



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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February 12, 2016

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Dear Mr. Painter and Mr. Poulsen:

Thank you for your letter dated February 2, 2016. We are pleased that you have raised your concerns directly to us. We hope that this response will alleviate the uncertainty you have regarding the Alaska Fisheries Science Center's commitment to providing sound and actionable science to the upcoming Crab Plan Team (CPT) and Scientific and Statistical Committee (SSC) meetings of the North Pacific Fishery Management Council. Our response has three parts: (1) a summary the CPT and SSC reviews of the snow crab model; (2) a description of AFSC's work-plan for addressing CPT and SSC comments and recommendations; and (3) our staffing plan for completing the snow crab assessment for the September 2016 CPT meeting.

Review of CPT and SSC requests:

In September 2015, Mr. Turnock presented six model scenarios:

- Model 0 – The assessment model forwarded from September 2014, but with the standard deviation parameter of the growth function set to 0.5. Growth was modeled with two linear segments connected at a differentiable (“smooth”) transition point.
- Model 1 – Same as Model 0, but (1) changing the survey logistic curves from estimating a size at 95% selected to an offset from the size at 50% selected; and (2) survey q for 1978–1981 and availability for the 2010 industry survey set as probit scales.
- Model 2 – Same as Model 1, but with the constant maturation probability removed and an increased weight on smoothing point for the female probability of maturing.
- Model 3 – Same as Model 2, but with the size-at-50% selected for female discard length changed from 4.2 to 4.4 (log scale) and the weight on growth likelihood increased from 2.0 to 3.0.
- Model 4 – Model 3, but with removal of the penalty on directed F mortality for male crab from 1992 to present (was on average F). F penalty for 1978-91 is on F deviations only.



- Model 5 – Model 4, but with the penalty on female fishing mortality from 1992-present removed, and using potlift data on males and females during 1992-present as an estimate of pre-1992 fishing mortality for female discards.

These six models were reviewed by the CPT in September and the SSC in October and several issues were identified that needed to be addressed before accepting alternative models. A list of CPT and SSC comments related specifically to requests for exploratory model runs is attached to the end of this letter. In response to the CPT and SSC comments, the stock assessment author presented the following information at the January CPT meeting:

- An incremental exploration of the influence of new data on model outcome.
- An exploration of different weighting on the trawl likelihood. A model run in which the weight for trawl bycatch likelihood was multiplied by four was presented to address a concern about the poor fit to trawl bycatch data.
- An exploration of alternative weights on trawl discard.
- The author compiled the commercial fishery CPUE.

In addition, the assessment author made a presentation to the CPT and discussed the issues with the snow crab assessment where the concerns raised in the September 2015 meeting were discussed. The author identified 18 model permutations that could be used if the CPT wanted to step through every incremental change from Model 0 to Model 4.

The CPT discussed the snow crab assessment and made recommendations for the May 2016 meeting. These recommendations are already in the CPT minutes that were made available to the public at the February council meeting in Portland (attached). The CPT noted that it “*does not think it will be necessary to provide results for each of the 18 models to get a good understanding of how model changes affect results*”. They provided several options for consolidation of results. Therefore, at this time we are not certain which specific runs, or grouping of runs, will be presented at the CPT meeting in May because some consolidation may occur depending on results of sequential runs. The CPTs specific requests for model explorations in addition to those identified in September include the following:

- Explore using a log-normal likelihood rather than a normal likelihood for trawl bycatch.
- Express likelihood weights as CVs rather than arbitrary weights.
- Compare population estimates used in the assessment with those provided directly by the survey group at NMFS Kodiak laboratory.

Strategy for model explorations for May CPT meeting:

As noted in our response to your letter last fall, AFSC is committed to improving our own internal oversight. AFSC is fully aware of all the issues raised by the CPT and SSC and the associated impact that uncertainty in this data-rich assessment imposes on the Annual Catch Limit. In response to January CPT meeting, the Mr. Turnock has prioritized model changes and has developed a work plan to accommodate as many of the remaining CPT and SSC requests as possible. This work-plan has been reviewed by leadership and AFSC agrees that it is a sound approach. Specifically, Mr. Turnock has obtained a sub-routine for implementing “jitter” runs within the snow crab model from Dr. Stockhausen. Jitter runs allow the author to explore the convergence properties of the model and this inclusion should alleviate CPT concerns regarding the initial step to Model 1. Once this is completed he will sequentially address the issues

necessary to more fully explore the strengths and weaknesses of Models 2 – 5, with a specific goal of understanding of how Models 2-5 affect results. As noted by the CPT, the number of runs it takes to resolve all those issues cannot be determined at this time.

Consistent with this commitment, the assessment will undergo in-house review by one of our top stock assessment authors, Dr. Martin Dorn. Our work-plan includes an early delivery for draft results of April 8. This provides an extended period of review and revision prior to the delivery of the summary of model explorations to the CPT in the last week of April.

Staffing Plan for May – September 2016:

AFSC plans to establish a grant with Dr. Cody Szuwalski this spring. When such arrangements are finalized, Dr. Szuwalski would transition into being the lead author for the snow crab assessment for September 2016 on an interim basis until a permanent position can be announced and filled at the AFSC. We anticipate that he will begin work in April 2016 and attend the CPT meeting May 9-13. We have identified Dr. Szuwalski as a well-qualified candidate to assume lead authorship of the snow crab assessment due to his strong academic record and experience modeling crab. He received his Ph.D. from the School of Aquatic and Fisheries Sciences, at the University of Washington. His thesis focused on stock assessment of snow crab. Since that time Dr. Szuwalski has remained active in crab stock assessment and he served as lead author for the 2015 Pribilof Islands, red king crab assessment.

Sincerely,

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September CPT comments regarding exploration of alternative models for the 2016 assessment cycle:

1. *“Model 0 changed dramatically in this iteration – explore the convergence to a global minimum by starting at different parameter values.”*
2. *“The CPT requests that any steps between Models 0 and 1 be evaluated in individual model scenarios.”*
3. *“Provide both the potlift data and the protocol used to extrapolate post-1991 discard data to pre-1992 historical female discards.”*
4. *“Explore potential conflicts of trawl likelihood weighting (Model 2) with other data sources.”*
5. *“Explore the dramatic differences in sequential survey estimates and why the models do not split the difference between the last two survey years.”*
6. *“Models 4 and 5 use an F penalty vector that is not broken out over time; evaluate a vector broken over time.”*
7. *“Explore a scenario in which the weight of the trawl discard likelihood is increased.”*
8. *The CPT recommended that these changes to the extent possible be evaluated for the January 2016 CPT meeting in order to resolve outstanding issues prior to model review in May 2016.*

October SSC comments regarding exploration of alternative models for the 2016 assessment cycle.

1. *“The SSC requests that, as a matter of standard practice and as consistent with the Terms of Reference, last year’s accepted model, updated with new data, as well as associated ABC/OFL specifications, should be routinely brought forward each year. Doing so allows evaluation of the consequences of updating the model with new data without the complication of any model structure changes.”*
2. *“The SSC requests adding a table of commercial fishery CPUE to the annual stock assessment; considerations of fishery CPUE could be investigated to help reconcile data conflicts.”*
3. *“As a matter of standard practice, the SSC requests that a suite of alternative starting parameter values be employed to help assure that models converge to a global, not a local, minimum.” (Same as CPT 1)*
4. *“The SSC requests the reporting of additional model diagnostics, such as plots of retrospective patterns, plots of residuals from alternative model fits to survey biomass, and the like, as typically reported in other assessments.”*
5. *“The SSC requests a sensitivity analysis to determine the effect of down-weighting size composition data. An upcoming data-weighting workshop may provide some guidance about data weighting for this stock assessment.”*
6. *“The SSC requests that a model be brought forward in which q is free and not bound by an upper limit of one.”*
7. *The SSC strongly endorses the CPT request to review a thorough documentation of alternative snow crab models at the crab workshop and CPT meeting in January 2016.*