corresponds to a total population size of 4,743 individuals.

Core assumptions adopted in this PVA are that:

- The western DPS is governed by the dynamics of a single integrated population.
- The net growth of the western DPS is not moderated by density dependence.
- The population growth rates are independent and serially uncorrelated normal random variables that hold for discrete periods, and the duration of those periods is described by serially uncorrelated exponentially distributed random variables with a mean duration of 10 years.
- Underlying factors influencing population dynamics in the future will not differ from the underlying factors that have governed population dynamics for the past 50 years, except that the component of mortality attributed to human factors (extraneous influences) can be estimated and, to the extent that these factors have been mitigated, can be assumed to not influence future populations.
- Fishery restrictions adopted in 2000 have resulted in a 2.5% increase in annual growth relative to the 1989-2000 period because of reduced prey-competition with the fishery (Table 4).
- There is an 80% probability that the core assumptions of the PVA are correct as estimated by the PVA subgroup of the SSLRT. That is, the combined probability of all other alternatives (which assume there is no risk to the stock) is 20%.
- If the effective population size decreases below 1,000 individuals (corresponding to a total population size of 4,743 individuals) at any time, the population is considered to be extinct and has negligible probability of recovery.

While a PVA could have been structured around alternative assumptions, the assumptions adopted for this PVA are not unreasonable and the PVA modeling approach is not restricted to the particular assumptions used to characterize this PVA. **The SSC endorses the PVA modeling approach as a valuable tool that provides a transparent, quantitative approach that addresses some aspects of the ESA requirements for evaluating risk.** The PVA model is a major advance in linking sea lion dynamics to hypotheses about factors affecting the population. We note in particular that the PVA includes a parameter to represent extraneous mortality (such as that due to shootings in the 1980's) and a parameter to represent hypothetical competition between sea lions and fisheries. Although there are a lot of uncertainties about the model, it has already helped and can help in the future to structure our thinking about the problem, synthesize much of the available data in a coherent approach, identify data gaps, and suggest refutable hypotheses and priorities for research.

The SSC envisions that a formal assessment using this PVA will follow the approval of the recovery plan, and that further refinement and revision of the PVA will continue with regular reports to the Council. Shane Capron (NOAA Fisheries) confirmed that the intent is to review the Recovery Plan every 5 years, which would require PVA model development and results. In essence this would create a parallel assessment process for SSL recovery efforts that would accord with the assessment processes in place for groundfish, crab, and scallops.

The SSC identified a number of weaknesses and desirable improvements that need to be addressed in future iterations of the PVA model:

- The model is a simplification of the real population, lacking age structure, lag effects in recruitment and population parameters, and density dependent effects. Yet the SSLRT assigned the model an 80% probability of being the “correct” model, which seems too high given the uncertainty about the population ecology.
- There is obviously large uncertainty about the “correct” or “best” model to use. Other model structures (e.g. Winship and Trites, 2006, Marine Mammal Science 22:124-155) should be explored, for example models that incorporate age structure and models that incorporate metapopulation structure, both of which are likely to influence estimated likelihoods of extinction. Results of already existing models of Steller sea lion population dynamics should be

compared to the current PVA. (See for example, Gerber and Van Blaricom, 2001; Fay, 2004; Winship and Trites, 2006; Wolf and Mangel, in press).

- Other sources of uncertainty in the input parameters need to be examined through sensitivity analyses, including, but not limited to:
 - The assumed quasi-extinction level of 1,000 effective individuals. This was fixed in the model although the conservation biology literature includes ranges from 500 to as high as 10,000. The choice of this threshold can be expected to have a very large impact on the results.
 - The magnitude of the estimated fishery prey-interaction effect. The estimate (reduction of 2.5% in the absolute annual growth rate between 1989-2000 and 2000-2004) was not adequately justified and is likely to be highly uncertain. One case of interest would be to assume that there is no competitive effect at current prey biomass levels and fishery exploitation rates.
 - The magnitude of the estimated extraneous mortality that can be attributed to incidental takes, harvests, etc., is not known with certainty and should be examined through sensitivity analyses or modeled as stochastic processes.
 - The assumption that growth rates in successive periods are independent is likely to have an important influence in the results and should be closely examined. There appears to be positive autocorrelation in the growth rate between periods, which is not accounted for in the present model.
 - The effects of assuming a constant growth rate within a period.
 - The effect of weighting each observed growth rate equally, even though the rates were averaged over very different periods of time, ranging from 5-19 years. This has the effect of overstating the impact of the steep decline observed between 1985 and 1989. One alternative approach would be to combine two shorter periods. For example, 1977-1985 and 1985-1989 could be combined into a single period that would correspond to a known oceanographic regime. Other approaches include weighting period-specific growth rates by the number of years over which they were averaged, or representing growth rates as a moving average process.
 - The assumption that the population does not display density dependence was not adequately justified and models with density dependence should be explored. In particular, it would be of interest to determine the effect of increasing the growth rate at low population levels to 5-10% as has been observed in other pinniped populations.
 - The probability that the PVA model is correct.

The description of the PVA should be revised so that the rationale behind the assumptions and model specification are made more transparent. The rationale for aggregating survey data to the level of a single DPS-wide growth rate spanning a number of years is presented as a preferred choice while metapopulation structure, regional, or rookery-scale observations, or shorter-time scale observations were dismissed without discussion. Given the constraints imposed from utilizing only five growth rates to model a growth rate distribution, further discussion is warranted to enable the reader to understand the basis for the choice of binning. The data used to choose an effective population size threshold of 4,783 animals should be explicitly described, not just providing a reference to genetic effects. The rationale for choice of values for biological parameters and values for the fishery competition effect in Table 4 should also be made explicit. The term “regime” should be replaced with the term “period” as regime causes direct confusion with generally accepted oceanographic regimes that do not precisely correspond with the five periods represented in the PVA model.

The PVA provides a useful framework for future evaluation of population recovery and changes in extinction risk. In the future, as additional consistent, spatially discrete biennial counts are completed, the PVA model can be refined to better reflect information on distribution of growth rates to more accurately

describe the variance in that distribution for forecasting. This should allow the approach of other modelers to be incorporated and yielding a currently optimal model form and parameter choices and to ultimately create a spatially explicit metapopulation model of the western DPS.

SSL Recovery Plan

The SSC received a presentation on the draft revised Steller Sea Lion Recovery Plan at the June 2006 meeting in Kodiak. At this meeting, the SSC identified major issues and developed comments on the plan as advice to the Council.

The SSC appreciates the efforts of the SSL recovery team to provide a balanced and fair treatment of the difficult issues surrounding development of a recovery plan. Public comments were provided by Dave Fraser (Adak Enterprises Inc.), Kevin Duffy (Marine Conservation Alliance), Doug Eggers (ADF&G), and Donna Parker (Arctic Storm). **The SSC identified seven major issues within the recovery plan for which we offer the following comments and recommendations.**

Population Structure

The SSC recommends that the plan be revised to provide a more comprehensive examination of the structure of the SSL population. For present legal purposes, there are just two segments – the eastern DPS and the western DPS. However, from a scientific perspective, **there needs to be a more thorough evaluation of whether the population dynamics of this species are well described as two largely independent population segments or if it would be more realistic to describe the SSL as a metapopulation.** A metapopulation, by definition, consists of discrete population segments (perhaps rookeries or fixed or slowly shifting sets of rookeries) connected by dispersal, where the dispersal among segments is not so minimal as to be negligible, nor so great that local dynamics are swamped. Information is presented in the recovery plan on segment mixing and on nuclear DNA research suggesting that male dispersal and inter-segment mixing may be higher than would be concluded from the mtDNA research alone, supporting a metapopulation interpretation. If the issue of population structure cannot be resolved, at a minimum, the management implications of the several possibilities should be clearly spelled out.

Biological Criteria

The delisting criterion for the western DPS (3% average annual increase for 30 years) is poorly motivated; the logic of using the recent history of the eastern DPS as a model for criteria to apply to the western DPS is, at best, questionable. A logically consistent approach could be based on a quantitative assessment of the probability of extinction in a specified time period for down listing and delisting, as would be provided by a PVA, as discussed above. If the population risk of extinction as generated by the PVA is above the threshold for down listing or delisting, then biological criteria (vital rates) are irrelevant. It is only if the population does not meet the stated thresholds that other data are needed to help explain why and help to define the threat to the population. **The rationale for criterion 3, which requires that no two adjacent population units are simultaneously in decline, should be grounded in sound science, possibly from results of a spatially distributed or metapopulation-based PVA model.** A criterion of this sort should reflect the reality of the spatial correlation that is likely to occur between adjacent areas due to the spatial and temporal scales at which oceanographic processes are likely to operate. Also, the SSC suggests that the plan clarify that this criterion applies for the specified time period in criterion 1, and that this criterion is predicated on criterion 1 being achieved.

Research plan to test the three major hypotheses (climate, killer whales, prey availability)

The SSC recommends that there be greater consistency within the plan in the treatment of hypotheses. In particular, Appendix 2A cites a substantial body of evidence that is inconsistent with nutritional stress as a causative factor in the 1990s, whereas the plan (p. 89-92) purports that evidence that sea lions were nutritionally stressed in the 1990s has been inconclusive. The recovery plan should be revised to reflect the evidence presented in Appendix 2A or should include explicit arguments for why that evidence is rejected. **We recommend that Appendix 2 be incorporated into the body of the recovery plan and that the distinction between acute and chronic nutritional stress be clarified.** The recovery plan needs to be more consistent in its treatment of the sequential megafaunal collapse hypothesis, which is thoroughly discounted at one point and then resurrected (p. 110) as though it had not been discounted. The possibility that climate-related changes in the prey base have served as a significant forcing function in SSL population changes is dismissed too quickly (p. 86), particularly given evidence for such changes in seabird data. **Greater consistency and less repetition are encouraged.**

The SSC suggests that the recovery plan could be improved by inclusion of a table comparing the hypotheses with any additional data to date. (See for example the NRC 2003 report,) Appendix 2A cites a Table 1, which was not included. Table 111-2 (p. 93) may be related to the missing table.

The SSC remains supportive of the development and implementation of an adaptive management program, but recognizes the difficulties in constructing and implementing such a plan. The problem with the current recovery plan is that it requires that the implementation of an adaptive management plan is “necessary to prevent extinction” but provides no rationale for this requirement. The SSC does not agree **that an adaptive management program should be a required element of the recovery plan. Nevertheless, we continue to strongly support the design of experiments at small but meaningful spatial scales with the appropriate level of monitoring to document effects of fishing on target and incidental species and habitats as well as sea lion response to those effects. The focus of the experiments should be to determine the level of fishing in the vicinity of rookeries that has a detectable effect on vital rates and population status of SSL.**

Efficacy of Past Management Measures

There needs to be better quantitative assessment of the efficacy of management measures and population increases and benefits. The recovery plan is very vague in this regard but mainly points to management measures in the 1990s as being responsible for the population stabilization observed. The plan needs to be more specific about the exact measures and when they were put in place and the timing of observed population stabilization, along with an analysis, couched in terms of time-lags associated with SSL population dynamics, that examines the concordance of in population-level responses with implementation of those measures. A table with a chronology of management actions would be a helpful starting point.

Critical Habitat Designation

When NMFS adopted the 20-nm buffers in 1993 (federal rule 50 CFR Part 226), they stated:

“It is important to emphasize that in designating these extended aquatic zones, NMFS is not attempting to justify or prove that these areas, in fact, actually do need special management or special regulation, but rather that these areas may be in need of management.”

NMFS went on to say:

“If and when specific management measures are proposed, it is anticipated that the proposed rule will explain the scientific basis and justification for the measures.”

Regarding the need for scientific justification, NMFS pointed out that new research was planned on sea lion foraging behavior including satellite telemetry studies and that

“Modification of critical habitat designation or specific management measures may be considered based upon this research.”

Given the extensive research that has ensued in the past 13 years, it would be expected that the basis for designating critical habitats would have a stronger scientific basis. Critical habitat designations should be reviewed and adjusted to better reflect research findings.

Threats Assessments

The ranking of impacts of threats appears to be subjective. For example, the medium rank for toxic substances seems high given the information on toxin levels reported in the recovery plan; however, as learned in discussion, the medium ranking is due to concerns for toxins in Russian waters. **It would be helpful to have the basis for this and other ranking to be better clarified in the plan.**

Although rankings for incidental take in fisheries are based on the available data, some of those data seem ripe for reconsideration. For example, the take estimate for the Prince William Sound gillnet fishery has been carried forward from an extrapolated estimate that is likely too high; whereas takes in unobserved fisheries may not be adequately accounted for.

Priorities for Plan Actions

The plan provides a long list of priority actions (p. 157-163) that must be taken. The requirement to take action on tasks under all three priority levels seems implausible given the extensive and varied list of actions. **If the language used to define the priorities is based on a NMFS standard and is required for this purpose, then this should be clearly described for the reader’s benefit.**

Other Specific Comments

The following comments are offered for consideration when the final revision of the SSL Recovery Plan is prepared.

1. The SSL Recovery plan should include estimates of the costs (foregone net revenues) to industry of existing SSL conservation measures and the relative distribution of costs across industry sectors and regions, especially for IRFA small entities.
2. If a Russian/Asian population segment is included in criteria that affect ESA listing, the Department of Commerce should explore trade measures to ensure that the U.S. industry, which incurs elevated costs to accommodate SSL conservation measures, is not unduly disadvantaged in competition with domestic imports of Russian/Asian product that does not incur comparable costs of SSL conservation measures.
3. Trend Analyses (p. 11-21)

The trend analyses have several inconsistent or questionable attributes:

- a. In the trend model, parameters are assumed to be fixed as presented in the plan, yet PVA analysis is predicated on the assumption that the parameters are stochastic. To be consistent, the trend analysis should use a random coefficients estimator rather than ordinary least squares.
- b. The trend models assume that the observations are drawn from a homoskedastic distribution, yet some of the observations are composites across multiple years and others (i.e., 2004) have been deflated by an assumed constant (3.64%). It is unreasonable to assume that the variance of observation errors associated with these data are constant. The trend analyses should use a GLS or MLE estimator designed to address heteroscedasticity.

- c. The trend models as specified are monotonic and consequently do not allow for density dependence.
 - d. Some of the trend models omit observations (e.g., trend estimates for St. George Reef, CA omit the observation for 1994). Other trend models include observations that represent incomplete censuses (e.g., the 1990 observation for the Western Aleutian Islands do not include observations from the Gillon Point and Agattu Island). The rationale for these omissions and the inclusion of incomplete observations should be discussed in the text or in footnotes.
 - e. Because the trend models were estimated as log-transforms of simple exponential models, the default statistics reported in the regression analysis are for the log-transformed relationship. These statistics should be rescaled and expressed in terms of the untransformed data. For example, for St. George Reef, the reported value of R^2 is 0.703 with a p-value for the associated F-statistic equal to 0.009. When rescaled in terms of the untransformed data, the value of R^2 is 0.808 with a p-value for the associated F-statistic equal to 0.002.
 - f. Because the trend models share a common set of explanatory variables and because the allocation of counts to six regions is arbitrary, there would be strong advantages to using a seemingly unrelated regression (SUR) or other simultaneous equation model to estimate model parameters and to test the statistical significance of differences in the estimated parameters between regions.
 - g. Autoregression and moving average models or polynomial time-trend models can also be used to estimate or describe trends without imposing the assumption that the trend is constant across the observation period.
 - h. The use of linear splines to represent hypothetical changes in trends needs to be cautioned: the analysis should explicitly note that the splines were specified rather than fitted and that the same discontinuities were assumed for all regions. If the model is to be represented using linear splines, an MLE technique should be used to select the number of splines and the locus of the discontinuities simultaneous with estimation of the coefficients. In regards to the apparent upswing in growth rates, the SSC recommends an analysis be conducted to evaluate the significance of changes in trends circa 2000.
4. (p. 14, bottom). It was surprising that papers on historical declines such as Causey et al. 2005¹, and others cited in Hunt and Stabeno (2005), most notably Turner (1886) are not cited. Additionally, Nelson (1987) provides useful information on past changes in SSL numbers in the Aleutians:

Nelson, E.W. 1887. Mammals. Page 267 in H.W. Henshaw, ed. Report upon natural history collections made in Alaska between the years 1877 and 1881. Report III, U.S. Government Printing Office, Washington, D.C.

Some quotes from this publication include:

- *Formerly they were abundant all along the Aleutian chain. They are now so scarce among these islands, and the ones that are found there frequent places so difficult to access, that the Aleuts secure very few of them each year. They are still rather common at a few points along the north shore of Unimak Island and the peninsula of Alaska, while small parties are found scattered all along the Aleutian chain, hauling up on certain rocky points and shelves facing the sea, most of which are well known localities to the Aleuts.*

¹ See Fisheries Oceanography 14 (Suppl. 1) 2005.

- *From the Aleutian Islands eastward and southward they occur all along the coast to California, where their range overlaps that of the southern species.*
 - *The natives of the Seal Islands (Pribilof Islands) claim that nearly seventy years ago the sea lions alone occupied nearly all of the shore line of Saint George Island, and numbered several hundred thousand individuals. By direction of the Russians they were driven off repeatedly until they left the place, and the shore was then occupied by fur seals.*
 - *Like the fur seal they have a dreaded enemy in the Killer Whale, which pursues and captures them at sea and about their rocky resorts. The native hunters when at sea frequently see them leaping high out of the water in useless endeavor to escape their pursuers. At such times they say it is dangerous for an umiak or other small boat to be in the vicinity, as the animal, in its terror, will sometimes leap into and wreck the boat. They are hunted with gun and spear in the Aleutian Islands, but, unlike most seals, if shot in the water in summer they will sink at once, owing to the small amount of fat on them at that season. In common with the fur seal, this species has the habit of swallowing stones. Mr. Elliott found stones weighing a pound or two in their stomachs, and preserved one stomach containing over 10 pounds of such stones.*
5. (p. 16). The description of population trends in Russian waters is presented in an odd way. First, there is the good news of recent increases, then discussions of earlier declines, with the reader left with the impression that these populations are not recovering. Table 1-4 suggests very strong recovery. What, if any, special protections are in place to aid this population segment?
 6. (p. 17). Nearly all increases in pup numbers in SE Alaska have been in new rookeries. Is the size of rookeries in SE Alaska determined by prey availability or the availability of suitable terrestrial space?
 7. (p. 17, bottom, to p. 18, top). It was surprising to see no mention about shooting of Steller sea lions at salmon net pens in British Columbia, particularly in the late 1990s. A timeline of management measure implementation in BC would be a useful addition to the plan.
 8. (p. 31). Herring is listed as an important prey in many areas, but Bering Sea populations of this fish have not recovered from heavy fishing pressure in earlier decades. Likewise capelin populations are down in the Bering Sea /Aleutian Islands. How does the seasonal availability of these fish fit with periods when juvenile Steller sea lions are weaning?
 9. (p. 35-36). Discussion of ecosystem interactions for the western DPS should reference recently published work on the marine ecosystem in the central and eastern Aleutians (e.g., 2005 Fisheries Oceanography, supplement).
 10. (p. 61-62). As noted in the NAS (2003) report, elimination of the provision to use lethal deterrence in commercial fisheries in 1990 and the reduction in the rate of the sea lion population decline starting in 1990 are unlikely to be mere coincidence. The number of shootings is not well documented, but anecdotal reports suggest that it may have been substantial. Much shooting of sea lions was reported in conjunction with the pollock roe-stripping fishery in Shelikof in the mid to late 1980s.
 11. (p. 62). The historical review of conservation measures regarding incidental takes is rather weak. For instance, the thousands of sea lions that were incidentally caught in the roe-stripping fishery in Shelikof Strait in the 1980s are not mentioned. That fishery was eliminated, in part because of the sea lion issue but also because of concerns about wanton waste. The section does not mention that NMFS observers are confined to groundfish vessels and does not report the large number of small vessels lacking coverage, nor the lack of observers on salmon and herring vessels, for instance. There is a

long history of interactions between longline, troll, and other fishing vessels and sea lions since the start of these fisheries in the late 1880s.

12. (p. 75-76). The review of orca predation is thorough. However, regarding sharks, it is difficult to fully rule out the possibility of sleeper shark predation on sea lions as only one study examined the diets of sleeper sharks near rookeries. Hulbert et al. (2006) found sleeper sharks to be an ambush predator with significant depth and geographic overlap with sea lions; they concluded that predation potential exists. Documentation of harbor seal remains in sleeper shark stomachs by Sigler et al. (2006) demonstrates that sleeper sharks are capable of consuming mammals of the size of sea lion pups or juveniles. Finally, a congener, the Greenland shark, has been implicated to inflict significant mortality on harbor seals on Sable Island, Nova Scotia, so population-level effects of shark predation are possible. Given this information, it seems premature to fully discount sleeper shark predation on Steller sea lions.
13. (p. 76). Potential beneficial relationships with fisheries should be considered and discussed. Sea lions have been depredating commercial fishing gear since commercial fisheries began in Alaska in the late 1880s. Presumably, there is some energetic benefit to consume a longlined cod or gillnetted salmon, both in terms of caloric intake and reduced energetic costs from not having to seek and capture a free-swimming prey. Discards may also benefit SSL.
14. (p. 76). It is puzzling why, in the discussion of the impact of commercial harvests on pinnipeds, there is no discussion of what has happened with northern fur seals since the early 1900s.
15. (p. 76-77). In addition to subsistence hunting by natives, non-natives also hunted sea lions as a cheap source of protein on fox farms. Also, shooting sea lions was considered great sport in the time when such shooting was not only legal, but encouraged by state and territorial governments.
16. (p. 78-79). The total incidental take of sea lions by the joint-venture trawl fishery in Shelikof Strait in the 1980s is underestimated by observer counts of sea lions taken in trawl cod ends transferred to motherships. Anecdotal estimates indicate that a similar number of sea lions were shot as fishermen tried to protect their nets and catches when nets were dragged near the surface by boats that were in cue for delivery to the motherships.
17. (p. 80). When attempting to estimate rates of sea lion entanglement in fishing gear, it should be noted that a significant proportion of sea lions sink immediately after death, thus reducing the probability of recovering carcasses on beach surveys.
18. (p. 86). The description of groundfish harvest strategy for the North Pacific is oversimplified and misleading. A $F_{40\%}$ harvest strategy is not exactly a MSY harvest strategy; a $F_{35\%}$ harvest strategy results in harvests somewhat less than those that would result from a F_{msy} strategy. The $F_{35\%}$ is set as overfishing, which is a limit not a target. $F_{40\%}$ results in harvests set to be safely below $F_{35\%}$. Possibly, higher fishing levels have been applied in parts of the Pacific region and BC, where sea lion numbers are increasing.
19. (p. 88-89). Much of the argument about diet overlap with other apex predators seems irrelevant. Seabirds take a trivial proportion of the prey biomass that might be of use to sea lions, and grey whales use small benthic invertebrates that they sieve from the mud. If forage fish are acknowledged to be of critical importance to sea lions, then increasing numbers of humpback and fin whales may be significant competitors. If this issue is to be invoked, why not examine the spatial relationship between the distributions of these two whale species and the diets/population trajectories of the sea

lions? Competition for forage fish from adult pollock and cod may be substantial and should be discussed.

20. (p. 95). The discussion of Grebmeier's paper seems irrelevant given the types of benthic invertebrates that she is discussing and the region where she is working.
21. (p. 97 on). There seemed to be much repetition in this section of material covered in Section III. The new presentations in Section IV, however, did not always follow the flavor of those in Section III, which was confusing. It would have been useful for this section to focus on the interpretations of the threats. At the end of section 1. Direct Threats, and 2. Indirect Threats on page 98, one would like to know what these findings meant.
22. (p.97-98). Classification of direct and indirect threats is not entirely clear. It is stated that *direct effects* are those that kill individuals and reduce survival rate and that *indirect effects* are those that reduce body condition. Most animal species can die of diseases and lethal doses of toxins, however, these two sources are placed in the *indirect threats*. Conversely, disturbance is listed as *direct*. This is understandable, if a disturbed animal tramples a pup or is consumed by a killer whale, but one would expect most disturbed animals to simply increase their activity rate, perhaps lowering their body condition (unless they caught a nice juicy salmon while in the water). In sum, the black/white distinction of direct/indirect is not likely to be so sharp; some threats fit into both categories as currently defined.
23. (p. 97, bottom to p. 98, top). The plan says,
If one or more direct threats were major impediments to recovery for the western DPS, continued low rates of juvenile and/or adult survivorship would be expected or observed, potentially with little or no change in fecundity, birth rates or condition. Current estimates of sea lion vital rates do not follow these expected trends.
This seems to be a sweeping, unsubstantiated conclusion. There is an unsubstantiated statement on p. 90 saying,
However, total birth rates at some rookeries and overall survival rates appeared to be lower in the 1990s.
These are examples of internal inconsistencies. Also, one does not expect all threats to be 100% or 0%; that is, reduction, but not elimination, of illegal shooting could have increased survivorship modestly, but not to full potential that would be associated with an absence of shooting.
24. (p. 102 top). The invocation of the precautionary approach here seems strange. From a management perspective, the precautionary approach would be to dismiss the role of killer whales and focus on the potential role of fisheries, which is the only area in which we can take precautionary action.
25. (p. 102 middle). The relevance of whether the present climate shifts are outside the range of past climate shifts is not clear. Almost certainly there have been climate shifts in historical, let alone prehistoric times, which rival those of the present. However, the changes in the present have taken place in the context of an altered ecosystem and thus may stress sea lions in ways that were not present before. A quick look at the Aleutian volume of Fisheries Oceanography will provide evidence of major declines in sea lion populations and shifts in populations of fish in the not so distant past.
26. (p. 102). It is not accurate to say that fish community structure in the eastern Bering prior to the 1976-77 regime shift is similar to that of today. Community structure is more than just species composition- the proportion of those species also plays an important role. Arrowtooth flounder and other flatfishes increased substantially, pollock increased and then decreased, salmon increased and

stayed high, and changes in forage fishes have been observed. So, it is hard to accept this assertion without some supportive analysis. Qualitatively, looking at Table I-13 on p.49, it almost looks like squid and octopus were significant portions of the diet before the decline in the 1940s to 1970s and again in the late 90s and 00s. Apparent increases in squid bycatch in the pollock fishery in Shelikof Strait in recent years and EBS this year makes one wonder whether squid abundance has increased or their distribution has shifted to favor feeding by sea lions. Perhaps the relative abundances of squid and octopus have changed over time; they do seem to be important to the diet of sea lions.

27. (p. 103 middle). The issue of a 60% reduction of biomass in multiple prey species is invoked, but it is not clear that this is the case in the Bering Sea Aleutian Islands. Circumstances in SE, the Gulf of Alaska, Aleutians and Bering Sea are all quite different. There is a need to be explicit about which area is being referred to, and how well information from one area can be extrapolated to another.
28. (p. 109, Summary and Scenarios). The statement is made that, *Steller sea lions had adapted to and accommodated fluctuations in the carrying capacity ... and apparently maintained, on average, a relatively large population size.* Again, published accounts from Nelson (1887) directly contradict this statement; apparently the western stock of sea lions had experienced a dramatic decline to low abundance by the 1880s before substantial fisheries developed. To reiterate, a relevant quote from Nelson (1887) is: *Formerly they were abundant all along the Aleutian chain. They are now so scarce among these islands, and the ones that are found there frequent places so difficult to access, that the Aleuts secure very few of them each year.* Of course, there could be a role of subsistence harvests in this decline, so former declines may not be fully attributable to natural causes.
29. (p. 109, Summary and Scenarios). These scenarios come across as rather speculative, although there is a substantial literature that evaluated roles of predation, fisheries, and multiple factors on the sea lion population; this literature should have been better cited when making statements and drawing conclusions.
30. (p. 114). The argument that the current measures should be maintained because “apparent population stability in the last 6 years is correlated with comprehensive fishery management measures implemented since the late 1990s” is spurious. Correlation cannot be equated with causation. This can be demonstrated by the observation that “*apparent population stability in the last 6 years*” is also positively correlated with the magnitude of SSL research expenditures, the average salary of SSL researchers, and the decline of tropical rainforest cover.
31. (p. 116). The statement is made that the eastern DPS has been recovering for nearly 30 years. Yet, no information was presented to suggest that the eastern DPS has ever been as abundant as it is now. Thus, the term “recovering” is unjustified.
32. (p. 117). The choice of statistically significant increase over 15 years appears arbitrary and subjective. There are no statements about what “statistically significant” means. With a enough data points, an increase of 0.01% is significant. Most real populations increase and decrease over different periods. So, the way in which the increase is calculated will determine the outcome of the significance test. Conditions (2) and (3) are vague and highly subjective. Similar reasoning was used to leave the eastern DPS as “threatened” in 1997 even though, in hindsight, the basis for listing is not strongly motivated.
33. (p. 118). The statement is made that, *Modification of the foraging habitat of the western DPS of Steller sea lion, through both natural and anthropogenic sources, likely resulted in decreased survival and reproduction and may currently limit recovery.* This appears to be the first place in the

document where it is indicated that the sea lion's habitat has been modified. Citations and supportive information are necessary prior to making such a statement.

34. (p. 119). Why would the risks of disease increase if the population declined further? If the animals are less crowded, transmission may decline, though clearly, as a population declines, each death has a greater proportional effect.
35. The recovery plan does not address any actions or planning for the possibility of future decreases in SSL abundance. Given the historical population trend, and the lack of understanding of what is driving the trend, an argument could be made that further poor performance is not unlikely in the future, and it will not be possible to assign impacts to anthropogenic versus natural causes. Explicit planning for this occurrence, and rationale for any management response should be present in the document.
36. Misc. errors:
 - p. 113 misspelling of discrete
 - p. 117 item 2: "determine that whether" – wording problem
 - p. 132 misspelling of implementation.
 - p. 132, item 5: "examines possibly effects" – some wording problem here
 - p. 136: misspelling of Ecosim.
 - p. 157: The threats legend for this table does not describe what "M" is.

DRAFT REPORT
of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
August 1-2, 2007

The SSC met during August 1-2, 2007 at the Marriott Hotel, Anchorage, Alaska. Members present were:

Pat Livingston, Chair
NOAA Fisheries—AFSC

Keith Criddle, Vice Chair
University of Alaska Fairbanks

Sue Hills
University of Alaska Fairbanks

Anne Hollowed
NOAA Fisheries—AFSC

George Hunt
University of Washington

Lew Queirolo
NMFS—Alaska Region

Terry Quinn II
University of Alaska Fairbanks

Farron Wallace
Washington Dept of Fish and Wildlife

Doug Woodby
Alaska Department of Fish and Game

Members absent were:

Bill Clark
International Pacific Halibut Commission

Gordon Kruse
University of Alaska Fairbanks

Seth Macinko
University of Rhode Island

Franz Mueter
SigmaPlus Consulting

A. Review of May 2007 Draft Revised SSL Recovery Plan

Presentations were provided by Bill Wilson (NPFMC staff), Kaja Brix (NMFS-PRD), Tom Gellatt (NMFS-NMML), Lowell Fritz (NMFS-NMML), Paul Wade (NMFS-NMML), Tom Loughlin (TRL Wildlife Consulting), Don Bowen (NPRB Review Panel), and Earl Krygier (ADF&G). Public testimony was provided by Andrew Trites (UBC, NPMMC, and former member of SSLRT), Dave Fraser (FV Muir Milach and former member of SSLRT), John Gauvin (H&G Workgroup), and Dave Benton (MCA).

The May 2007 revision of the May 2006 draft recovery plan prepared by the Steller sea lion recovery team (SSLRT) was taken on by a group within NOAA because the SSLRT was disbanded upon completion of the May 2006 draft. The SSC notes that although the revised draft recovery plan built on the foundation of work completed by the SSLRT, the current draft was not reviewed or approved by the SSLRT.

The SSC appreciates the substantial efforts that were involved in developing the revised draft recovery plan and in organizing the external reviews of earlier drafts of the recovery plan. Some portions of this draft have incorporated previous comments made by the SSC. However some issues are still outstanding and these form the basis of our comments that follow.

Background and Conservation Measures

Distribution and Population Structure. The SSC appreciates the added information on the Asian portion of the wDPS and some additional discussion on the possibility of SSL being a metapopulation. However, metapopulations or other alternatives to the current legal structure of two distinct populations should be developed further. In particular, a discussion of the criteria (for example rates of movement in addition to genetics) that would be needed for the agency to revise its determination of the population structure would be helpful. The SSC recognizes that analysis and interpretation of genetic and movement data is

not easy. **Therefore, until stock structure has been definitively delineated, the recovery plan should explore the management implications of possible alternative stock structures.**

The recovery plan does not include a parallel discussion of population structure (or lack thereof) for the eDPS. As a basis for and justification of the subsequent lack of subregional recovery requirements, it seems reasonable to expect evidence here that the eDPS has no structure, or much less than that in the wDPS. This aspect of similarity or dissimilarity between the eDPS and wDPS should be explored.

Habitat characterization and use. The new information on habitat usage by Steller sea lions (presented in section 2—Marine Habitat Use) improves on the information that was originally used to designate critical habitat (section 3—Designated Critical Habitat). Thus, in accord with our previous recommendations, the SSC recommends that Recovery Task 2.1 (maintain, modify as needed, critical habitat) be given a priority of 2a instead of 3.

Feeding Ecology. Data on energetic demands should be addressed separately from discussion of the validity of the “junk food hypothesis”; understanding energetic demands is important to understanding potential impediments to Steller sea lion recovery irrespective of the validity of the “junk food hypothesis”. Continued use of the term “junk food” in reference to nutritional studies is confusing and should be discontinued.

Factors Potentially Influencing Western and Eastern Populations

Overall, this section presents a comprehensive discussion of the potential threats to Steller sea lion recovery. **The SSC is not aware of additional threat factors that should be considered, but notes that the recovery of Steller sea lions will be influenced by the interplay of multiple factors.**

Issues of food quality and/or limitation are discussed in three sections of the document: page 40, page 81, and page 100. This treatment is confusing. On page 81, the document correctly states that bottom up forces may result from: a) natural changes in the species composition, distribution or quality of prey; or b) changes in the species composition, distribution or quality of prey caused by fishing. However, the discussion of the influence of these changes on Steller sea lions appears on pages 40 and 100. Page 81 notes that the potential effects of bottom up forcing include changes in size at age and the number of successful pregnancies. Juvenile survival should be added to this list. Likewise, page 100 should include a discussion of nutritional stress related to changes in prey diversity.

Care should be taken to differentiate between the effect of shifts in the abundance and composition of Steller sea lion prey and the nutritional value of gadids and other forage fish.

It is important to maintain balance in the presentation of alternate hypotheses. For example, on page 101, the document cites a paper by Fritz and Hinckley (2005) as conclusive evidence that climate-induced changes in prey availability were not associated with the Steller sea lion decline. For balance, this section should reference the paper by Trites et al (2006), which suggests that climate-induced changes may have contributed to the decline. **The SSC notes that climate-induced shifts in the carrying capacity could occur. These shifts could influence the abundance and distribution of prey.** Differentiating between climate-induced and fishery-induced reductions in carrying capacity will be difficult but is of substantial research and public interest.

The SSC appreciates that the revised draft recovery plan includes historical references. However, it may be advantageous to consider including the historical references under a separate section, to highlight that the information is different in scope and character from information generated in modern sampling efforts.

The draft recovery plan should include additional explanation of the reasons for which the threat assessment for killer whale predation was downgraded from high to medium. Was the change made because there is a low probability of mitigating the impact, or because the weight of evidence suggests

that the estimates of killer whale predation do not exceed the estimated natural mortality rate of Steller sea lions? The draft recovery plan should explain if the threat assessments, in general, are influenced by mitigation potential. **Threat assessment should be determined independent of mitigation potential.**

The section on sequential megafaunal collapse should be moved either immediately before, or immediately after, the section on the potential impact of killer whale predation. **The SSC agrees with the NPRB reviewers who remarked that rejecting the sequential megafaunal collapse hypothesis does not lessen the possibility of top-down impacts of killer whale predation; it is a separate issue.**

The SSC was pleased to see the new information on transient killer whale abundance, distribution and diet in the document and in Paul Wade's (NMFS-NMML) overview of recent information on transient killer whale abundance, distribution, and diet that was used for the new killer whale threat discussion.

Throughout the document (e.g., pages 27, 42, 82, and 106) the recovery plan references Holmes et al. (in press) as a study that provides evidence of prolonged declines in birth rate. The SSC received a pre-publication copy of this manuscript. Page 17 of the manuscript includes a description of sensitivity analyses that were conducted. However, none of these examples held birthrate constant. Figure 4 of the manuscript shows adult survivorship was perhaps inversely correlated with birthrate. The constant birthrate hypothesis would balance the hypotheses regarding change in birthrate and change in juvenile survivorship.

Threats Assessment

Overall, this section presents a comprehensive discussion of potential threats to Steller sea lion recovery that might be operating in both the eastern and western DPS. Sections of the recovery plan regarding threats posed by killer whale predation, threats posed by environmental change, and threats posed by competition with fisheries have been revised from the 2006 version of the plan that was provided to the external reviewers. **To guard against the perception of an unbalanced treatment of the scientific data, and to be sure that all new data are included, a small group of non-agency scientists should be included in a team responsible for preparing a final draft of the recovery plan.**

- The ranking of impacts of threats needs further clarification. How was the “weight of evidence approach” used to categorize the relative impact of each threat? Providing detailed explanation of how factors were ranked and what influenced the ranking decisions would contribute to public understanding.
- The SSC notes that the recovery plan includes separate discussions of the food web and threats affecting Steller sea lions. This partitioning results in discussions on nutritional stress being presented several pages after the discussion of bottom-up forcing. The section on nutritional stress should be moved closer to or included in the bottom up section.
- The recovery plan concludes that toxic substances are found in relatively low concentrations in SSL tissues and provides no evidence to support the “medium” threat level designation. Further clarification is needed.
- Although the reasons for the decline of the western DPS are unlikely to ever be known with any degree of certainty, it is clear that the factors responsible for the decline may not be identical to the factors limiting population growth at this time. This realization is mentioned in the recovery plan but further discussion of how multiple factors may be operating and may have differing strengths in various regions is warranted.

Recovery Strategy, Development of Recovery Criteria, and Delisting Criteria

One substantive improvement in this draft recovery plan is that it more fully incorporates the PVA model developed by Goodman. The SSC reiterates that an appropriately structured PVA “provides a useful framework for evaluation of population recovery and changes in extinction risk”. Nevertheless, endorsement of the use of a PVA, should be understood as an endorsement of PVA as an analytic framework designed to highlight assumptions and data gaps; our August 2006 report includes several recommendations for needed improvements and modifications to the PVA developed by Goodman as well as several suggestions for improvements that are needed in the estimation and forecasts of population trajectories. While our advice was acknowledged in NMFS’ response to comments, the technical issues that we identified in the PVA and in the trend projections have not been addressed in the current draft recovery plan. The extinction risk of 1% in 100 years, lack of density dependence, and use of old growth rates in the PVA are examples of assumptions that need to be re-examined in future analyses.

The recovery criteria are based on an assumption that a change in carrying capacity has not occurred, even though the recovery plan (page 89) acknowledges that it may have. **The recovery plan should include a discussion of how a modified carrying capacity might affect the appropriateness of the proposed recovery criteria.** When the PVA is developed for the implementation plan, the issue of a change in carrying capacity should be fully explored.

The recovery plan should include a more detailed explanation of the reasons for the recovery criteria and how their attainment will be assessed. For example, more justification is needed for using the 100-year timeframe as a recovery criterion for Steller sea lions, a pinniped with a shorter generation time than is characteristic of the large cetaceans for which the 100-year timeframe was developed.

The description of the recovery criteria should be revised to emphasize that the specific values obtained (e.g., 3% over thirty years) are subject to revision as new information becomes available and new analyses are undertaken. Furthermore, those values should be connected with the concepts of recovery explained earlier in the section involving risk probability and increasing population trends.

Recovery criteria are required to be objective and measurable under the ESA. However the first and second downlisting criteria (page 136) are vague with respect to the definition of statistical significance and need to be defined explicitly.

NMFS has indicated that it intends to revisit recovery criteria every five years, but this schedule is not specified in the body of the recovery plan. In fact, the only place that modification of approved recovery plans is mentioned is in the discussion on page *ii*. There it says that plans may be changed for “new information, changes in species status and the completion of recovery actions.” Is this really intended to be an “and” and how will this comport with the 5-year revision scenario? **The process for the 5-year evaluation of recovery criteria should be described in the recovery plan and in the implementation plan.** It is important that this process be specified soon, because compiling and analyzing new information will be a multi-year task.

Recovery Action Outline and Implementation Schedule for the Western DPS of SSL.

The SSC has again reviewed the proposed recovery actions for the wDPS of SSL and notes that four items (1—maintain population monitoring and research on key threats, 2—maintain current fishery conservation measures, 3—design and implement an adaptive management program, and 4—develop an implementation plan) were selected from the list of recovery actions and identified on pages 124-125 as items to be implemented. The SSC suggests that the plan provide greater justification for the selection of those items. Items two through four are identified in the plan as having priority 2a, while numerous other actions identified in the schedule (pages 176-184) as priority 2a are not included. **In particular, action 1.2 “estimate vital rates” should be included in the short list of priority items to implement.** We

concur that the implementation plan itself (item 3) belongs in the list of items to implement first. When the implementation plan is written, attention should be given to identification of actions that will be taken in the event that one or more of the recovery criteria for downlisting and delisting are not met during periodic review/revision of the recovery plan (e.g., every 5 years). **The implementation plan should provide an outline of the process, timeline, and expected participants for revising the plan and using a PVA to identify the most prudent actions to promote recovery.**

The SSC suggests that item 2.1 “maintain and modify critical habitat” be elevated from priority 3 to 2a. In addition, research to specifically test whether the wDPS is now under a new, lower natural carrying capacity should be included as a priority 2a action, and a hypothesis testing framework should be included with clear criteria for that determination.

With regard to the priority levels, the SSC suggests that the agency revisit the recovery planning guidelines and consider adding a category for monitoring activities. The motivation for this suggestion is that monitoring activities are vital for determining the status of the population, but cannot be easily construed as “an action that must be taken to prevent extinction ...”

It should be noted that the recovery action costs reported in this section are projected costs for the agency to conduct research and outreach activities as outlined. These agency costs do not reflect the costs (foregone net revenues) to communities and industry or the relative distribution of costs across industry sectors and regions.

As noted in our August 2006 report and as noted by the NPRB review panel, because the causes of the decline of Steller sea lion populations and their slow recovery are unknown, the efficacy of management actions taken to date and of the actions contemplated in the recovery plan is, at best, uncertain.

**Council Motion on the Steller Sea Lion Recovery Plan
August 3, 2007**

The Council moves that a letter be drafted and sent to the Secretary regarding the Steller Sea Lion Recovery Plan. The Council endorses and appends the SSC's comments on the May 2006 and May 2007 Recovery Plan drafts. The letter should highlight the following concerns and issues:

1) Modify the wDPS recovery criteria as follows:

a) Modify the downlisting criteria: The population will be downlisted from endangered to threatened if the population is determined to be stable or increasing over a period of 1.5 generations (equivalent to the Team's 15 years) in U.S. jurisdiction, without requiring subarea consideration (current data indicate this period would start in 2000).

b) Modify the delisting criteria: The population will be delisted if the population is determined to be stable or increasing over a period of 3 generations (current data indicate this period would start in 2000).

c) The recovery criteria requirements to keep in place current fishery mitigation regulations at 50 CFR 679 should be modified to accommodate appropriate adaptive management and mitigation measures based on the best available science. The agency should modify the criteria to focus on adaptive management measures appropriately scaled to localized conditions instead of large scale experimental design. Further, the criteria should call for *appropriate* rather than *current* mitigation measures.

2) Modify the Threats Assessment such that the standard for determining the likelihood of extinction is modified from the standard of 1% chance of extinction in 100 years (10 generations) to 10% chance over three generations (30 years).

3) Reinstate the Recovery Team recommendation that the killer whale predation threat be "Potentially High" rather than "Medium", and conduct additional research and scientific workshops to resolve issues with the assessment of the effects of transient killer whales on the current wDPS population and the impact on the population's recovery. This process should include a broad cross section of scientists with views on all sides of this issue.

4) Increase priority of Critical Habitat redesignation to 2a from level 3.

5) Adopt SSC recommendations on prioritizing actions and developing the Implementation Plan designed around a multiple hypothesis testing framework, including lower carrying capacity.

6) The current analysis is based on the unsupported assumption that conditions leading to the steep decline through the 1980s will occur again. The Council disagrees. The Council recommends a reevaluation of this assumption underlying the PVA. Further, the Council recommends model results excluding periods of high incidental and intentional takes be presented for comparison with results presented in the current draft.

7) Include in the Recovery Plan a provision for an annual report from NOAA regarding the actions taken pursuant to the plan, any new information regarding the status of SSL populations relative to recovery factors, and any new information regarding the status of the species under the listing criteria.

8) Delete ABC adjustment sub-task from Section 2.6.6, and retain 2.6.7 as a priority 3 task.

9) The Council recommends that the draft recovery plan summarize and incorporate recent field work on localized depletion.