

# North Pacific Fishery Management Council

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## MINUTES

Scientific and Statistical Committee  
April 17-20, 1995

The Scientific and Statistical Committee of the North Pacific Fishery Management Council met April 17-20, 1995 at the Anchorage Hilton. All members were present with the exception of Phil Rigby and Sue Hills:

Terrance Quinn, Chair  
Doug Eggers  
Rich Marasco  
Jack Tagart  
Bill Aron

Keith Criddle, Vice-Chair  
Al Tyler  
Harold Weeks  
Doug Larson  
Marc Miller

### C-1 Oil Lease Sale

The SSC considered presentations by Council and NMFS staff and heard public comment regarding the DEIS for the Cook Inlet Planning Area Oil and Gas Lease Sale 149. The action before the Council is to recommend to Mineral Management Service a management alternative for the proposed lease sale that emphasizes the importance of minimizing potential impacts of oil exploration activities on Cook Inlet marine resources, and users of those resources. The SSC recognized the importance of commercial and recreational fisheries in Cook Inlet, and the area's special significance as habitat for (among other things) migratory salmon, spawning herring, numerous shellfish species, sea birds and marine mammals including Steller sea lions and beluga whales. While the exploratory phase is likely to pose only minor risks of adverse impacts, the SSC notes that full development of any discovered oil resources is likely to present substantial risks to marine organisms, particularly in the transportation phase.

Of the six alternatives presented, the SSC recognized merit in the protection zone concepts characterized by alternatives IV-VII. Each of the proposed protection zone scenarios warrants consideration, and could be recommended for the particular resources they address; however, the four alternatives should not be considered mutually exclusive. **The SSC, therefore, recommends that the Council consider an additional alternative which includes all the protection zones identified in alternatives IV-VII.** In addition, it was noted that even with these protection zones in place, adverse impacts may occur outside the lease sale area should there be a development phase. The Council should have the opportunity to comment further if an oil development phase is ever proposed.

## C-2 Inshore/Offshore

Council staff provided the SSC with an overview of the Draft EA/RIR for the proposed reauthorization of Amendment 18/23 to the Gulf of Alaska and Bering Sea/Aleutian Islands Fishery Management Plans dated April 7, 1995. It also received public testimony from John Gauvin, Rebecca Baldwin, Vince Curry, Paul MacGregor, Sheerly Marquardt and Duncan Flannigan.

The SSC commends Council staff for their effort and appreciates the opportunities it has had to comment on the development of the analytical package at earlier states. The document addresses both efficiency and equity issues to the extent that the data allow. **We recommend that the document be sent out for public review after the following concerns have been addressed.** The following statement appears several times in the document, "However, given that the original analysis projected a range from \$37 million loss to \$11 million gain (depending on model parameters used), it is likely that the impact of an additional three-year allocation more closely approaches neutrality, in terms of net benefits to the nation"(p.202). **The SSC believes that such a strong statement is not warranted by the data and analysis and should be toned down.**

Uncertainties in the data necessitate that greater caution be exercised in the development of conclusions. In making the statement quoted, the authors assumed that harvesting/processing costs either have remained unchanged from the 1991 OMB survey or, that they have changed proportionately in both sectors. The document does not address the validity of this assumption. A large part of the analysis is focused on a comparison of sector gross revenues. Revenues were determined by aggregating catches by harvest/processor class, without regard to target species, and multiplying by appropriate prices. This approach reflects the way catches are accumulated to manage for the Inshore/Offshore allocation. The difference in gross revenue per metric ton of catch would be different if catch aggregation was based on target species. In addition, industry representatives have expressed concern about the use of blend estimates because of the way utilization rates are treated in their calculation. While a re-analysis of the data to account for these two issues is likely to reduce the difference in gross revenue indicators, it is unlikely that the conclusion that the prior cost-benefit analysis of the inshore/offshore amendment over-stated losses would change. **It is recommended that the document be modified to contain a statement of assumptions and limitations of the analysis.**

It was brought to the SSC's attention that the following report was submitted to the Council, "A Summary Review of Policy Measures and Relevant Performance Indicators As Applied to the North Pacific Inshore/Offshore Allocation" prepared by Economic & Environmental Analysts. The SSC extensive agenda did not permit a thorough review of this document. Nevertheless, the SSC notes that this document addresses some of the stability issues identified at the January meeting.

## C-3 License Limitation

Council staff presented a brief overview of the history of the license limitation analysis, and noted the range of documents from prior meetings that are applicable to the Council's decision. These include the September EA/RIR, the Appendices dated November 14, 1994, the Supplemental Analysis (SA) dated March 9, 1995, and the Supplemental Social Impact Assessment (SSIA) dated March 29, 1995. The only document not previously reviewed in detail by the SSC were the SSIA and SA, though the SSC did hold a teleconference in mid-March to do a quick evaluation of the SSIA prior to sending it out for public review. The staff and contractor were responsive to SSC comments about the need for minor changes before release for public review. The SSC also heard a presentation about the SSIA from Michael Galginaitis and Michael Downs of Impact Assessment, Inc., and heard public testimony from David Hillstrand and John Gauvin (AFTA).

**The SSIA provides useful descriptive analysis of the number of vessels qualifying for licenses and endorsements under the two main qualifying periods, 400 and 800, relative to a baseline of 1993 participation. This information is arrayed by vessel category and geographic area. It also briefly enumerates expected social impacts and concludes generally that there will be little social impact, except possibly in Western Alaska. The main anticipated problems may come from a lack of flexibility for some vessels which fish a relatively large number of fisheries if they don't receive endorsements for all their fisheries.**

**The SSC notes that the lack of social impact is a direct result of the fact that both qualifying periods would result in roughly a doubling of the number of vessels and endorsements relative to current effort as measured by 1993 participation for the groundfish fishery. If the Council chooses measures to further limit participation, such as requiring minimum landings, social impacts would likely occur. However, for the two highlighted qualifying periods the SSC sees little gain in net economic benefits resulting from license limitation. In fact, the large number of qualifying vessels may actually cause an acceleration of fishery effort relative to the status quo and cause a reduction in net economic benefits.**

**"Uncertainty (over rules for transition to an ultimate IFQ system) may foster more people to try and fish their licenses than otherwise would, as a speculative venture. This is the major nexus for negative social impacts arising from maintaining relatively free access to the fishery through a relatively large supply of licenses (p. 41, SSIA)."**

**The lack of apparent net benefits from license limitation led the SSC to discuss the relative merits of license limitation as opposed to a moratorium (which appears likely to be implemented soon) followed by an IFQ system. This is relevant because license limitation with large numbers of qualifying vessels will not achieve several of the goals set forth in the EA/RIR of Sept. 18, 1994 (Executive Summary, pages E-16E-18). The SSC discussed license limitation versus moratorium at its April 1994 meeting, noting that**

**"Like the moratorium on entry, license limitation is a particular means of capping the number of participants, not the level of effort or capitalization." (SSC minutes, April 1994).**

**The advantages of license limitation relative to the moratorium have to do with the fact that more restrictions are placed on where and for what species vessels can fish; this may make fisheries easier to manage and reduce the chance of large accumulations of effort in small areas or for certain species. However, if the Council wishes to achieve some form of comprehensive rationalization as an end goal, it may be that this can be achieved more rapidly or with lower implementation cost by a moratorium directly followed by the CRP.**

**The SSC notes that a number of features of the license limitation program are interrelated, including**

- 1) transferability of licenses;**
- 2) severability of license endorsements either from combination licenses or from vessels; and**
- 3) the transition from license limitation to IFQ.**

**Predictions about the effects of these features can be made both from the SSIA and theory and evidence from other license limitation fisheries. Transferability and severability increase a fisherman's flexibility. In the case of transferability, licenses may acquire a market value which can be realized by sale prior to IFQ implementation; in the case of severability, two severed endorsements will be worth more than a single license with the same two unseverable endorsements. Not allowing transferability may be a desirable option to provide a more fixed pool of catch histories to use for determining IFQs. However, this would only make sense if the Council were clearly moving in a reasonably short period to IFQ's; otherwise some mechanisms for transfer**

would clearly be needed. If licenses are non-transferable, the Council can expect a variety of creative attempts to get around this, the simplest being leasing arrangements.

Some other features of the license limitation program, such as minimum landings or poundage requirements, clearly have the effect of reducing the number of qualifying vessels and endorsements. The SSIA does a good job of pointing out these tradeoffs, which impact different segments of the fleet in different ways. Reducing the number of qualifying vessels can be expected to increase the net economic benefits that can be realized from license limitation, even if they cannot be quantified. Regarding this last point, the SSC believes it important to provide some context for evaluating the analytical approach chosen for this particular regulatory initiative. In reviewing other parts of the analytical package, the SSC noted that:

"Economic analysis of license limitation typically focuses on net benefits (efficiency) and equity issues. By defining the qualification criteria for licenses or QS, the Council determines the initial distribution of economic opportunities. The analytical package developed by Council staff characterizes potential distributional consequences of alternative license allocations, but does not quantify the net benefits of the license limitation program. The SSC does not consider the lack of net benefit assessment to be a critical shortcoming in the analytical package because experience with license limitation programs indicates that they are unlikely to provide significant long-run net economic benefits." (SSC minutes, December 1994)

An important reason for the evolution of the analytical approach is recognition of the difficulties and great cost required to obtain the needed information (e.g., on harvest costs) to conduct more detailed and accurate benefit-cost analyses. Instead, recognizing the difficulties with quantifying everything into a dollar metric, including uncertainties about prices and costs, a quantity metric (numbers of vessels and licenses) was adopted to facilitate the evaluation of the potential distributional impacts. As the SSC noted in its June 1994 discussion of analytical approaches,

"Given the eligibility criteria, the nature of the license, ownership restrictions, and who receives the license that are characteristic of an alternative, data are available to describe distributional consequences.

Theory suggests that there are no long-run net economic benefits to license limitation programs. It is for this reason that ITQ programs are preferred by economists. However, the Magnuson Act identifies multiple objectives for fisheries management. The extent to which license limitation addresses one or more of the Council's objectives should be clearly articulated.

For example, an alternative could be motivated by the objectives of preserving fleet diversity and contributing to the economic and cultural stability of coastal communities." (SSC minutes, June 1994)

The SSIA and related staff analyses of the distribution of licenses and endorsements provide information relevant to considering the other objectives noted.

Though quantification of benefits and costs to derive net benefits was not necessary nor appropriate in this instance, the SSC would like to further note that it is generally desirable to conceive of the analytical approaches to identifying the benefits of proposed regulations in these terms. In the next steps toward CRP, greater attention to costs and benefits may be needed.

## **C-8 Bycatch and Discard Reductions**

The SSC received presentations on Harvest Priority by Joe Terry and Increased Retention/Increased Utilization by Lew Quierolo. Time did not permit discussion and consideration of these issues.

## **C-9 Endangered Species Review**

The SSC was informed that the recommendation on the status of the Steller sea lion under the ESA has been forwarded to NMFS Headquarters for decision and appropriate action.

## **D-1 Scallop Management**

The SSC received presentations from David Witherell and Sue Salvesson on the need for and characteristics of a revised draft scallop FMP. Public testimony was presented by Mark Kandianis, John Doody, James Fletcher, Theresa Kandianis, and Mike Andrews.

**Under the current constraints of the Magnuson Act, the absence of a valid FMP presents a significant potential for a conservation problem in this fishery. Nevertheless, the complete closure of this fishery will likely result in forgone revenues of over \$6 million annually. The SSC urges that an attempt be made to identify a way to allow a constrained fishery that would collect information on the scallop resource.**

The SSC notes the substantial uncertainty in nearly all knowledge areas needed to manage this fishery. Estimation of population abundance and size/age structure, scallop biology, life history and stock production parameters; analyses of reproductive potential, population thresholds, recruitment and limiting factors; and investigations of exploitation rates are of paramount importance. All of these issues are important to the determination of Guideline Harvest Levels (GHL's). At least some of this necessary information will have to be contributed by the fishery, as neither ADF&G nor NMFS have the budgetary and human resources to initiate a comprehensive scallop research program. We recommend that ADF&G, NMFS and industry members begin discussions of alternative strategies to meet these important research needs.

A proposal for a research fishery was presented during public testimony from James Fletcher; we encourage the proposer to more fully develop this proposal in writing and submit it to NMFS, ADF&G and the SSC for review. However, the proposer's recommendation of a 400,000 pound allocation of shucked meats to each participating vessel would result in a larger total harvest than has occurred in any one year in the past. This level is clearly unacceptable.

The current FMP draft lacks a clear statement describing how GHL's are calculated. It specifies an OY range from 0 to 1.1 million pounds and defines overfishing as landings that exceed OY. The SSC believes that this is a reasonable approach given the available information. Until additional data becomes available, the guideline harvest levels specified in the November 30, 1993 draft FMP should be used. The SSC believes that any operational FMP must give serious considerations to effort limitation, i.e., ITQ system.

There is a clear need for observer coverage of the scallop fleet to begin collection of the necessary biological and fishery information. Whether this is done pursuant to the Council's Research Plan or the Alaska Observer Program should be determined by which agency assumes the principal management responsibility; requirements for observer coverage should not be duplicated.

The SSC reviewed the crab bycatch limits recommended by the Council. **Bycatch amounts that occur based on the numbers recommended should not create any conservation concern at this time.**

#### **D-2(a) Chinook Salmon Bycatch**

The SSC reviewed the EA/RIR for Amendment 21b (Chinook Salmon Bycatch Management) to in the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands.

The chinook salmon bycatch occurs during the late fall through late winter period and is composed of immature fish. The origin of these bycatches is mostly from western Alaska river systems, based on stock identification studies of trawl bycatches in the late 1970's and early 1980's. The proposed measures to reduce bycatch of chinook salmon in the BS/AI groundfish fishery are allocative (i.e., they allocate the catch and burden of conservation among groundfish and directed salmon fishers). At historic bycatch levels the interceptions of chinook salmon by the BS/AI groundfish fisheries represent between 1% and 4% of the run to the Yukon River and between 2% and 7% of the Nushagak River.

**The chinook salmon bycatch occurs over a broad area and during times of the year when the groundfish product quality is high; consequently, a small block area is not available where significant reductions of chinook salmon would occur with time/area closures without imposing potentially large costs on the groundfish fishery. The time-area closure concept is likely to become unworkable very quickly because of the large number of actual and potential bycatch allocation issues the Council faces.**

The SSC notes there currently is a voluntary, industry-sponsored, program that provides individual disincentives to chinook bycatch-- the Salmon Foundation program that requires a payment of \$20/chinook caught to help fund salmon research. Such a payment program provides disincentive for catching chinook (though the appropriate magnitude of the disincentive can be debated), and it addresses the bycatch problem at the level of individual harvester, without penalizing clean fishermen for the actions of a few. **The SSC notes that the voluntary program has been in place for a limited period, and recommends that the Council provide an opportunity for these voluntary measures to operate before considering more draconian alternative measures to reduce chinook salmon bycatch such as time/area closures.**

#### Comments on the Bycatch Model Used in the Analysis

While the Bering Sea Bycatch Model is capable of providing useful insights about some of the gross tradeoffs associated with regulatory alternatives, the model as presently configured does not realistically address effort substitution between closed areas and remaining open areas, and does not realistically address the changes in CPUE in areas as effort levels change in response to regulation. **The estimates of net benefits should be regarded as relative values useful for ranking the options and not as forecasts of the actual net benefits anticipated under the alternatives. Models such as the bycatch model used in this analysis represent simple accounting rules for the redistribution of effort as a result of area closures and cannot be relied on to predict actual fleet movements. In particular, following a closure, the model redirects effort throughout the balance of the Bering Sea in proportion to the average magnitude of historical catches. The cost data used in the analysis are old and may not reflect current operations. The gross revenues reported for directed salmon harvests are underestimated because they do not include recent years and fail to adjust the gross revenues from earlier years to compensate for inflation. The SSC believes that beginning work on improvements to the model in these areas is important and should be undertaken in the near term because of the pervasive nature of the bycatch issues the Council faces. Work undertaken to improve the model with respect to chinook salmon bycatch will also have immediate payoffs with respect to chum salmon, crab, halibut, and other bycatch species.**

## **D-2(b) Crab Bycatch Management and Rebuilding**

David Ackley (ADF&G) provided an overview of the draft EA/RIR document for Bering Sea trawl closure alternatives. He also summarized the report prepared by the Fluharty Committee resulting from a joint meeting of members of the crab and BSAI groundfish plan teams. John Gauvin and Jon Henderschedt demonstrated the "Sea-state" program which was used by industry to monitor bycatch rates during the 1995 rock sole fishery and helped fishermen avoid areas with high crab and halibut bycatches. Additional public testimony was provided by Arni Thompson and Lisa Bullitto.

**The SSC applauds the efforts of the Fluharty Committee to broaden the discussion of crab status and rebuilding to embrace more comprehensive causes of mortality and limiting factors. This is a significant step on the road to more comprehensive bycatch management.**

The SSC also appreciates the staff's preparation of a document describing all groundfish and closure areas in the Bering Sea and Aleutian Islands. The immediate question before the Council is whether to send the draft EA/RIR for additional Bering Sea trawl fishery closure areas out for public review. The document is currently incomplete in that it lacks a discussion of economic costs of the potential measures. Despite the limitations of the analytic and predictive power of the Bering Sea Bycatch model (see distribution under D-2(a)), the SSC feels that the insights it provides are useful. **The SSC also recommends that a qualitative discussion of the economic impacts of the contemplated measures be included in the document.** This qualitative analyses should include a discussion of the potential effects of bycatch constraints in other trawl fisheries (e.g. cod) resulting from re-directed effort. These elements should be incorporated before the document is released for public review and comment.

The SSC notes that the Fluharty Committee recommended that any approved time-area closure for king crab should sunset after a period of time as broader bycatch management measures are developed. The SSC agrees that closure measures should be considered short-term measures.

**The SSC continues to believe that it is important to address the cumulative effects of bycatch management measures in a more comprehensive fashion.** Bycatch management to date has been based on partial analyses, the cumulative effect of which do not necessarily result in an optimization of Bering Sea fisheries as a whole. Significant limits on our efforts to understand the broader picture are (1) the existing bycatch model is an accounting model ill suited to predicting how fishing effort will be re-allocated based on closure, and (2) our estimates of economic impacts are currently limited to gross revenues; evaluation based on costs and net revenues are necessary.

**Comprehensive bycatch management will require significant effort which the Council and cooperating agencies cannot afford at this time. The SSC will appoint a sub-committee chaired by Rich Marasco, to examine information needs for economic impact assessments. This sub-committee will report to the SSC in September.**

## **D-2 (c) Pacific Ocean Perch**

The SSC was asked to evaluate whether the 1995 P.O.P. TAC should be amended to facilitate rebuilding and whether the P.O.P. rebuilding plan should be amended to provide a more flexible TAC algorithm. Jane DiCosimo reviewed the development of these issues which were precipitated by comments from ADF&G. Jon Heifetz, NMFS (Auke Bay), Jim Ianelli (AFSC), and Jeff Fujioka, NMFS (Auke Bay), presented the SSC with a



supplemental report found in the Council's briefing book. The SSC would like to commend Jon Heifetz, Jim Ianelli and Jeff Fujioka for their timely and thorough review of issues presented by ADF&G.

The SSC believes in general that TACs should be set at a level less than or equal to the ABC. The 1995 P.O.P. TAC is substantially lower than the ABC. Thus, the SSC finds no compelling biological rationale to recommend a lower TAC.

With respect to amending the P.O.P. rebuilding plan so that the current algorithm which generates the TAC is regarded as a limit on TAC rather than a prescription for TAC, the SSC believes the Council should have flexibility in setting TAC levels and therefore supports an amended plan. However, the SSC wants to emphasize that the exploitation strategy represented by the current TAC setting algorithm is expected to provide the requisite conservation benefits to the stock while facilitating stock rebuilding.

#### **D-2(d) Halibut Grid-Sorting**

Council staff and Bob Trumble gave a presentation highlighting changes made to the EA/RIR submitted to the Council for its January 1995 meeting. Steve Hughes and Fred Munson gave public testimony.

In January, the SSC requested that revised draft EA/RIR address the effects of grid sorting on: (1) bias and variability of catch and bycatch estimates, (2) the viability of the VIP program, and (3) calculation of halibut bycatch by vessel and across vessels.

It was also indicated that the relevant comparison for bycatch mortality from the grid sorting experiment (66%) was that from the non-pelagic trawl pollock fishery mortality (77%) rather than the mortality for the Pacific cod fishery (65%). All of these issues have been addressed in the April 1995 draft EA/RIR.

On page 15 of the April draft EA/RIR the document indicates that total reduction in discard mortality with use to grid sorting would likely be reduced by from 15 to 25 percent. How the range was determined is unclear, and the SSC suggests that this be clarified. After the modification is made the SSC recommends that the document be sent out for public review.

The SSC cautions that the observed differences in halibut survival rates were not examined using formal statistical methods and should not be interpreted as having statistical significance.

#### **E-1 Council Operations**

In its January 1995 minutes, the SSC noted the current magnitude and complexity of the workload undertaken by the Council is overwhelming its staff, the staffs of cooperating agencies, and the advisory bodies of the Council. This is compromising the effectiveness of the Council management efforts and adversely impacting the preparation and review of documents prepared by the Council staff and outside organizations (such as oil and gas lease sales).

The SSC thanks the Council's Executive Director for making available earlier Council reports dealing with workload issues and the development of its processes and procedures for operations. The SSC reviewed documents prepared following five meetings held by the Council between 1984-1990 with particular attention focussed on the current policy document (1990) on annual management cycles.



The SSC believes that strict adherence to the 1990 rules would provide a step forward to enhancing Council operations. The SSC, however, believes that more must be done in the face of declining budgets and staffs and the growing complexity of management issues which include ITQs, increasing diversity of constituents, the high level of overcapitalization, and bycatch and use issues.

**The SSC accordingly suggests that a special meeting of a newly formulated policy and planning group be held as soon as possible. The group would include representation of the Council, its staff, the AP and the SSC, as was done effectively in the past. The group should be charged with updating the current operating procedures in the face of human resources limits. While not trying to limit the agenda, the SSC suggests that an examination of the meeting schedule, particularly in regard to frequency and the timing of meetings, alternate schedules for TAC determination, and the development of a new approach for prioritizing amendment proposals might be particularly helpful to the Council process.**

## **E-2 Risk Assessment**

In December 1994, the SSC decided to consider the issue of risk assessment in stock assessment: the identification, quantification, and incorporation of uncertainty into the assessment of stocks. A theme session on this topic was held at this meeting. Materials included a paper on risk assessment of POP (by Ianelli, Heifetz, and Fujioka), articles about stock assessment on the east coast of the U.S. (contributed by Hal Weeks and Al Tyler), a discussion paper on uncertainty in stock assessment (by Al Tyler), and a review of risk assessment techniques (by Jim Ianelli).

At the current time, quantitative descriptions of uncertainty in stock assessments are beginning to emerge. There is uncertainty in both the estimation of current exploitable biomass and in the fishing mortality variable used in the calculation of ABC's. This uncertainty is due to a variety of factors, including sampling variation, ageing error, choice of natural mortality, growth and reproductive variation, and inter-annual variability in or lack of information about population parameters.

A variety of techniques could be used to quantify and express such uncertainty.

- (1) Sensitivity analyses may be done if statistical variability cannot be described. This is the most common situation in current NPFMC assessments.
- (2) A variety of techniques (likelihood methods, bootstrap techniques) lead to estimates of standard error or confidence intervals. There is much concern on the SSC about intervals; experience in a variety of fishery management circles has shown that managers often gravitate toward the upper end of a recommended harvest interval. Another issue here is which group (scientists, managers) is best equipped to integrate the biological risks of harvesting. Is the management process best served by providing as narrow an interval as possible for the managers? Some who have worked within the Council process think the answer is yes.
- (3) In the discussion paper by Al Tyler, a ranking system for uncertainty was suggested for both components of ABC (biomass and fishing mortality). This requires some subjective determination of the uncertainties at different stages of the assessment process.
- (4) Recently, Bayesian and decision analyses have been used for determining the amount of risk associated with various management activities. Biological risk could be determined as the probability of the population falling below a particular level. Fishery risk could be determined as the probability of the

harvest falling below a particular level. One way of presenting such risks is with a decision table: various risks are tabled given the various states of nature and alternative management actions.

- (5) Jim Ianelli presented a new technique (Bayesian estimation or Monte Carlo integration) that allows parameters to be treated as random variables with prior distributions. The stock synthesis model provides the likelihood given the observations and the posterior distribution of population parameters can be calculated.
- (6) Adaptive management is a technique that explores which management strategies provide for learning about the system. Essentially, this is a type of Bayesian updating approach.
- (7) In the process of risk assessment, a loss function (the management error associated with a decision) must be described. In statistics, quadratic or absolute difference loss functions are common. However, in fisheries, asymmetric loss functions are probably more desirable: the loss due to overexploitation should get more weight than the loss due to underexploitation. Thus, it may be that the target exploitation rates may end up lower than the optimal rates obtained if uncertainty is ignored.
- (8) A new approach using fuzzy arithmetic may be a method of incorporating uncertainty (Ferson 1993, Management Strategies Symposium). This approach uses possibility laws instead of probability laws for assessing risk.

In summary, a variety of approaches can be used to better incorporate and illustrate the effects of uncertainty on the fishery management process. The issues of risk entail descriptions of time horizon, spatial scales, loss functions, ranking systems, subjectivity and perceptions, expressions of uncertainty, measurement metrics, dynamical processes, and determination of end-users of the process. In the North Pacific Fishery Management Council, the class of decision choices in stock assessment has almost been restricted to biologically risk-averse strategies. Within this class, a point in the range has been sought to balance biological and fishery risks. Generally, determining a low biological risk has been treated as a constraint before examination of fishery risk is undertaken.

The SSC requests the Plan Teams to examine issues related to risk assessment and expression of uncertainty at its next stock assessment meeting. The SSC would like the Teams' opinion(s) on how uncertainty can best be expressed in stock assessments.

#### ADF&G Funding

The SSC is concerned about the potential effects of proposed reductions (up to \$5.3 million) in ADF&G research and management budgets. ADF&G provides important research and management contributions for groundfish, scallop, and crab stocks. Without these contributions, the Council's ability to manage these resources may be adversely affected and may require that more conservative management measures be enacted. The SSC urges the Council to contact Alaska's legislative leadership to express such concerns.

April 19, 1995

Clarence Pautzke  
North Pacific Fishery Management Council  
P.O. Box 103136  
Anchorage, AK 99510

Dear Clarence:

The attached section of the SSC minutes reflects our growing concern with the current Council process and its impact on our ability to provide both timely and high quality advice to the Council. While the Council staff has done a magnificent job in its attempt to serve the Council the combination of time demands and issue complexity had been overwhelming and had made it difficult to reach closure in the preparation of high quality documents that are also available in sufficient time for critical review.

We believe that there is a better way to do business, in fact, there must be a better way if the Council is to remain successful. We are all committed to work with you and the rest of the Council family to find this way.

Sincerely,

*s/Terrance Quinn*

Terrance Quinn  
SSC Chair