Northwest Fisheries Science Center Response to
Technical Issues Regarding the 2008 Pacific Hake Assessment raised in the
"Minority Report to the 2008 Pacific Hake STAR Panel Report" (Sinclair, et al.)

March 7, 2008

- **Characterization of stock status and trend**

In both the first and final paragraphs the Minority Report attempts to create the impression that the hake stock is in dire straits, e.g.: "the population biomass is declining and at its historic minimum, the exploitation rate is increasing and at its historic maximum, and there is no indication of good recruitment." However, both the SS2 and TINSS models indicate that spawning stock biomass is near the target (40% of the unfished level), and the SS2 point estimate for the size of 2005 year class is the second largest since 1984. In the VPA model, not only is the 2005 year class the second largest since 1984, but the 2003 year class is the third largest over that span. The population biomass is not at its historic minimum, according to either the VPA or SS2 formulations, for which biomass was lower in 1999 than in 2008. Further, the SS2 model estimates that the spawning biomass will increase over the next few years due to the recruitment of the 2005 year class.

- **Comments on data used in the assessment models**

Beginning in the second paragraph, and continuing through 'Point 1.' on the following page, the authors state that all three models used the same input data, with the exception of the ageing-error matrix used in SS2. In fact, there were significant additional differences in the use of data, including 1) the combination of length and age data outside of the VPA and TINSS models versus the inclusion of separate data series in SS2, 2) the use of year-specific weights assigned to sampled data in SS2 versus uniform weighting in the other models, 3) the combination of fishery data for the U.S. and Canadian fleets in both the TINSS and VPA models, 4) the use of an incomplete weight-at-age matrix as an input to the VPA and TINSS models, as opposed to the estimation of age- and year-specific growth in the SS2 model, and 5) differences in the error structure assumed for the survey time series between the SS2 and VPA/TINSS models, which dramatically alters the relative weight placed on early values in the time series.

- **Response to technical issues raised in the Minority Report regarding the SS2 model:**

  - "*The panel failed to recognize the clear evidence that the SS2 model did not reach global convergence (Figure 25 STAR report)*" Figure 25 of the STAR report shows that when the SS2 model was jittered from the final base model, smaller negative log likelihood values were not found. This is a common diagnostic to conclude global convergence. The fact that the negative log likelihood changes very little over a range of M-offset values implies a shallow likelihood surface, and that the data in the model are relatively uninformative regarding this parameter. The range of final M, which results in no more than a 1 point change in negative log likelihood (0.58-0.60), is not significant in terms of

- depletion or other parameters. In any case, the final MCMC model run integrates across the range of uncertainty in this parameter.

- "*The Panel did not question the clear technical flaw of the SS2 model indicated by a severely biased retrospective pattern.*" While not desirable, the SS2 model does show a retrospective pattern which indicates that some model parameters, such as survey
- catchability q, change as new data are added. This is illustrated in the figure below which shows estimates of acoustic survey catchability q and the size of the 1999 year class as functions of the terminal year of data included in the current model. In the case of q, this is not surprising, since the acoustic survey is assumed to be much more precise since 1992 and this provides only <u>4</u> reliable data points prior to 2002. The change in q obviously has an effect in the scaling of the population as shown by changes in the estimated strength of the 1999 year class. We believe that the retrospective trend in the estimated value of q reflects a survey time series that has only recently become adequate (in terms of duration, precision, and observed biomass variation) to allow management guidance to be based on models where q is estimated. This is, in fact, a principal reason why prior hake models adopted for management have relied upon fixing the value for q.
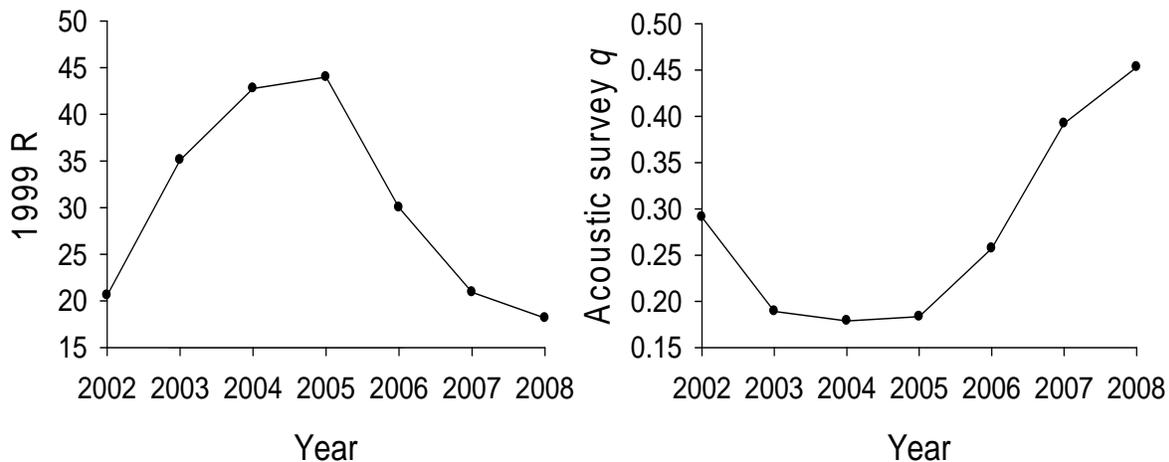
- **Final model estimates and range of Spawning Biomass and ABC**

Figure 1 of the Minority Report contains quantities that are not comparable and that differ from those required by the Council TOR. Further, the STAR panel report and draft versions of all three documents report quantities for a range of preliminary, intermediate and final model configurations. To facilitate a clear comparison of the final results reported to the Council for each model, Figure 1, below, illustrates values and confidence intervals for spawning biomass, depletion and 2008 OY amounts.
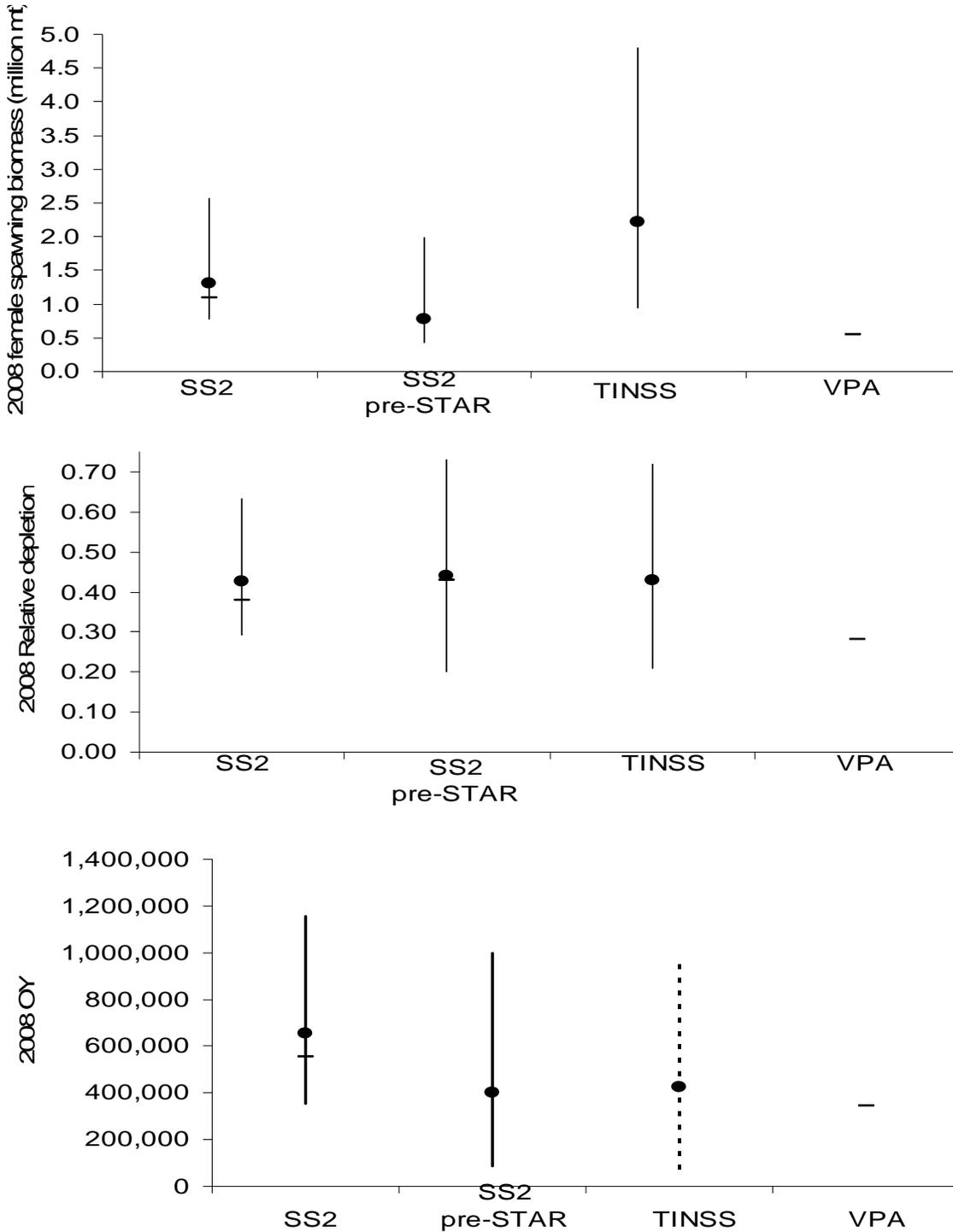
Figure 1. Comparison of 2008 female spawning biomass, relative depletion and OY (40:10 harvest control rule applied to F40% proxy harvest rate) maximum likelihood estimates (horizontal marks) posterior median values (circles) and 90% credibility intervals (vertical lines) for the three models. Note that the dashed credibility interval for TINSS is a 95% interval and uncertainty is not reported for VPA quantities.