Pacific Salmon Commission

600 - 1155 Robson Street
Vancouver, B.C.
V6E 1B5
(604)684-8081
(604)666-8707 (fax)

To: Mike Lapointe

From: Jim Cave

Date: Wednesday, Apr 11, 2007

Re: Further review of the consequences of reduced test fishing as a result of the Laroque Decision.

During the telephone conference call, the Panel and the Technical Committee asked for a more explicit consideration of the consequences of dropping particular test fisheries. I'm still not quite certain all that is being requested, but here I attempt to provide a more explicit description of the main issues as I see them. Note that as some of these requests have come from the technical people on the FRPTC, some of the technical detail is important to include.

Dropping Area 13.

One of the options raised during the discussions with the Test Fishing Working Group was to drop one of the purse seine test fisheries in Johnstone Strait. As the Area 13 test fishery is closer to the river, members felt that test fishery could be dropped. The C/Set data from these test fisheries are used to project abundance of sockeye in the marine areas. They provide data seaward of Mission for the stock groups. As a consequence of this, we project the sockeye abundance entering the river, and also to assist in developing estimates of timing and run-size for Panel Management. For the most part the lagged estimates of abundance from each of the two sites are averaged if there are no significant fisheries in between the sites. By removing one of the test fisheries, there will be no opportunity to average the estimates, and as a consequence the variance in the estimate will increase. The variance P of the Bayes most probable estimate of log abundance $\log N_j$ is,

$$P = 1/\left(\sum_{alldata} 1/Vi\right). \qquad (1)\ \text{(Scandol et al 1995 MS)}$$

If for example, we have two highly uncertain test fishing estimates (variance = 1 in each case) this equation gives,

$P = 1/(1+1) = 0.5$

If we only have one of these test fishing estimates, we have,

$P = 1/(1) = 1$

This variance and the estimate log N_j can then be used to provide an approximate Bayes posterior probability distribution for N using the log-normal density function:

$$p(N)=(1/\sqrt{2\Pi P})\ \exp\ [-.5(\log N/Nj)^2/P]/N \qquad (2)\ \text{(Scandol et al 1995 MS)}$$

Here the log-normal form arises from assuming that (1) daily abundance estimates made during the season are log-normally distributed. The take home message from this analysis is that

the addition of another test fishery (from one to two) results in a drop by 50% in the estimate of variance. This is particularly important if the day-day variances in a test fishery are auto-correlated. That provides a huge improvement in the prediction intervals in the estimates of run-size (Figure 1).

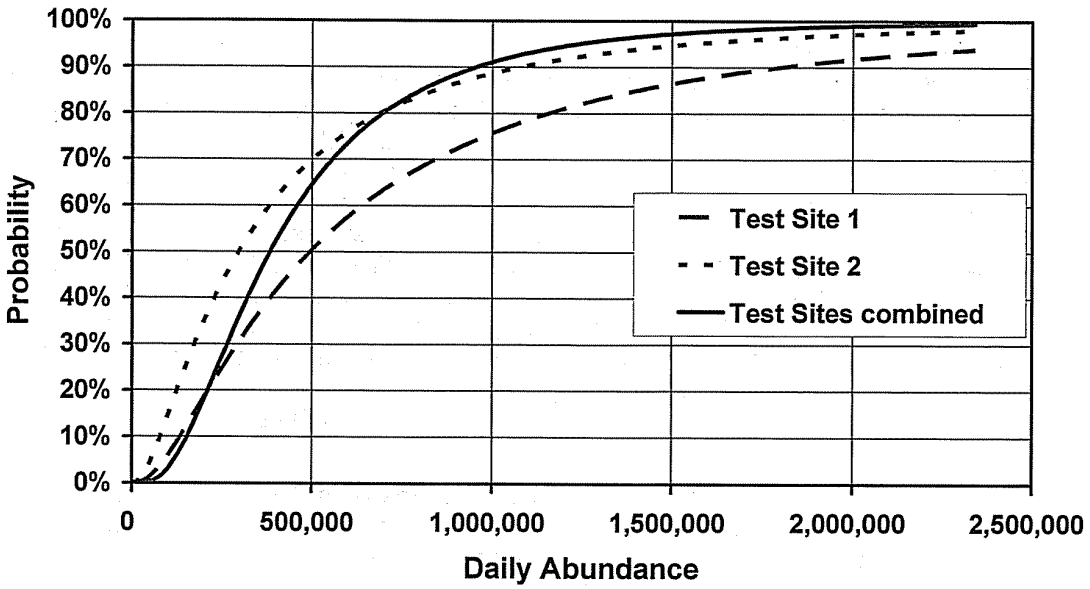

Figure 1. Cumulative Bayes posterior curves (derived from equation 2 above) are shown for an in-season application of two different estimates from theoretical test fisheries of high variance (V_i = 1) with two different estimates of daily abundance on day t of 500,000 (test fishery 1) and 300,000 (test fishery 2) and the combined Bayes estimate (387,000). The steep trajectory for the two sites combined is due to the lower overall variance P (=0.5). Note that the Bayes estimate is not simply the average of the two individual estimates (which would be 400,000) but is in this case the average of natural logs of the estimates and then retransforming back to arithmetical space.

Drop one of the River Test Fisheries.

Staff have resisted as raising this as an option, however, it continues to come up as a possible cost savings measure. Because of the dependence of the Mission estimates on species composition, we would have to consider dropping the Cottonwood test fishery. Most of the jeopardy pertains to stock identification. The Cottonwood test net is a "specialist net" of multiple panels with different mesh sizes. The attempt was to build a net that is as non-selective as possible within the sockeye size range. The Whonnock net however was designed with a goal towards non-selective information on species composition. So the three main consequences if we drop Cottonwood are: 1) possible bias in stock composition estimates due to size selectivity in the Whonnock test net in the sockeye size range; 2) low sample size for DNA stock ID (if we relied only on Whonnock in 2006 our average daily sample sizes for stock ID would have been reduced by over 60%); 3) lack of additional information for species composition. While at times stock ID estimates from marine test fishing can be applied to the river estimates of abundance, this becomes more difficult if some portion of the stocks delay. Given the importance of the river test fisheries for stock ID in the lower river, particularly for the assessment of late run impacts and the

early upstream migration of late runs, the decision to keep Cottonwood should be an easy one for the Panel to make.

Schedule of Seine Test Fishing.

Reasonable savings could be made if seine test fishing is reduced or eliminated in July. In the past several years sockeye abundance in Johnstone Straits has not developed until August. If there is a need for information, the Area 12 seine test fishery should be started first, and only if there is a strong signal to do so from the Round Island Gillnet test fishery. Also, from a technical standpoint there is no basis to link the amount of test fishing time in Area 12 with Area 13. As noted above, the most pressing requirement is for seine test fishing in both Areas during August. However, in 2005, at the end of the season, we used purse seine test fishing to provide final estimates of species composition at Mission, as river test fishing estimates of species composition were clearly biased high towards sockeye. 27% of the sockeye escapement, timed to the marine area test fisheries occurred in September. The potential dilemma in 2007 is brought about by: 1) bias in the estimates of species composition from the river test fisheries and 2) the inadequacy of using river test fishing to index abundance using the traditional method of applying a expansion factor (historical or in-season derived) to project late season abundance of sockeye. This second point is due to the intense predation activity by seals in the vicinity of the test fishing sites. The seine test fisheries in September would provide flexibility to use this option to provide for estimates of species composition.

The reduction in seine test fishing in Area 12 and Area 20 in September will result in severely increased uncertainty in late-run abundance because of somewhat limited feedback in the abundance of late-runs from the estimates of escapement at Mission if these stock delay to some extent. This would be compounded if reliable estimates of species composition are unavailable from river test fisheries in September.

Implications of reduced frequency of test fishing

A small reduction in frequency (e.g. every other day instead of every day) would not reduce accuracy on average but would increase variability of run size estimates substantially due to less frequent sampling of the run. In any individual year, accuracy could be reduced if for example a few days of migration were associated with an extreme abundance level (e.g. large purse seine catch days in 2006). In addition, the information available for some Panel meetings would be less current. The Area 20 gillnet test fishermen are becoming concerned with reductions in income which has steadily eroded in recent years and they may reconsider their participation in the test fishery. In addition, there will be a perception issue with some of the participants in the industry that are used to daily information. With respect to Canada's proposal to fish every other day in for 5 day periods in July and September in Johnstone Strait purse seine, staff believe the information obtained from daily sampling in September is more valuable than the information obtained from every other day sampling in July. Gillnets can be used for July assessments, there is no alternative marine information that can be used for Late-run and species composition assessment in September. Thus the staff preferred option is to commence purse seine test fishing in August and continue for consecutive days in September rather than the alternate days in July and September. Though the total number of days test fishing is the same in each case, it is not clear to staff whether these options are revenue neutral as there may be added costs associated with the off days under the every other day option.

Scandol, J., C.J. Walters, J.D. Cave, M.F. Lapointe. 1995. MS. In-season stock assessment and tactics for reducing over-fishing risk in gauntlet fisheries for pacific salmon.