PACIFIC OCEAN PERCH

STAR Panel Meeting Report

Alaska Fisheries Science Center
Seattle, Washington
June 12-16, 2000

STAR Panel Members
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Overview

The STAR panel (Panel) reviewed this assessment of Pacific ocean perch (POP) at Seattle, WA on June 12-16, 2000. The assessment used here continues with the same assessment model as used in 1998 and incorporates updates to survey and fishery data. The assessment region covers the Columbia and Vancouver INPFC areas ranging from southern Oregon to the US-Canada border. The methods and results are clearly presented in the assessment document. The Panel commends the stock assessment team for their work, and on their cooperation in conducting additional analyses and revisions in response to this review.

Major sources of information include:
1. Landed catch, as recorded by comprehensive catch landing receipts and historical data from foreign and domestic fisheries
2. Age composition of landed catch.
3. Trawl survey conducted triennially in the 30-200 fathom depth range provides the primary index of abundance used to tune the trend in the assessment model. Additional tuning data include a trawl survey targeted on POP in early 1980s, and a logbook CPUE index during the early years with a target fishery.

A major difference between this assessment and its predecessor is related to the degree to which prior information is used to constrain estimates of catchability (**q**) for the triennial trawl survey. Over the past several years, this trawl survey has not exhibited a marked increase or decrease and assessment models have progressively relaxed the constraint (prior) on values for **q**. The current assessment indicates that **q** is lower than previously estimated and population biomass is greater than estimated in past assessments. The overall conclusion is that the stock is relatively stable at a low level of abundance. The assessment model explicitly includes estimation of MSY and the biomass level that would produce MSY. The Panel judges these estimates to be sufficiently reliable to replace proxies based on spawner per recruit calculations.

List of Analyses Requested by the STAR Panel:

The 1998 survey biomass value was incorrectly input to the model in the draft results and report. *This was corrected during the meeting and in the final draft report.*

The best model fit without a prior on survey catchability (**q**) indicated that was **q** was less than 0.1, which was considered to be unrealistically low by the STAT Team, but informative prior distributions on **q** were considered too constraining by the Panel. *The STAT produced results based on alternative prior distributions and calculated profiles over a range of values for q to determine the model components that were influencing the estimates of **q**.*

The estimate of **q** was substantially less than that from the 1998 assessment (**q**=0.4). As a result, 1998 biomass was estimated as 18,000 mt from the 1998 assessment and 30,000 mt in the 2000 assessment. *At the request of the Panel, the STAT conducted retrospective analyses with the*

current assessment model: 1) removing 1998 survey data and 1997-1999 fishery size composition, and 2) removing the 1995-1998 survey data and 1994-1999 fishery size composition.

The decision to propose a B_{MSY}-based rebuilding threshold as a replacement for the current B_0-based threshold depends on the reliability of the stock-recruit relationship. *At the request of the Panel, the STAT included a prior on steepness based upon the posterior probability of steepness for generic rockfish from the rockfish meta-analysis, and conducted a sensitivity analysis on Beverton-Holt versus Ricker spawner-recruitment curves.*

The draft assessment report assumed age at 50% maturity was 10 years, but a more appropriate published estimate is 8 years. *The Panel requested that the maturity schedule assumed in the model be revised according to 50% maturity at age-eight.*

The draft assessment report assumed 511 mt catch in 2000 based on the recent average catch. However, the Panel concluded that catches of less than 300 mt are expected, because optimum yield in 2000 was specified as 270 mt. *Appropriate revisions were made.*

Comments on Technical Merits:

1) MATURITY - Estimated maturity at age was revised in the draft 2000 assessment based on published histological observations from Alaska (age at 50% maturity was estimated to be 10 years). The maturity schedule in the 1998 assessment was based on visual examinations, which indicated an age at 50% maturity of seven years, but visual maturity determinations are easily biased. The British Columbia assessment also assumes an age at 50% maturity of seven years. The Panel concluded that the best estimates of maturity are from estimates published from examinations during the spawning season in the stock area that indicate an age at 50% maturity of eight years. The Panel noted that the estimated selectivity indicates that Pacific ocean perch are fully selected to the fishery near age 10, so revising the assumed maturity schedule may have a considerable influence on reference point estimates.

2) STOCK BOUNDARIES - The Panel noted that POP fishery and survey catches are continuously distributed across the U.S./Canada boundary. The current assessment considers only the U.S. resource, and does not include Canadian data.

3) GROWTH - Contrary to the patterns in size at age reported for yellowtail rockfish, there is no indication of decreased size at age for POP. However, there is little current information available to detect a change.

4) CATCH DATA - The Panel thought that a description of the historical development of the fishery was important for evaluating B_{MSY} proxies. In summary, there was a substantial fishery targeting Pacific ocean perch during the early 1940s, then approximately 15 years of negligible catch before the large foreign fishery developed. The proportion of POP in foreign red rockfish catch was discussed. The assessment assumes that nearly all foreign red rockfish catch was POP.

There is a great deal of uncertainty in the Soviet catch reports and little information to assume species composition during early assessments. It was recommended that a careful re-review of 20 year old summaries of species composition in foreign catch be conducted so that an agreed best estimate can be published for use in POP and other species assessments. The Panel suggested that assuming approximately 90% of foreign red rockfish catch was POP may be consistent with assessments of other rockfish stocks. While it is important to get this feature of the assessment as accurate as possible, the 1998 assessment concluded that results were not sensitive to the assumed portion based on a sensitivity analysis that assumed only 50% of 1966-1968 foreign catch was POP (e.g., 1998 SSB was 44% of B_{MSY} assuming 100% POP in foreign catch and 47% B_{MSY} assuming 50% POP).

The Soviet exploratory fishing data from 1953 to 1978 has some potential to be processed into an index of POP distribution and abundance. The geographic coverage was somewhat inconsistent between years and the information has not been quantitatively included in the assessment, but the data are consistent with a substantial decrease in stock biomass in late 1960s, as indexed by the domestic CPUE series. The data may also have valuable information on rockfish species composition during that period.

5) HISTORICAL RECRUITMENT PATTERN - The 1951 or 1952 cohort was outstanding in the Canadian assessment of POP, but it appears that the same recruitment pulse was interpreted by the U.S. assessment as the 1956 yearclass. This occurs primarily because the U.S. assessment can't distinguish detailed recruitment patterns during the early years because early age composition data was based on surface age determinations, rather than the more reliable break-and-burn determinations used in later US data and the Canadian assessment. Because of the bias in the surface ages, early US age data were truncated at age 15 years causing the blurring of the recruitments prior to the 1956 yearclass. Subsequently, the 1970 yearclass was dominant in the catch at age and produced a relatively strong estimate of recruitment (age-3 in 1973), but the cohort was still small compared to historical recruitment estimates.

6) SURVEY CATCHABILITY - Most Panel discussion focused on estimation of the survey catchability (**q**) and the role of prior distributions in constraining the value of **q** in this and past assessments of POP. This is an important issue because low **q** values produce population biomass estimates that are several-fold greater than the swept-area biomass estimates produced by direct survey analysis. As the assessment has developed over time, prior constraints on **q** have been relaxed. For example, in assessments from the early 1990s, the **q** for the POP slope trawl survey was assumed to be 1.0 and the **q** for the triennial trawl survey was estimated. Preliminary model runs in the current assessment had triennial survey **q** near the lower limit (<0.2) of an informative prior distribution (i.e., a prior distribution with a narrow range and sharper peak), to be near 0.1 with no prior, and to be 0.18 with a vague prior (i.e.,. a prior distribution with a higher variance than the informative prior). These estimates of **q** are substantially less than the estimate from the 1998 assessment, in which estimated **q** to be near the lower limit(0.4) of the prior used in that assessment. Retrospective analyses indicated that the revised estimate of **q** in the 2000 assessment primarily results from this change in model

formulation rather than retrospective inconsistency (**q** = 0.20 from the 1998 and 1995 retrospective analyses). The likelihood components that were most improved with low estimates of **q** were the stock-recruit function, recruitment variability, and survey biomass likelihood components. Results were sensitive to the prior on **q**: 2000 SSB was 69% of B_{MSY} with the less informative prior and 46% of B_{MSY} with the informative prior, and projected harvests at $F_{50\%}$ or F_{MSY} are substantially lower with the informative prior. The STAT Team considered values below 0.2 to be unrealistically low, and noted that low **q** produced a high steepness parameter (**h**) for the spawner-recruitment relationship. Unfortunately, **q** for the same survey of the Alaskan stock of Pacific ocean perch is not well estimated and lends no guidance on **q**. There was equivocal advice and differences of opinion within the Panel on the realism of such low values for **q**. The Panel concluded that the informative priors were not defendable, because the resulting estimate of **q** was the lowest allowable with the informative prior, the prior likelihood of the value estimated by the 1998 assessment (**q** = 0.4) was less than the prior likelihood of unrealistically large values (e.g., 1.5) in that assessment, and the estimates of spawner-recruitment steepness (**h** = 0.6) from the less informative prior is consistent with the rockfish productivity meta-analysis.

7) - SPAWNER-RECRUITMENT - Two distinct model types were provided in the draft assessment. One was an age-structured model with no underlying estimate of productivity, and the other was an age-structured production model in which annual estimates of recruitment were constrained by their deviation from a spawner-recruitment relationship which was simultaneously estimated by the model. The Panel concluded that including the stochastic production function was the best model scenario, because it allows estimation of reference points that are based on uncertainty in the spawner-recruitment relationship, not just on point estimates.

Analyses were presented that compared spawner per recruit (SPR) approaches to approximating B_{MSY} and age-based production modeling. Results showed that SPR proxies of B_{MSY} may be badly biased if a positive slope exists in the spawner-recruitment relationship.

SPR proxies for B_{MSY} are also very sensitive to the period used to derive mean recruitment. For example, using the entire series of recruitment from the POP assessment produces a virgin biomass (B_0) that is greater than any biomass ever observed. The Panel concluded that estimating B_0 and B_{MSY} from an age-based production model is more appropriate than a SPR-based proxy if the expectation of strong recruitment increases at higher stock sizes.

For POP, the Panel endorsed estimation of the steepness of the spawner-recruitment relationship, but there are several factors which influence the precision of the estimated steepness. One technical factor is that constraining recruitment deviations relative to the long-term mean recruitment versus constraining recruitments relative to an estimated spawner-recruitment curve could lead to a model result that has less long-term trend in recruitment, but sensitivity analysis presented to the Panel indicated that this was not occurring in the POP assessment. Another technical factor is that the definition of steepness (i.e., the proportion of R_0 expected at 20% of B_0) is arbitrary but possibly influential with a flat prior on steepness. Initial

POP assessment results included no prior on steepness and concern arose that the probability distribution of results included an unreasonably high proportion with steepness near 1.0. The Panel recommended a prior on steepness based on the posterior probability of steepness from the rockfish meta-analysis. The posterior probability of steepness for POP itself from the rockfish meta-analysis would not be appropriate, because it was based on the estimate of survey **q** from the 1998 assessment. Results from the analysis with this steepness prior were similar, but had a more precise estimate of steepness. Finally, there is a possibility that some of the apparent curvature in the POP spawner-recruitment relationship is actually a result of only obtaining recruitment estimates from low spawner biomass during a period of poor ocean climate conditions. In summary, despite the above caveats, the Panel concluded that the evidence for increased probability of strong recruitment from large stock sizes was convincing enough to endorse MSY-based targets as a replacement for SPR-based proxies.

Subsequent to the Panel meeting, model runs were conducted using a Ricker spawner-recruitment function rather than the Beverton-Holt function used in the baseline model. This was done at the request of the Panel in order to explore the sensitivity of model results to the form of the function. The resulting estimates of MSY and biomass level that would produce MSY are about 25% greater with the Ricker curve than with the B-H curve, however the short-term harvest would be slightly less under under the Ricker model. This indicates that the medium-term forecasts (including rebuilding schedules) for this stock are sensitive to the assumed form of the recruitment function, so any such forecasts should be accompanied with appropriate caveats of uncertainty.

The Panel discussed the appropriate way to express uncertainty in stock status determinations. For example, the estimate of 2000 SSB is 69% of B_{MSY} and 57% of the current target biomass (40% of B_0), but there is a considerable probability that it is less than 50% of B_{MSY}. The precise probability is conditional on the estimated steepness. The uncertainty is increased further when issues of model formulation (such as which spawner-recruitment function is used) are considered. In all cases, further rebuilding is necessary to return POP biomass to the B_{MSY} level. The Panel defers to the SSC for further consideration of the role of this updated stock assessment in tracking the rebuilding of POP.

Areas of Disagreement:

All potential areas of disagreement were resolved, and the Panel reached consensus for all conclusions.

Unresolved Problems and Major Uncertainties:

In general, the Panel concluded that the wide variance in parameter estimates (e.g., 45% CV on 2001 SSB) and sensitivity to modeling assumptions (e.g., the difference between results from alternative model scenarios) are to be expected with low sampling intensity and low frequency of surveys.

Recommendations for Future Research:

1. The accuracy and precision of stock status evaluations would be increased if more resources were devoted to data collection. For example, the assessment would improve if the 1995 survey ages were processed, discard rate was monitored, age composition of catch was sampled, and frequency of surveys were increased.

2. Investigate methods to estimate the proportion of POP in historical foreign red rockfish catch, including analysis of Soviet exploratory fishing data and domestic trawl fishery species composition data from the same era. Consider the technical merits of developing estimates that are consistent with other rockfish estimates. Information from the Soviet cruises should also be examined for consideration as an index of relative stock size.

3. The technical merits and feasibility of assessing the resource as a trans-boundary stock should be considered.

4. Evaluate the advantages and sensitivities of general model features. One is exploration of methods for constraining recruitment estimates and including spawner-recruitment relationships. Another is use of constant fishery selectivity, versus changes in selectivity indexed to known events such as mesh size changes, versus constrained time-varying fishery selectivity. Investigation and guidance on these two issues would be useful for all assessments that use similar models.