SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON 2011 SALMON METHODOLOGY REVIEW

The Salmon Subcommittee of the Scientific and Statistical Committee (SS-SSC), the Salmon Technical Team (STT), and the Model Evaluation Workgroup (MEW) met at the Council office in Portland on October 4 and 5, 2011, to review the four salmon methodology issues identified by the Council at the September meeting:

- Abundance-based management framework for Lower Columbia River (LCR) tule fall Chinook,
- Cohort reconstruction and harvest impact model for Sacramento winter run Chinook,
- Examination of the potential bias in Coho Fishery Regulation Assessment Model (FRAM) from mark-selective fisheries, and
- Review and evaluation of preseason and postseason mark-selective fisheries north and south of Cape Falcon.

Abundance-based management framework for Lower Columbia River tule fall Chinook

Mr. Ray Beamesderfer presented the work of the Tule Chinook Work Group (TCW) on evaluating the relative risk and relative change in fishing opportunities presented by alternative abundance-based management (ABM) approaches (Agenda Item C.1.a Attachment 1). ABM could provide more protection for weak runs, and more fishing opportunity on large runs.

The model was similar to the one used to evaluate Klamath River Fall Chinook *de minimis* fisheries which has been reviewed by the SSC. Data are limited for LCR wild tule Chinook (LRN) so LCR hatchery tule Chinook (LRH) were used as a proxy for predicting the status of the stocks. The Population Viability Model developed included both hatchery and natural stocks in a single model. Results are dependent on the current mix of hatchery and natural stocks.

The model evaluated conservation risk and harvest benefits under a variety of ABM scenarios. Conservation risk was expressed as the probability of natural stocks falling below a critical threshold in 20 and 100 years. Harvest benefit was expressed as change in average harvest numbers over 100 years. "Win/win" scenarios with reduced risk and increased benefits were recommended for further consideration. Consecutive years of restricted fishing are especially damaging to the viability of fisheries. The SSC recommends evaluating the probability of multi-year closures and the median length of closures as additional criteria for comparing scenarios.

The analysis assumes that hatchery production remains constant. If hatchery production changes, then the tier structure will need to be reevaluated. Furthermore, tier frequency of occurrence is modeled on recent past environmental conditions but will be dependent on patterns of future environmental conditions and may not match model expectations in the near future. The SSC considers the methods to be reasonable for addressing the relative risks and benefits. With the addition of a closure analysis, the results will give insights into social and economic effects and be adequate for setting harvest policy.

Cohort reconstruction and harvest impact model for Sacramento winter run Chinook

Dr. Mike O'Farrell (STT) gave presentations on the cohort reconstruction for Sacramento winter run Chinook (Agenda Item C.1.a Attachment 2) and the harvest impact model developed for Sacramento winter run Chinook (Agenda Item C.1.a Attachment 3).

Cohort reconstructions were performed for ten broods (1998–2007) of hatchery-origin Sacramento winter run Chinook (SRWC) using coded-wire tag data. The results of the cohort reconstruction indicated that the majority of ocean fishery impacts came from recreational fisheries south of Point Arena, California. For complete broods 1998–2005, the number of potential SRWC spawners was reduced by an estimated 11 to 28 percent due to ocean salmon fisheries. In the future, consideration of genetic stock identification (GSI) data may help to more closely define the distribution of SRWC in the area south of Point Arena.

The winter run cohort reconstruction was reviewed by the Center for Independent Experts (CIE) in March 2010 and its comments were incorporated into the analyses presented for Council review. The SSC considers this cohort reconstruction to provide the best available estimates of:

a) past SRWC fishery impacts, by time and area, and
b) parameters needed for the winter run Chinook harvest impact model.

The Winter Run Ocean Harvest Model (WRHM) is similar to the Klamath Ocean Harvest Model (KOHM) and Sacramento River Harvest Model (SHM) have been previously reviewed by the SSC and STT and approved for Council use. The three ocean harvest models treat age structure differently. The KOHM is fully age-structured, the SHM combines all ages and is not age structured, and the WRHM models only age 3 fish. A size-at-age model is incorporated into both the KOHM and WRHM in order to forecast release mortality incurred by sublegal size fish. In contrast to the KOHM and SHM, the WRHM does not account for in-river fisheries, as winter run Chinook are rarely harvested in the Sacramento River.

The SSC considers the WRHM a significant improvement in the Council's ability to model and project harvest impacts on Sacramento winter run Chinook, and endorses the model for Council use. The SSC compliments the authors for providing thorough and comprehensive documents, which greatly facilitated the review process.

Examination of the potential bias in Coho FRAM from mark-selective fisheries

Mr. Robert Conrad and Ms. Angelika Hagen-Breaux presented an evaluation of the bias in Coho FRAM estimates of the mortalities for unmarked stocks when mark-selective fisheries operate during a FRAM time step (Agenda Item C.1.a Attachment 4). This has been a difficult issue because the calculations needed to make a rigorous bias adjustment cannot be implemented in the current FRAM. The authors have developed and tested an alternative method to estimate the bias within the FRAM framework.

The analysis compared stock-specific fishery exploitation rates (ER) for unmarked stocks using the standard FRAM to bias-corrected estimates calculated from FRAM output for the years 2009

and 2010. The average differences by which FRAM underestimated the total exploitation rate for unmarked stocks were very low: -0.003 in 2009 and -0.002 in 2010.

In the standard FRAM model, the bias increases with the number and intensity of mark-selective fisheries. Bias in this analysis was low because mark-selective coho fisheries in 2009 and 2010 tended to be relatively low in intensity and concentrated in earlier time periods. In the final time step fisheries are typically more intensive and non-selective. The nature of the FRAM model is to overestimate unmarked mortalities in these terminal fisheries, partially balancing the underestimation of mortalities in earlier mark-selective fisheries. As long as the pattern of fisheries is similar to those in 2009 and 2010, overall bias in the FRAM model is expected to be low.

Although bias was generally low, accounting for bias could be important for stocks that are managed for exploitation rate guidelines. Without bias correction, ER guidelines could be exceeded. This appeared to be a risk for Fraser River Coho and Lower Columbia River Coho. The differences between the FRAM and bias-corrected ERs in time step 4 (September) were large enough so that these stocks may have exceeded ER guidelines due to lack of bias accounting.

The current testing excluded several significant sources of mortality including catch non-retention (e.g., coho mortality in Chinook fisheries), drop-off mortality, and mark recognition errors. For this reason the total mortality rates reported in these analyses are generally lower than rates that were modeled by the STT. The bias correction results reported could not be compared with more analytically rigorous bias estimates. However, the degree of bias is consistent with the theoretical modeling that the SSC reviewed in 2010.

The SSC recommends that the proposed bias-correction methods be implemented and tested in FRAM. Testing should include code evaluation and verification of results under a variety of fisheries scenarios and with the full set of mortality factors. This implementation should be available for methodology review in 2012 prior to adoption for use in 2013 fisheries modeling. For 2012 fisheries modeling, the SSC recommends continuing to use their interim guidance, including a pre-season evaluation of impacts. The Council may choose to include a precautionary buffer for stocks with exploitation rate guidelines.

<u>Review and evaluation of preseason and postseason mark-selective fisheries north and south of Cape Falcon</u>

Dr. Robert Kope (STT) presented an evaluation of causes and effects of bias in anticipated mark rates in the ocean recreational mark-selective fisheries for coho salmon in 2000 – 2010 (Agenda Item C.1.a Attachment 5). More unmarked fish are typically encountered per marked fish landed in the ocean mark-selective fisheries than expected pre-season, raising the concern that more unmarked fish may be killed as a result of incidental mortality than is projected pre-season.

Bias was apparent in the expected mark rates, and varied by year and by management area. Several possible causes of the bias were investigated, including: over-predicting marked hatchery fish abundance; under-predicting unmarked fish abundance; and a differentially lower survival of

marked fish relative to that of unmarked fish. The report concluded that under-predicting natural coho abundance was the most likely cause of much of the observed bias in expected mark rates. The report also noted that post-season estimates of incidental mortalities due to the release of coho in mark-selective fisheries have been less on average than predicted pre-season because mark-selective fisheries generally have not landed their pre-season expected catch or quota. The SSC notes that mark recognition errors and incorrectly reported hatchery mark rates could also contribute to the bias.

The SSC recommends that this issue continue to be examined.

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