Center for Independent Experts (CIE) Independent Peer Review of the Eastern Bering Sea Tanner Crab Assessment Review, 9-11 June 2026

Peer Review Report

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Executive Summary and Summary of Findings[1]

1. The Tanner crab review was an opportunity to comment on ongoing Tanner crab issues and stock assessment research, but it was not a stock assessment review. An updated stock assessment was not available although the previous assessment was discussed.
2. The Terms of Reference include: 1) progress towards a new GMACS stock assessment model, 2) side-by-side (SBS) catchability and size selectivity experiments, 3) biological reference points, harvest control rules and ABC calculations, 4) potential use of a two-area assessment model, and 5) approaches to handling hybrid crabs (Tanner x snow crab) recently seen in the fishery.
3. *TOR-1*: Reviewers support the move to GMACS and expect it to be accepted in the next assessment as the primary model. Differences between GMACS and TCSAM02 seem well understood and the two models give similar results when the models are configured in a similar manner. Development and testing continue, as would be expected, and some suggestions for potential improvements were made at the meeting.
4. *TOR-2:* SBS catchability and size selectivity estimates for Tanner crab in the survey bottom trawl were plausible and the analysis was sound, although work is ongoing and suggestions for potential improvements were provided. The SBS selectivity pattern was logistic and similar, but not identical to patterns from the 2025 TCSAM02 and preliminary GMACS models. The best preliminary SBS catchability result was q=0.591 (based on Model 3 in a background paper). Estimates from the 2025 TCSAM02 and preliminary GMACS models were about q=0.46 (by eye, based on Figure 17 in "2026 Tanner Crab Assessment Considerations"). Considering uncertainty, these estimates are similar although the SBS results translate to a reduction in estimated biomass of large fully mature crabs by about 22%. These are preliminary, ignore variance and are likely to change as SBS and GMACS estimates are refined. The best way to reconcile any differences is to include SBS results as prior information for parameters in the new GMACS assessment model.
5. *TOR-3:* The current Federal biological reference point, harvest rule and overfishing definitions based on F35%, are inappropriate and perform poorly for Tanner crab. The biology of Tanner crab, regulations and fishing practices make reference points like F35%, inapplicable and overly aggressive.
6. *TOR-4: No* advantages to using a two-area model were identified.
7. *TOR-5:* There is no reason to take immediate action in the Tanner crab fishery to accommodate Tanner-snow crab hybrids. The "spawning biomass" for hybrid crabs is protected if Tanner and snow crab spawning biomass levels are maintained. Legal size hybrids in the Tanner crab fishery are currently counted against the Tanner crab quota. The hybrid contribution varies but is always low. Management at this level seems reasonable though perhaps unnecessary. If management becomes necessary, it should focus first on the snow crab fishery where hybrids are most common.
8. Nothing in this report is intended as criticism of the data, managers or scientists responsible for Tanner crab. Everyone I encountered was competent, hardworking and knowledgeable. Review discussions were open and frank. All question were readily answered. Data, particularly from the survey, seemed of good quality. The stock remains productive, despite problems with F35%, due to the care and diligence of the people involved.

[1] See Appendix 1: Bibliography of materials provided for review, Appendix 2: CIE Performance Work Statement (including Terms of Reference), and Appendix 3: Panel membership and participants at the review.

Summary of Role

The Center for Independent Experts (CIE) contracted me to help peer review recent efforts to improve stock assessments and management advice for Tanner crab. The review was held 9-11 June 2026, at the Alaska Fisheries Science Center (AFSC) office in Seattle, WA. The peer review was conducted according to the terms of reference (TOR) described in the Performance Work Statement (PWS) provided as Annex 1 to Appendix 2 of this report.

Meeting arrangements

1. The meeting was ably chaired by Cody Szuwalski (AFSC). The Technical Team (Team) was led by William Stockhausen (AFSC).
2. Participants interacted in a constructive and collegial manner. Discussions were frank, honest and respectful. The Team satisfied requests for additional information or analyses quickly. Significant progress was made on all topics.
3. The meeting was unlike other CIE reviews in my experience. The topics were ongoing research and potential technical approaches to dealing with current issues. There was no new or updated stock assessment to review although the 2025 assessment served as background information.
4. The meeting was modest in size with about a dozen attendees who seemed to be all either CIE, AFSC or Alaska Department of Fish and Game (ADFG) staff. The number and qualifications of the attendees seemed sufficient for the work at hand.
5. CIE reviews usually include a consensus summary report compiled by the meeting chair who is not a CIE reviewer. However, the chair elected not to prepare a summary for Tanner crab.
6. CIE reviewers are required to prepare independent reports, such as this one. The reports should address topics and question in the Terms of Reference or judged to be important based on discussions or Reviewer experience. Reviewers are not required to reach consensus. However, reviewers generally reached or approached consensus for Tanner crab.
7. There were two areas of potential improvement to the meeting arrangements (documents and TOR). Many documents (thousands of pages) were distributed before the meeting, but most seemed irrelevant (e.g., assessment, SAFE and other reports for crabs other than Tanner). Guidance identifying key reports came just a few days before the meeting, making timely preparations difficult. The file names for documents were not clear. There were duplicate and updated versions of some reports. The Team was obviously busy and may have required more administrative support. In any case, these issues resulted in wasted time and made reviewer preparations difficult.
8. *Comment on meeting organization*: We received two sets of TOR for Tanner crab that differed to some extent. One version was sent by NTVI in the Performance Work Statement (PWS), which is an annex to our consulting contracts. The meeting chair distributed the second by e-mail a few days prior to the meeting. I used the NTVI TOR for this report without comparing the two because it was part of my contract.

Background

9. Eastern Bering Sea Tanner crab are found primarily in federal waters. The Alaska Fisheries Science Center (AFSC) conducts an annual multispecies survey to monitor the stock and for use in stock assessments which are used in managing the fishery. Other management decisions and actions are delegated to Alaska

Department of Fish and Game who use the same survey and fishery data but make relatively little use of assessment model results or federal biological reference points in regulating harvest.

10. CIE reviewers were told that federal stock assessment results and the federal harvest control rule are typically ignored in Tanner crab harvest management because harvest management is delegated to the State of Alaska. The history and basis for this approach were not explained. However, knowledgeable persons at the meeting suggested it was reasonable under existing circumstances because harvest levels using the Federal control rule might be high enough to depress stock size and endanger fishing (the Alaska approach is less aggressive). This concern is apparently based on history of the stock and fishery although this information was not reviewed in detail at the meeting.
11. Managers and scientists expect to use a new model (Generalized Modeling for Alaskan Crab Stocks or GMACS) in the next assessment in place of the current Tanner crab stock assessment model (TCSAM02). The new model is already used for other crab stocks and the application to Tanner crab and testing have been underway for several years.
12. There is no apparent crisis in the Tanner crab fishery. The most remarkable event is the relatively high abundance of Tanner-snow crab hybrids in catches for both species and in the survey during 2024-2025. Most of the hybrid bycatch is in the snow crab fishery. Both snow crab and hybrids are generally too small to be legally retained or marketed with male Tanner crabs.

Findings, Conclusions and Recommendations Listed by TOR

TOR 1. Generalized Model for Assessing Crustaceans Stocks (GMACS): Comment on the pros and cons of transitioning from the status quo bespoke assessment to the GMACS framework. Are there any concerns with the GMACS framework that would preclude its adoption? If so, are there clear paths to addressing these concerns (and what are the paths)?

1. All the reviewers and attendees at the meeting support a move to GMACS and expect it to be accepted in the next assessment as the primary assessment model.
2. The new GMACS model is in final testing and development mode but is a clear improvement to the existing TCSAM02 stock assessment model, which has been used in Tanner crab assessments for many years. GMACS is inherently more flexible than TCSAM02 and should serve well as Tanner crab modeling approaches and data evolve. Moreover, it will be easier to improve GMACS to include new features, such as state-space modeling.
3. GMACS has the advantage of being used for other crab stocks with a wider range of users and available programming talent. Thus, it appears to have operational and efficiency advantages over TCSAM02.
4. GMACS was modified and tested in comparison to TCSAM02 prior to the review. Additional refinements are expected prior to the next assessment.
5. There are persistent problems with TCSAM02 in fitting survey trend and size composition data that also exist in GMACS. However, GMACS is a better platform for solving the problems and for making future assessment modeling progress.
6. There are a few remaining decisions to make for GMACS, but the assessment scientists and management team have a handful of good options and will easily make the decisions in good time as additional testing proceeds.

7. Suggestions from meeting discussions include: 1) Use the new estimate of survey catchability and selectivity from side-by-side experiments as priors in fitting GMACS. 2) Consider including state-space modeling capabilities in GMACS.
8. Lack of fit to the survey trend and size data is the most important issue in fitting the old model and GMACS. It might be useful to force the model to fit the trend using a large likelihood weight and identify where fit to other data or model component degrades. Areas with degraded fit indicate data conflict or some other problem in the model. The same analysis might be conducted by heavily weighting the size data.
9. It would be helpful to conduct a full likelihood profile analysis, possibly over the survey catchability parameter, to determine areas of agreement and disagreement in fit to all data and prior information. For example, do survey size and trend information conflict with each other and is the conflict responsible for lack of fit?
10. I was concerned about the long "spin up" and heavy reliance in the assessment model on historical catch data collected during 1949-1974, prior to the survey. Based on Figure 11 in the background paper "2026 Tanner Crab Assessment Considerations", male Tanner crab reach terminal molt and stop growing at about age 5-6 years. It should be possible to start the model in about 1969 and have the estimated population ready to match the first survey size composition in 1975. I do not see much benefit in including the earlier catch data, which are probably less accurate, given that Tanner crab have shown cyclic population dynamics. The long spin-up approach with historical catch data is common and more appropriate for long-lived fish that may have experienced a slow decline from their unfished virgin state. What is the effect of starting the model just a few years prior to the onset of the survey? Do perceptions about current and projected stock conditions change? Does fit to survey trend and size data improve?

TOR 2. Side-by-side selectivity: Are the methods presented for estimating the selectivity of the NMFS survey gear based on the side-by-side experiments scientifically sound? Are the resulting changes in the scale of the population when incorporating the side-by-side data into the assessment defensible and appropriate for providing management advice? If not, how would the reviewer approach the provision of management advice using assessment output that incorporates the selectivity experiment data?

1. The experiments addressed concerns that harvest calculations were too high because the catchability (fishing power) estimate for the survey net in the stock assessment model was too low. However, the issue at the root of the concerns is probably F35%, which overstates potential catch for Tanner crab (see below).
2. Our documents used the words selectivity and catchability interchangeably. The two terms are closely related, but the distinction is important. Selectivity is a measure of relative fishing power (scaled 0 to 1) that changes with crab size. Selectivity is zero for animals too small or large to be captured. Selectivity is scaled to one for fully selected size groups that are most readily captured.
3. Catchability refers to fishing power of the net for fully selected size groups in absolute terms (i.e., the probability of capture given the net contacts a fully selected crab). Catchability ranges from zero for useless nets to 1 for nets that capture all the fully selected fish in their path. "Catchability" or fishing power for an individual Tanner crab of specified size is selectivity at size times catchability of the net.
4. The methods used to estimate survey selectivity and catchability were sound and like approaches used elsewhere although the work is ongoing and suggestions were provided by AFSC (see below).
5. The best SBS survey selectivity estimates for use in converting survey catches to stock size were from Model 3 (0.329 at 75 mm CW for females and 0.591 at 140 mm CW for males). Estimates from a wide range of alternative statistical analyses models were similar. Size-selectivity increased with size in a logistic fashion as expected based on the size composition data.

6. Both the catchability and selectivity results were plausible for a large crab in bottom trawl gear, the analysis was sound but is likely to improve. The SBS selectivity pattern was logistic and similar, but not identical to patterns from the 2025 TCSAM02 and preliminary GMACS models.
7. The preliminary SBS catchability result for male Tanner crabs was q=0.591 (based on Model 3 in the SBS background paper). Estimates from the 2025 TCSAM02 and preliminary GMACS models for fully recruited males were about q=0.46 (by eye, based on Figure 17 in "2026 Tanner Crab Assessment Considerations"). Considering their mutual variance and uncertainty, the alternate estimates are similar. It would be useful to have reviewed the variances as well as the point estimates.
8. All other things equal and for the same catch of fully recruited male crabs, nets with higher fishing power (catchability =1) result in lower biomass estimates, while nets with lower fishing power (catchability < 1) result in higher biomass.
9. The difference in biomass estimated directly by scaling up a hypothetical survey datum of 1.0 for fully recruited Tanner crab would be 1/0.591=1.69 using the SBS catchability and 1/0.46=2.17 using the TCSAM02 or preliminary GMACS estimates. Thus, the SBS based biomass would be 1-1.69/2.17=22% lower. These results are preliminary, ignore variance and are likely to change as SBS and GMACS estimates are refined.
10. The best way to reconcile any differences in SBS and assessment model selectivity is to include SBS results as prior information for catchability and selectivity parameters in the new GMACS assessment model. In this way, information from the SBS experiments, survey trend and size composition data and commercial catch and size composition would all be used to estimate stock size more precisely.
11. There was an analysis of environmental effects on tow-level catchability and selectivity due to depth, sediment characteristics, temperature, and other variables. Unfortunately, the environmental predictors were correlated which interferes with interpretation of results. For example, it is difficult to determine if temperature or depth are better predictors of catchability and selectivity if temperature is correlated and changes with depth. It might be better to use uncorrelated principal components in modeling or use a principal components analysis to help identify the important groups of variables and then choose a predictor from each group of correlated variables.
12. The analysis of environmental effects on catchability and selectivity was useful and interesting. However, it may be difficult to use in predicting catchability and selectivity for the entire survey based on environmental data for each tow. I like the idea of using models with survey station as random effects to estimate the underlying average survey level catchability and selectivity parameters better.
13. The selectivity and catchability estimates could be used to estimate population abundance and size composition quickly and directly from survey data in years with no assessment or for smaller areas of interest but without a stock assessment model. This approach involves errors as large as the random errors in the survey data and does not use additional data that may be available. It might, however, be useful if managers decide to manage spatially or experiment with higher or lower harvest rates in small areas because stock size could be estimated without regional assessment models.
14. If questions about survey catchability and selectivity persist, depletion studies or optical surveys could be used to estimate selectivity and catchability by different means (see Hennen et al. 2012. ICES Journal of Marine Science 69: 240–249; Thorarinsdottir et al. 2010. ICES Journal of Marine Science 67: 345–354).

TOR 3. Reference points: Are F35%-based reference points appropriate for Tanner crab in light of terminal molt and the discrepancy between maturity and selection in the fishery? If not, can the reviewer provide more appropriate alternatives for reference points? Is morphometrically mature male biomass the appropriate metric for use in the harvest control rule?

1. Based on technical consideration described below, the current F35% harvest rule is not appropriate for Tanner crab, because it is too aggressive given Tanner crab biological and fishery characteristics. Knowledgeable

persons attending the review meeting seemed to agree based on historical and recent fisheries patterns that the current F35% harvest rule would lead to unsustainable catches.

2. Fortunately harvest management has been delegated to the state of Alaska which uses a conservative but complex set of approaches based on survey, catch data and assessment results to maintain lower and presumably safer catch levels. The alternative approaches are sometimes applied spatially while the Federal harvest rule applies to the entire stock.
3. F35% ignores males and focuses instead on average female lifetime reproductive opportunity aka "spawning biomass per recruit". It tries to ensure that females in a fished stock achieve 35% of the reproductive output they might expect in an unfished stock, on average. Thus, the F35% approach attempts to manage the fishery for male Tanner crab based on fishing effects that are close to zero on females, without considering any interactions that may exist between the two sexes.
4. F35% was originally developed by simulation analysis as a proxy for Fmsy in a "typical" finfish fishery. The simulations assumed an underlying spawner-recruit curve, both sexes are harvested and have the same growth curve and maturity rates, and that the fishery selectivity and maturity curves are similar. The last assumption is most important.
5. The key features of Tanner crab that make an F35% control rule untenable is that the catch consists of large males that enjoy the highest reproductive success. Sublegal size males are sometimes mature but not legal and not targeted by the fishery. Females are smaller and not allowed in landings.
6. Based on these Tanner crab characteristics and under the simplistic assumptions of the original F35% simulations, female Tanner crab are not affected by any level of fishing on males. Thus, F35% as calculated for finfish will be too high for Tanner crab, because females are completely protected and not expected to be harvested, even when fishing mortality for males is very high.
7. This problem with F35% for Tanner crab can't be remedied by adopting a higher (e.g., F40%) or lower (F10%) level target for spawning biomass per recruit because, ignoring bycatch mortality, females are effectively immune to fishing in the reference point calculation.
8. F35% as calculated in TCSAM02 and preliminary GMACS models is not infinite or as large as suggested in the above comments, because calculations in the assessment model are more realistic for Tanner crab than in the original simulations for finfish. In particular, the assessment models assume that females are bycatch in the directed male Tanner crab fishery and in fisheries for other species with some mortality. However, the F35% calculated will still be too high.
9. The current harvest control rule is used to identify overfishing and overfished stock status based on assumptions about F35% as a proxy for Fmsy. It is a poor choice in this regard as well because F35% does not approximate Fmsy for Tanner crab. Thus, a new set of reference points and overfishing definitions should be developed whether Alaska continues to manage Tanner crab harvest or not.
10. The problems with the F35% harvest control rule seem responsible for the widespread skepticism I encountered about the current reference point and harvest control rule. I imagine that the problem also has bearing on other topics in this review, including survey catchability and selectivity and potential two-area modeling.
11. Apart from the problems with F35%, there is a great deal of uncertainty about Tanner crab productivity. Survey and catch data for Tanner crab show a cyclic pattern with high male biomass and elevated catches followed by reductions in both female and male stock size. Potential explanations for the cyclic pattern include environmental forcing, sperm limitation when large males are not abundant, depletion due to fishing on dense crab concentrations, lack of adult mixing, poor reproductive success in small male, or some density dependent effect when stock size is high or low.
12. Potentially sustainable harvest ranges from recent catch since about 1980 based on state regulations to a level yet to be determined. At the lower end, managers face risk to the fishery (foregone yield) due to overly conservative management and at the upper end risk to the crab resource due to overfishing.

13. I do not think it is currently possible to estimate crab productivity, and I take both ends of the range, except the highest levels, seriously. All we really know is that the Tanner crab stock and fishery have remained productive and not collapsed in recent decades under current harvest management.
14. Scientists should formulate hypotheses and try to understand exactly what drives Tanner crab population dynamics and fishery productivity. I would focus on the possibility that fishing on large mature males interferes with reproduction, possibly because smaller mature males are not able to mate effectively. It would be interesting to protect more large male crabs from fishing.
15. It is easy to imagine interest in obtaining higher yields from the Tanner crab fishery. In comparison to other fisheries, the management procedures seem conservative. It might be useful to consider "adaptive management" approaches that evaluate hypotheses about higher productivity using fishing experiments. For example, fishing mortality might be increased in a small area to test stock resilience or decreased to zero to see if population dynamics cycles persist.
16. In any case, I recommend managers consider risks, proceed with caution, start at the current status-quo catch level and use management procedures (including new reference points and a new control rule), that are robust to the range of uncertainty and provide information about potential yield.
17. Ideally, the new reference point approach would be flexible and easy to adjust as experience and added information accumulate.
18. A simple "empirical" control rule might work well. Such procedures are available and used all over the world. A simple approach based on the survey was demonstrated by the Team lead at the review meeting (see comments below).
19. We discussed empirical control rules that might serve, at least on an interim basis. These harvest control rules would set OFL by increasing or decreasing catch around its long term median level based on trends in the most recent survey. In other words, OFL would be larger than median catch if the survey was "high" and vice versa. The Lead demonstrated one approach at the meeting in response to reviewer requests.
20. Empirical control rules can be based on trends in assessment model stock size estimates, instead of raw survey data to utilize all available information.
21. An empirical approach might alleviate concerns by maintaining catches initially at the safe status quo median level. It is simple and should appeal and be accepted by constituents. Managers could further explore the productivity of the resource by, for example, increasing the catch based on a larger fraction when the survey is high. Thus, managers could use the empirical rule in adaptive management to better understand the potential productivity of Tanner crab.

TOR 4. Two-area model: Under what circumstances would a two-area model for Tanner crab be recommended? Are there any circumstances under which a two-area model would expressly not be recommended? Are there any data that could be gathered (or analyses performed with existing data) to inform this decision?

1. No advantages to using a two-area model were identified by meeting participants, although some persistent spatial differences in the stock and fishery were mentioned.
2. ADFG already uses spatial management when it seems appropriate based on regional catch and survey results. This approach could be continued if a better control rule and definition of overfishing were available for the entire stock.
3. I wonder if these questions are somehow related to problems with F35%, distrust with the current control rule and differences between ADFG and potential federal harvest management. If so, the immediate solution is to improve the reference points and harvest rule.

TOR 5. Hybrid snow/Tanner crab: How should hybrid crab be treated in the assessment? How should hybrid crab be treated in the development of reference points and harvest control rules? Are there additional data streams that would be helpful to gather or experiments to be performed that would better inform how to treat hybrid crab in assessment and management?

1. There is no reason to take immediate action in the Tanner crab fishery to accommodate hybrids.
2. Legal size hybrids in the Tanner crab fishery are currently counted against the Tanner crab quota. The hybrid contribution varies but is always low. Management at this level seems reasonable though perhaps unnecessary.
3. The current surge in hybrids may be a short-term event.
4. The "spawning biomass" for hybrid crabs is protected if Tanner and snow crab spawning biomass levels are protected. Thus, current management for Tanner and snow crabs protects the spawning biomass for hybrids.
5. Hybrid crabs tend to be smaller than Tanner crab and retained mainly by the snow crab fishery. Intensive management of hybrids based on the Tanner crab fishery would probably be ineffective and difficult.
6. It is not clear if hybrid crabs are environmentally important or desirable.
7. If more intensive management is eventually desired for hybrid crabs, it should begin in the snow crab fishery where hybrids are most often caught.

Appendix 2. Performance Work Statement for CIE Reviewers at the Tanner crab review meeting in Seattle, WA, June 9-11 (including original Annex 1 and Annex 2 with Terms of Reference).

Performance Work Statement (PWS)
National Oceanic and Atmospheric Administration (NOAA)
NOAA Fisheries
Center for Independent Experts (CIE) Program
External Independent Peer Review

Review of Eastern Bering Sea Tanner Crab Assessment
June 9 - 11, 2026

Background
NOAA Fisheries is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NOAA Fisheries science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards[2].

Scope
The goal of this review is to gain external expert review and input on several issues with respect to the Bering Sea and Aleutian Islands Tanner crab assessment, including:

1. transition of the Tanner crab assessment to the Generalized Model for Assessing Crustacean Stocks (GMACS) framework,
2. methodology for incorporation of data collected in side-by-side selectivity experiments into the Tanner crab assessment,
3. the appropriateness of currently used reference points for Tanner crab (and potential alternatives),
4. the feasibility and need for development of a two-area model for Tanner crab
5. how to treat hybrid snow/Tanner crab in the assessment and management process

External expert review for this stock is necessary and timely because Tanner crab abundance is currently increasing strongly and hybridization with snow crab has reached levels not historically observed. If these trends continue, Tanner crab may become a larger part of the portfolio of fished crab stocks in the Bering Sea than it has been for the past several decades. External review will help ensure the science used in the management of Tanner crab continues to be robust and transparent in the pursuit of management advice that maximizes long-term sustainable catches.

[2] https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/memoranda/2005/m05-03.pdf

The specified format and contents of the individual peer review report are found in **Annex 1**. The Terms of Reference (ToRs) of the peer and review are included in **Annex 2**. The tentative agenda of this virtual panel review and process review meetings is included in **Annex 3**.

Requirements
NOAA Fisheries requires three reviewers to conduct an impartial and independent peer review in accordance with this Performance Work Statement (PWS), OMB Guidelines, and the ToRs below. Modifications to this Performance Work Statement (PWS) and ToRs cannot be made during the peer review, and the Contracting Officer's Representative (COR) and the CIE contractor shall approve any modifications prior to the peer review. All ToRs must be addressed in each reviewer's report.

Effective review of the issues of concern requires reviewers with several specific skillsets. In-depth experience with the implementation and behavior of *integrated size-structured assessment models* that have complex internal dynamics and are fit to numerous data sources is needed to appropriately review the Tanner crab model. Experience in the *management of crustaceans* is needed to support the analysis and discussion of reference points and harvest control rules. Finally, knowledge of *crustacean biology* is needed given the distinct structure of Tanner crab population dynamics and the resulting implications for management.

The chair, who is in addition to the panel of three reviewers, will not be provided by the CIE. Although the chair will be participating in this review, the chair's participation (e.g., labor and travel) is not covered by this contract.

Tasks for Reviewers
Each CIE reviewer shall complete the following tasks in accordance with the PWS and Schedule of Milestones and Deliverables herein.

Pre-review Background Documents: Two weeks before the peer review, the NOAA Fisheries Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NOAA Fisheries Project Contact will consult with the CIE on where to send documents. The CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance with the PWS scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Documents to be provided to the CIE reviewers prior to this review include:

Documents for review (links to come):
- Document describing issues for which input is needed
- 2025 Tanner Crab Assessment
- May 2026 Preliminary Tanner crab models and other analyses

Background information:
- Survey tech memo
- previous MSE work (BSFRF, UW, ADFG, AFSC)
- State TAC docs
- Chionoecetes mortality papers
- Hybrid crab background

Panel Review Meeting: The CIE reviewers shall conduct the independent peer review in accordance with the PWS and ToRs and shall not serve in any other role unless specified herein. The CIE reviewers shall attend and actively participate in a professional and respectful manner as members of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NOAA Fisheries Project Contact is responsible for any meeting arrangements (e.g., conference room reservations, video conferencing logistics, etc.).

Chair Summary Report: The reviewers shall assist the Chair of the meeting with contributions to the summary report. Reviewers are not required to reach a consensus.

Contract Deliverables - Independent CIE Peer Review Report: The CIE reviewers shall complete an independent peer review report in accordance with this PWS. The CIE reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. The CIE reviewer shall complete the

independent peer review addressing each ToR as described in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Foreign National Security Clearance
When reviewers participate during a panel review meeting at a government facility, the NOAA Fisheries Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the Project Contact for the purpose of their security clearance, and this information shall be submitted at least two weeks in advance. For additional information, please see the following link: https://www.commerce.gov/osy/programs/foreign-access-management. All CIE reviewers must have a REAL ID-compliant form of identification to access Federally owned or leased facilities The contractor is required to use all appropriate methods to safeguard Personally Identifiable Information (PII).

Place of Performance
The place of performance shall be the Alaska Fisheries Science Center, Seattle, WA.

Period of Performance
The CIE reviewers' duties shall not exceed **14** days to complete all required tasks.

Schedule of Milestones and Deliverables
The contractor shall complete the tasks and deliverables in accordance with the following schedule:

Schedule	Milestones and Deliverables
Within two weeks of award	Contractor secures participation of the CIE reviewers.
At least two weeks prior to the panel review meeting	Pre-review documents are provided to the reviewers.
June 9 - 11, 2026	The reviewers participate and conduct an independent peer review during the panel review meeting.
Approximately 2 weeks later	Contractor receives draft reports
Within 3 weeks of receiving draft reports	Contractor submits final reports to the Government

* The Peer Review Summary Report will not be submitted to, reviewed, or approved by the Contractor.

Applicable Performance Standards
The acceptance of the contract deliverables shall be based on three performance standards: (1) The reports shall be completed in accordance with the required formatting and content in **Annex 1**; (2) The reports shall address each ToR as specified **Annex 2**; and (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Travel
All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (Travel resources | GSA), and all contractor travel must be approved by the COR prior to the actual travel. Any travel conducted prior to the receipt of proper written authorization from the COR will be done at the Contractor's own risk and expense. International travel is authorized for this contract. Travel is not to exceed $12,000.00.

Confidentiality and Data Privacy
This contract may require that services contractors have access to Privacy Information. Services contractors are responsible for maintaining the confidentiality of all subjects and materials and may be required to sign and adhere to a Non-disclosure Agreement (NDA).

NOAA Fisheries Project Contact:
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Annex 1: Peer Review Report Requirements

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations as specified in the ToR.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   a. Reviewer should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewer should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewer should elaborate on any points raised in the Summary Report that they feel might require further clarification.

   d. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the panel summary report. The CIE independent report shall be an independent peer review of each ToRs and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Performance Work Statement
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

Review of Eastern Bering Sea Tanner Crab Assessment

CIE reviewers are contracted to complete their independent peer review based on the ToRs. Therefore, the CIE-NOAA Fisheries review and approval process is based on whether the CIE independent reports addressed each of the ToRs.

1. Generalized Model for Assessing Crustaceans Stocks (GMACS)
    a. Comment on the pros and cons of transitioning from the status quo bespoke assessment to the GMACS framework.
    b. Are there any concerns with the GMACS framework that would preclude its adoption?
    c. If so, are there clear paths to addressing these concerns (and what are the paths)?
2. Side-by-side selectivity
    a. Are the methods presented for estimating the selectivity of the NMFS survey gear based on the side-by-side experiments scientifically sound?
    b. Are the resulting changes in the scale of the population when incorporating the side-by-side data into the assessment defensible and appropriate for providing management advice?
    c. If not, how would the reviewer approach the provision of management advice using assessment output that incorporates the selectivity experiment data?
3. Reference points
    a. Are F35%-based reference points appropriate for Tanner crab in light of terminal molt and the discrepancy between maturity and selection in the fishery?
    b. If not, can the reviewer provide more appropriate alternatives for reference points?
    c. Is morphometrically mature male biomass the appropriate metric for use in the harvest control rule?
4. Two area model
    a. Under what circumstances would a two-area model for Tanner crab be recommended?
    b. Are there any circumstances under which a two-area model would expressly not be recommended?
    c. Are there any data that could be gathered (or analyses performed with existing data) to inform this decision?
5. Hybrid snow/Tanner crab
    a. How should hybrid crab be treated in the assessment?
    b. How should hybrid crab be treated in the development of reference points and harvest control rules?
    c. Are there additional data streams that would be helpful to gather or experiments to be performed that would better inform how to treat hybrid crab in assessment and management?

Reviewers must provide details on the basis of their responses to the review questions.

Annex 3: Tentative Agenda for the Eastern Bering Sea Tanner crab assessment

June 9-11, 2026

Chair: Cody Szuwalski (cody.szuwalski@noaa.gov)
(to be expanded as presentations develop)

Day	Time	Topic	Presenter
June 9	9-12	Welcome and overview	Szuwalski
	930-12	Introduction to Tanner crab assessment	Stockhausen
	1-2	Survey data description	Kodiak team
	2-3	Catch data description	ADFG
	3-5	Discussion and identification of requests	
June 10	9-12	Report back on CIE requests	Stockhausen
	1-5	Discussion and identification of final requests	
June 11	9-12	Report back on CIE requests	
	1-5	Wrap up	

Appendix 3: Panel membership and participants at the review.

William Stockhausen, NOAA, Assessment Lead
Cody Szuwalski, NOAA, Meeting Chair
Grant Adams, NOAA
Sandra Lowe, NOAA
Melissa Haltuch, NOAA
Mike Litzow, NOAA
Jim Ianelli, NOAA
Cole Monnahon, NOAA
Tyler Jackson, ADFG
Katie Palof, ADFG
Yong Chen, CIE
Martin Cryer, CIE
Larry Jacobson, CIE