Draft SSC Report
June 2022

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General comments for crab stock assessment authors (1 of 1)

- The SSC ***recommends*** that the stock structure template be completed for all red king crab stocks in the EBS
- The SSC ***suggests*** that a brief summary of model features and runs is sufficient documentation for preliminary model runs
- The SSC ***requests*** that the CPT develop guidelines for when to change model start dates
  - While changing the start date might simplify models and improve model fits, it may lose historical context for the stock
  - Consider data availability, model complexity, impacts to recruitment estimates, perspective on long-term changes in population dynamics of the stock, such as changes in M, and impacts to stock projections

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Aleutian Islands Golden King Crab (AIGKC) (1 of 2)

- Full assessment, based on two models (EAG, WAG) summed to provide the OFL and ABC for the entire area
- Stock decreasing in recent years in both regions, and relies primarily on fishery CPUE for trend information
- The stock is considered to be in Tier 3a, not overfished
- The SSC ***recommends*** model 21.1e2, in agreement with the CPT, with a 25% ABC buffer from the maximum permissible, less than last years 30% buffer
    - Basis: no fishery independent survey, continued retrospective pattern in AIG model, declining trend in the year:area interaction CPUE series likely to be used in the next assessment, no convergence concerns

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Aleutian Islands Golden King Crab (AIGKC) (2 of 2)

- The SSC ***supports*** the CPT research recommendations including:
  - GMACS model development with consideration for one combined model with two areas and inclusion of the cooperative survey data
  - Exploring the use of the NMFS Aleutian Islands trawl survey data
  - Investigating the potential source of conflict between the CPUE indices and size composition data that may be causing the retrospective trend in EAG
  - A model run that includes year:area interaction in the CPUE index

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BBRKC Model Runs (1 of 2)

- Eleven models were considered that address the way that natural mortality, BSFRF data, catchability are modeled and a change in the start year
- The SSC ***supports*** CPT recommendations:
  - 21.1b, (base GMACS with updated bycatch data)
  - 22.0a (estimate M, retain BSFRF data, change start year to 1985)

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BBRKC Model Runs (2 of 2)

- The SSC had suggested exploring alternative ways to incorporating survey data (i.e., estimating catchability)
- The SSC ***requests*** a stock structure template be completed for June 2023 for all EBS RKC stocks

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Tanner crab Model Runs (1 of 2)

- Authors continued to focus on reducing model complexity and addressing parameters hitting bounds during estimation
- The SSC ***supports*** the CPT recommended models for September
  - Model 22.01: (base model with updated data, including updated bycatch estimates)
  - Model 22.03: 22.01 + aggregated fishery catch (instead of sex-specific catches)
  - Model 22.06a: 22.03 + new start date of 1982 with a small smoothing penalty
  - Modified Model 22.06a: 22.06a + bootstrap estimates of annual input sample sizes

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Tanner crab Model Runs (2 of 2)

- The SSC ***supports*** the CPT recommendations for future work:
  - Approaches to incorporate BSFRF survey data
  - Modeling ADF&G management areas as separate fisheries
  - Continued progress towards GMACS (but recognizes this may wait until additional improvements in the snow crab GMACS model occur)

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SMBKC Model Runs (1 of 1)

- The SSC ***agrees*** with the CPT recommended models to bring forward for the September CPT meeting.
  - Model 16.0 - 2020 version
  - Model 16.0 with updated data
- The author is considering changing the size bins in the model
  - The SSC ***suggests*** that authors consider the empirical measures of molting probability that inform the model fit (growth matrix) as it relates to this change

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PIRKC Model Runs (1 of 2)

- Triennial Assessment Cycle - Last Assessment in 2019
- No directed fishery since 1999
- The SSC ***recommends*** model 22.1 (2019 GMACS model with updated data) and three new models:
  - 22.1c = model 22.1 + ADFG pot survey data
  - 22.1d = model 22.1 + NMFS survey size composition data
  - 22.1e = model 22.1 + ADFG pot survey data + NMFS survey size composition data.

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PIRKC Model Runs (2 of 2)

- The new models 22.1c-e were not reviewed by the CPT in May and will be held to a greater level of scrutiny.
- The SSC ***supports*** CPT recommendations for addressing connectivity between the PIRKC stock and other RKC stocks

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Snow Crab Assessment Model (1 of 3)

- The SSC reviewed proposed models and model runs for the 2022 snow crab assessment
- The SSC ***finds*** that the new GMACS version of the snow crab model is a superior modeling platform compared to the previous model, results in a better fit, will greatly enhance transparency, and will facilitate further model development
- The SSC ***recommends*** adopting the GMACS version as the new base model for the 2022 assessment

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Snow Crab Assessment Model (2 of 3)

- The SSC ***recommends*** bringing forward the following models:
  - 21.g - GMACS version that matches the previous base model as closely as possible
  - 21.g with prior constraint on mortality to keep M more consistent with recent estimates of M
  - 21.g without fixing initial numbers-at-age
  - 21.g that includes these two changes
  - Tier 4 model calculations with the current base value for M (as a fallback option)

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Snow Crab Assessment Model (3 of 3)

- The SSC ***strongly recommends*** that analysts prioritize working towards a model-based survey index that incorporates the NBS data into the assessment
- The SSC ***strongly recommends*** including appropriate uncertainty intervals on estimates of biomass and abundance
- The SSC ***recommends*** that the author work with BSFRF to summarize observations from harvesters that may help inform stock dynamics
- The SSC ***finds*** that the strong evidence for a link between temperature and snow crab mortality provides sufficient support for using high mortality scenarios or mortality events that best represent recent conditions when doing projections for rebuilding analyses

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Snow Crab Rebuilding Plan (1 of 7)

- The SSC reviewed the initial rebuilding projections, supporting analyses, and CPT recommendations.
- The SSC ***finds*** that snow crab rebuilding may be highly dependent on projections of intermittent extreme temperature events associated with climate change in the Bering Sea.
- The SSC ***recommends*** that further analyses reflecting this increased potential for mortality events (as estimated to have occurred in 2018-2019) need to be conducted before appropriate rebuilding parameters can be selected, including a determination of whether T_{max} is less than or greater than 10 years.

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Snow Crab Rebuilding Plan (2 of 7)

- The SSC ***supports*** the CPT recommendation to use the GMACS software as the basis for further analyses.
- The SSC ***recommends*** that the prior on natural mortality used for the rebuilding model be made consistent with last year's assessment model and the likely preferred model for 2022.

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Snow Crab Rebuilding Plan (3 of 7)

- The SSC ***recommends*** that annual recruitment and mortality estimates should be resampled from four different time-periods in order to bracket a range of plausible rebuilding trajectories. These periods are:
  - 1982-2017 - including no elevated mortality events
  - 1982-2019 - including the mortality event estimated in 2018-2019
  - 1994-2019 - reflecting more recent recruitment conditions
  - 2005-2019 - approximating a 1 in 7 chance of elevated mortality events projected under the current climate conditions

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Snow Crab Rebuilding Plan (4 of 7)

- The SSC ***recommends*** that the B_{MSY} used for each of these rebuilding trajectories be based on the specific period of recruitment.
- The SSC ***recommends*** that the B_{MSY} calculation use only the 'base' M from each period, consistent with the treatment of mortality events for other stocks.
- The SSC recognizes that rebuilding to B_{MSY} specified in this way may be delayed by future mortality events.

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Snow Crab Rebuilding Plan (5 of 7)

- The SSC ***recommends*** that five fishing mortality alternatives be used for each projection:
  - $F = 0$
  - Average bycatch (including groundfish and other crab fisheries) over a recent period
  - An approximation of the State harvest control rule with bycatch
  - An approximation of the State harvest control rule without bycatch
  - $F = F_{ABC}$

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Snow Crab Rebuilding Plan (6 of 7)

- The SSC also ***suggests*** including one sensitivity projection for a qualitative comparison using the State harvest control rule with an elevated level of bycatch reflecting potential unobserved mortality.
- The SSC noted that the CPT and public testimony identified potential tools for managing snow crab bycatch.

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Snow Crab Rebuilding Plan (7 of 7)

- The SSC ***finds*** that the northern Bering Sea may be increasingly important to snow crab dynamics and that the rebuilding analysis and assessment may be strongly informed by the 2022 trawl survey data.
- The SSC ***recommends*** that these sources of information be included in both analyses to the extent possible.

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Updates to Survey - Corner Stations (1 of 1)

- NMFS proposed dropping EBS survey corner stations around the Pribilof and St. Matthew islands to free up staff and survey resources for sampling other areas (e.g. deep stations at northwest edge of the EBS survey grid).
- 26 corner stations require 6–7 survey vessel days, cost ~ $100k and serve to increase sampling for blue king and red king crabs.
- Impacts to abundance, length composition, and general crab stock assessment results likely minimal except for PIRKC and SMBKC
- The SSC agrees with the CPT and ***recommends*** not changing the EBS survey stations at this time and ***recommends*** corner station sampling be included in future survey strategic planning analyses.

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Updates to Survey - BBRKC Resampling (1 of 2)

- Proposed change would increase the resampling threshold from ≥10% pre-molt-mate females to ≥25% and limit the number of resampled stations to 20.
- Resampling currently occurs in 20–30 stations annually using 7–10 days at sea.
- Primary goal → improve the accuracy of size composition data for post-molt females. Other goals → improve abundance estimates for mature females and estimates of reproductive status.
- Proposed change would have excluded only one resampling year (2021) since 1999, and impacts on size comps in that year would have been minimal.

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Updates to Survey - BBRKC Resampling (2 of 2)

- The SSC ***notes*** the proposed change may potentially free up survey resources but is not likely to enhance the performance of the resampling program.
- The SSC ***notes*** that the analysis did not address the broader impacts of the proposed change on the BBRKC stock assessment going forward.
- The SSC ***recommends*** the current BBRKC resampling protocols remain in place.
- The SSC ***recommends*** that BBRKC resampling be included in future survey strategic planning analyses.

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Draft BBRKC Risk Table (1 of 1)

- SSC provided input on a draft BBRKC risk table
- The SSC confirmed that the risk tables process is that risk tables should initially be developed by the stock authors with input from the CPT and that the tables should be included in the crab SAFE documents.
- The SSC commends the author for developing the draft BBRKC risk table and requests that an updated draft version be brought forward in October.