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Comments on Survey Methodology and Results for Collection of Economic Data Used in the Analysis of Long-Term Allocation Options for the Pacific Sardine Harvest Guideline

SSC Economics Subcommittee
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Introduction

At the April 2005 Council meeting, the SSC reviewed a document entitled "Allocation of the Pacific Sardine Harvest Guideline - Amendment 11 to the Coastal Pelagic Species Fishery Management Plan - Preliminary Alternatives Analysis (including Errata Sheet)" (hereafter referred to as "Amendment 11 Alternatives Analysis"). As part of that review, the SSC requested supporting documentation, which was not available at that time, for data and methods used in the analysis of alternatives. In response to the SSC request, Dr. Sam Herrick (CPS Team chair) prepared a working document dated May 2005 and entitled "Survey Methodology and Results for Collection of Economic Data Used in the Analysis of Long-Term Allocation Options for the Pacific Sardine Harvest Guideline" (hereafter referred to as "Survey Methodology"). This document was provided to the SSC Economics Subcommittee on May 10, 2005. The Subcommittee appreciates Dr. Herrick making this additional information available to the SSC.

According to the survey methodology, the purpose of collecting cost-earnings data from West Coast sardine processors is to analyze effects on producer surplus of proposed adjustments in the sardine harvest guidelines. The proposed adjustments involve changes in the allocation among three geographic regions: Southern California (San Pedro), Northern California (Monterey), and the Pacific Northwest (Oregon and Washington). The analysis of alternatives presented to the SSC in April 2005 was based on cost-earnings data for processors, and was intended to capture trade offs among alternatives in terms of changes to long run producer surplus for each geographic region.

Comments below focus on three specific aspects of the data collection method and use of the data in the analysis of alternatives:

1. Limitations and potential bias in the Delphi method used to collect economic data on processor operations;
2. Limitations of excluding ex-vessel profits, and basing producer surplus estimates for the industry on data from processors alone;

3. Limitations of basing producer surplus estimates on a narrow definition of variable costs, which excludes costs that vary from year to year, and are adjustable in the long run.

Comments pertaining to the three items above highlight important caveats to the current analysis of alternatives for the Pacific sardine fishery. Based on these caveats, the Economics Subcommittee concludes the current data and analysis of alternatives is not sufficient information for making an assessment or evaluation of "long-term allocation options" for the Pacific sardine fishery.

As explained below, even if processor data are accurate, which is currently unknown, the definition of producer surplus used in the analysis is most appropriate for economic conditions that would prevail in the short run. Additional factors, some included in the processor cost-earnings data, but excluded from the analysis of alternatives, need to be considered explicitly in a long run evaluation of changes to producer surplus for each geographic region.

Using the processor cost-earnings data alone for a short run analysis of alternatives would be incomplete because of changes in ex-vessel revenues, which currently are not included in the definition of producer surplus used in the survey methodology. Therefore, the Economics Subcommittee highlights the recommendation by the full SSC in April 2005 that effects on ex-vessel revenues from projected changes in landings be included in the analysis of alternatives. If available, operating costs for vessels could be subtracted from ex-vessel revenues to estimate producer surplus for harvesters.

Delphi Method

The data was developed under contract with fishing industry associations using a "Delphi type process" (Survey Methodology, May 2005, p. 1). Processor representatives from the 3 geographic regions participated in this process to develop estimates of processing costs and capacity for each area. The cost-earnings data were developed by three regional panels consisting of sardine processors who accounted for virtually all sardine landings in their respective regions. According to the survey methodology, the objective of this data collection effort was to develop representative cost-earnings data for CPS processed products, by geographic region, to:

- Profile the population of sardine processors in each region in terms of firm size, employment, and product mix;

- Estimate variable input requirements (e.g. labor, energy, ice, transport) and unit processing costs for each area;

- Estimate annual expenditures on "Fixed" inputs (e.g. insurance, lease payments on building, structures, equipment) for each area.

A Delphi process (generally speaking) is a method of structuring group communication to address a question that does not lend itself to precise analytical techniques, but can benefit from subjective judgments made collectively by a group of experts.

It is not clear why a Delphi process was an appropriate way to collect data for the analysis of sardine allocation alternatives: (1) While the Delphi method is suited to issues that cannot be addressed in a precise analytical manner, cost-earnings information is (by contrast) amenable to quantitative estimation via a standardized survey instrument. Given that such an instrument was in fact prepared, it is not clear why a Delphi method was used instead of asking processors to fill out the instrument on an individual basis (as is customary in standardized surveys). (2) While a basic premise of the Delphi method is that subjective judgment by experts can provide insight into an issue, the expectation in the case of sardine allocation was that such subjective judgment would yield biased information. For instance, the Survey Methodology document notes that "...there are likely to be inherent biases in the data that was [sic] acquired. This mainly has to do with the contentiousness of the issue at hand strategically influencing the information provided by participants in the data collection exercise; i.e., strategic bias" (Survey Methodology, May 2005, p. 4). Given this expectation of biased results using the Delphi method, it is not clear why the Delphi method was considered an appropriate information collection method.

The survey methodology gives two rationales for having regional panels rather than individual processors fill out the survey instrument:

(1) The panel approach "streamlined development of the data" (Survey Methodology, May 2005, p. 5).

The survey methodology does not define "streamlined development," but any attempt at "streamlining" should be constrained by the need for valid data. In this regard, the data developed by the regional panels may well be representative of regional cost-earnings. However, unless adherence to an explicit and appropriate information collection protocol can be demonstrated, we have no independent basis for evaluating strengths and/or weaknesses of the data, identifying areas of uncertainty, or evaluating whether the data collected are in fact representative. For instance, some of the data used in the analysis presented at the April SSC meeting have been replaced by a different set of vales, based on concerns expressed by Northwest processors. On what basis can we judge the relative validity of the two sets of values?

(2) The panel approach provided a "built in peer review of data by virtue of the process" (Survey Methodology, May 2005, p. 5).

Processors may be well positioned to identify implausible data provided by other processors. However equating "intense debate amongst industry members regarding the validity of the data used in the analysis" to "an extremely rigorous peer review" (Survey Methodology, May 2005, p. 5) is not accurate. A true peer review requires that reviewers not have a vested interest in the outcome, and that they be at least as interested in the methodology (including, in this case, technical aspects of the Delphi method) as in the results of the work being reviewed.

Even non-statistical information collection methods such as the Delphi method require adherence to a particular information collection protocol. Unless the SSC knows what protocol was used to develop the processor data, and whether each regional panel adhered consistently to the protocol, the SSC will be unable to evaluate the validity of the data. Without a technical basis for evaluation, the SSC cannot distinguish cost-earnings profiles produced by regional panels from regional negotiating positions. This is particularly troublesome, given that processor debates regarding data validity occurred in the heat of the allocation issue, when the use to which the cost-earnings data would be put was clear to all parties.

Producer Surplus and Ex-Vessel Profits

Ex-vessel profits are not included in the producer surplus estimates used in the analysis of alternatives. Purchases of

unprocessed fish by processors are counted as a variable cost to producers in the analysis, and therefore, this source of ex-vessel revenues does not contribute to producer surplus. The assumption that ex-vessel revenues do not contribute to producer surplus is valid if, and only if, ex-vessel revenues exactly equal total economic costs of vessel operation (i.e. economic profits are zero).

If ex-vessel revenues exceed costs, then producer surplus in the analysis of alternatives underestimates true producer surplus. Vertical integration among processors and vessels is a related issue. Processors may own vessels, or have other special arrangements, and imputing purchases of raw fish by processors at observed ex-vessel prices could substantially underestimate true producer surplus. More generally, isolating possible behavioral responses to changes in a single fishery is restrictive given the suite of existing revenue sources and other possibilities that may be available to vessel operators.

To address the issue of changes in ex-vessel revenues affecting estimates of producer surplus, an analysis of changes in ex-vessel revenues among alternatives should be conducted, and included with the analysis of alternatives. At the April 2005 Council meeting, the SSC recommended that projected changes in ex-vessel revenues be added to the analysis of alternatives. Including these changes would provide another source of information to complement the current analysis of alternatives, which assumes that processor revenues net of a restricted set of costs are an adequate proxy for true producer surplus. However if vessel profits are positive, this proxy underestimates benchmark levels of producer surplus in each region. How this discrepancy affects estimates of changes in true producer surplus is not clear. Projecting changes in ex-vessel revenues for each geographical region would provide an independent source to alleviate concerns about relying solely on processor cost-earnings data for the analysis of alternatives.

Producer Surplus and Costs

The goal of analyzing long-term allocation options for Pacific sardine harvest guideline is to estimate the incremental change in producer surplus for each fishery sector when comparing each of the proposed allocation options to the status quo (Amendment 11: Alternatives Analysis, p.21, 2005). The formula for estimating the incremental change in producer surplus is obtained by multiplying the projected change in sardine landings by "an

estimate of producer surplus per metric ton for each fishery sector" (Amendment 11: Alternatives Analysis, p.21, 2005). This per metric ton estimate of producer surplus is constant across alternatives, and in particular, does not depend on the size of the change in landings under each scenario in each region.

The formula for calculating changes in producer surplus in the analysis of alternatives is consistent with the definition of long run producer surplus only if this formula is used as a local approximation. Producer surplus is the cumulative difference between the price received by producers at the market equilibrium quantity of output and the marginal cost of producing each successive unit of output. Generally, marginal costs increase with scale as less efficient resources are used for production. In the special case where marginal costs are constant, which is assumed implicitly in the formula for producer surplus, technology exhibits constant returns to scale. Therefore according to economic theory, long run economic profits and producer surplus are zero under every alternative.

The analysis of alternatives attempts to minimize variation in the per unit factor for producer surplus by including only costs that are directly proportional to the weight of sardines processed. The unit factor for producer surplus in the analysis of alternatives is formulated as the market equilibrium price for processed sardine products net of per-unit variable costs such as expenditures on raw sardines, ice and storage, and transportation. Other costs including facilities, equipment, insurance, etc. are not considered variable costs in the analysis, and thus, appear as a residual in producer surplus. This cost residual cancels and does not affect estimates of change in producer surplus, but only if these costs are the same under the status quo and the proposed alternatives. This assumption seems unlikely, given the dynamic nature of the CPS fishery and the long-term outlook of the analysis.

Changes in ex-vessel prices or prices of processed sardine products are potential sources of variation among alternatives that would affect unit estimates of producer surplus in each geographic region. Differences among alternatives in the type of processed sardine products available to markets would presumably affect demand, and therefore, market prices may respond differentially among alternatives. Similarly, substantial changes in demand for raw sardines in each geographic region could affect ex-vessel prices, which would require adjustments to the unit estimates of producer surplus.

While these economic effects on prices are indirect, and usually ignored in short run analyses, markets would surely adjust to the proposed allocation in the long run. Therefore, the possibility of differential effects on prices should be considered in a long run analysis. An important simplifying case to consider is the possibility of a perfectly elastic demand curve, which could be a reasonable approximation if close substitutes for processed sardine products are readily available. In this case, changes in landings among alternatives would not affect market prices for processed sardine products. Because the market for sardines is global, perfectly elastic demand for processed sardine products may be regarded as a reasonable simplifying assumption.

As noted above, economic relationships between processors and vessel operators (i.e. degree of vertical integration) are not explicit in the analysis of alternatives. Hence, assumptions about market demand and supply functions for raw sardines are not explicit either. Some comments above about the contribution of ex-vessel revenues to producer surplus could be addressed by assuming that supply of raw sardines is perfectly elastic. Then, ex-vessel prices would be equal to the marginal cost of producing a unit of raw sardines, which would be the same for any scale of sardine harvest. However, an assumption of constant marginal costs among alternatives does not seem plausible for sardine harvesters in the long run.

Recommendations for June 2005

1. Currently, producer surplus in the analysis of alternatives consists of processor revenues net of processor variable costs. Changes in ex-vessel revenues should be included in the analysis of alternatives to i) evaluate potential effects on producer surplus in the harvesting sector, and ii) provide a source independent of the processor cost-earnings data collected using the Delphi method.

2. Per unit estimates of producer surplus are valid as local approximations over a limited range of conditions in the short run that depend on many unknown parameters such as elasticity of demand for processed sardines, elasticity of supply for raw sardines, and input demand elasticities for raw sardines, and other inputs (e.g. capital, energy, labor, etc.). Estimating these elasticities is surely beyond the scope of the current analysis. However to link the analysis of alternatives explicitly to a long run version of producer

surplus, "fixed" inputs described in the Survey Methodology should be included in the analysis and results. In particular, additional tables showing estimated total (or average) annual expenditures on fixed inputs for the three geographical regions would be helpful.

3. Some aspects of the data collection methodology and analytical framework used for economic analysis are still unclear. While the Survey Methodology document is very helpful in this regard, details about the particular information collection protocol used with processors, and underlying assumptions in the market equilibrium model used in the analysis of alternatives, should be further clarified and explained.

Recommendations Beyond June 2005

Many issues associated with analysis of long run producer surplus could be addressed using a computable economic model. For analyses that focus on economic efficiency, a priority for future work should be the development of a computable economic, or bioeconomic, model (partial equilibrium) for the Pacific sardine industry to evaluate effects of various policy alternatives on producer and consumer surplus.