Crab Plan Team

REPORT

January 23-25, 2019
University of Alaska Fairbanks Northwest Campus
Nome, AK

Committee Members in attendance:

Ben Daly, **Chair** (ADF&G-Kodiak)
Katie Palof, **Co-Chair*** (ADF&G-Juneau)
Diana Stram, **Coordinator** (NPFMC)
Jim Armstrong, **Coordinator** (NPFMC)

Ginny Eckert (UAF/SFOS-Juneau)-phone
André Punt (Univ. of Washington)
Shareef Siddeek (ADF&G-Juneau)
Miranda Westphal (ADF&G-Dutch Harbor)

Committee Members absent:

Martin Dorn, **Co-Chair*** (NMFS/AFSC-Seattle)
William Bechtol (UAF-Homer)
Brian Garber-Yonts (NMFS/AFSC-Seattle)

Krista Milani (NMFS/AKRO - Dutch Harbor)
William Stockhausen (NMFS/AFSC - Seattle)
Cody Szuwalski (NMFS/AFSC - Seattle)

Members of the public, State, Agency staff in attendance:

Jenefer Bell (ADF&G-Nome)**
Adam Bockman (Fisherman/NSEDC/WSAC)
Ashley Dunker (NSEDC)
Jamie Goen (ABSC)
Scott Goodman (NRC/BSFRF)
Tom Gray (Fisherman)
Hamachan Hamazaki (ADF&G-Anchorage)**
Luke Hensley (ADF&G-Nome)
Leonard Herzog (Fisherman)
Renae Ivanoff (NSEDC)
Wes Jones (NSEDC)
Scott Kent (NSEDC)
Simon Kinneen (NSEDC/NPFMC)

Charlie Lean (NSEDC)
Justin Leon (ADF&G-Nome)**
Frank McFarland (Fisherman)
Justin Noffsker (NSEDC)
Eric Osborne (Fisherman)
Josh Osborne NSEDC
Edward Poulson (BSFRF)
Jocelyn Runnebaum (ADF&G-Juneau)
Madison Shipley (UW/BSFRF)**
Vicki Vanek (ADF&G-Kodiak)-phone
Dawn Wehde (NSEDC)
Bo Whiteside (ADF&G-Kodiak)
Jie Zheng (ADF&G-Juneau)

*   Provisional until confirmed in May
** Presented to CPT

Administration

The Crab Plan Team (CPT) meeting began at 9:00 a.m., and CPT members and others in attendance introduced themselves. It was noted that no NMFS/NOAA Fisheries staff were in attendance due to the ongoing Federal shutdown. The absence of these members constrained the CPT's ability to address several items in the original agenda that had included four meeting days, but was reduced to three days. The attached final agenda was agreed upon for the meeting. Adobe Connect / Teleconference broadcast of the meeting was made available, and was posted to the CPT meeting agenda page on the Council website. All

PowerPoint presentations were posted to the agenda, and the Team reviewed assignments and logistics for finalizing the SAFE Introduction section and the CPT minutes.

Election of Co-Chairs was discussed, and Martin Dorn and Katie Palof were provisionally elected pending confirmation by the Team in a follow up when the federal employees are available. Ben Daly of ADF&G will continue to serve as a chair during this period.

Issues to be addressed at the May 2019 CPT meeting that were deferred from the January agenda due to the absence of Federal CPT members include: Snow crab PSC limit analysis, VAST application and implications for SMBKC and other crab assessments, Alternative development, timing and workplan for SMBKC rebuilding, Tanner crab assessment issues, and Economic SAFE review.

Norton Sound Red King Crab final assessment OFL/ABC

Dr. Toshihide "Hamachan" Hamazaki presented the Norton Sound red king crab assessment to the CPT. New trend data in the assessment included the estimates from the 2018 ADFG bottom trawl survey in Norton Sound, the 2018 winter commercial and subsistence fishery data, the summer commercial fishery data, the winter commercial retained catch size composition data for 2016-2018, and an update to the CPUE index. The ADFG survey results were presented and showed that the survey catch was comprised largely of females and sublegal males, with most of the catch occurring at two stations. The 2018 survey had the lowest abundance of legal male crab in the entire time series, but the highest (by a significant margin) for female and pre3 (<76 mm) males.

The assessment model includes 8 size classes. Natural mortality is fixed at $0.18yr^{-1}$ for size classes 1-6, but estimated at a higher value for the largest two size classes. The model assumes the same selectivity and catchability for new and old-shell crabs, and discard mortality is assumed at 0.2. Winter catch selectivity is assumed to be equal to winter pot survey selectivity. Maturity data do not exist for Norton Sound red king crab males and the assessment does not include a stock-recruitment function. The OFL is for legal crabs only, thus maturity does not affect the OFL calculation.

The CPT discussed moving NSRKC from Tier 4 to Tier 3. Uncertainties associated with various biological processes of the stock, including a lack of male maturity data and high estimated natural mortality of large size classes were briefly discussed by the CPT. Much of the CPT was absent, however, due to the federal shutdown, thus, a broader discussion of this topic did not occur. Hamachan provided Tier 3 calculations and evaluated the suitability of the stock for Tier 3 status. Tier 3 retained legal biomass OFL was 1.86 million lb, 7.75 times higher than the Tier 4 OFL of 0.24 million lb. The higher Tier 3 OFL is due to the high natural mortality of large crabs and the selectivity pattern. The CPT acknowledged the length-dependent OFL calculations but did not discuss at length. The CPT does not feel it is appropriate at this time to elevate NSRKC to Tier 3 given uncertainties about assumed biological processes (high M of large crab, lack of male maturity data) and the absence of the full CPT.

Previous CPT recommendations included quantitatively evaluating the representativeness of observer sampling and evaluating simple versus more complex selectivity curves (i.e., one-parameter versus two-parameter logistic curves) to allow the ABC and OFL to be expressed in terms of total catch rather than retained catch. Hamachan quantitatively evaluated observer sampling. Current practices do not lead to

representative samples based on the number of crab per area (i.e. they are not proportional to population estimates). As such, samples could be biased if spatial differences in crabs size exist. Comparisons were not possible for some areas due to small sample numbers.

Hamachan evaluated eight model run alternatives, a base model (model 18.0) that assumes a fixed retention pattern and uses retained and discard length-composition data to estimate total catch selectivity, and several models that incorporate different stanzas (1987-1994 and 2012-2018) of size composition data from the summer and winter commercial fisheries and estimate separate retention selectivities for the summer and winter fisheries. The CPT has the following comments on the various models:

● Estimating the retention pattern does not change fit to population dynamics, but improved fits to commercial retention and tag recovery data that inform the size transition matrix and molt probability.
● Estimating separate retention patterns for the summer and winter fisheries did not improve the model fit.
● It is inappropriate to omit the 1987-1994 data without a strong justification.
● Given that summer total catch and winter retention data will be taken annually, incorporating those two datasets 8 (Model 18.2a, b) is desirable. Both model scenarios that incorporate summer total catch and winter retention data estimated identical OFLs, but it was recommended to include the 1987-1994 data set lacking a justifiable reason for omitting.

Based on these considerations, the CPT recommends that the OFL and ABC be based on model 18.2b. The CPT has the following recommendations for the next assessment:

● Continue to evaluate methods to improve ADF&G bottom trawl survey biomass estimation, including model-based approaches such as VAST.
● Conduct a sensitivity analysis to evaluate the effect of mark-recapture data by fitting the model only marks that are at liberty for one year.
● Evaluate potential differences in survey Q between NOAA and ADFG bottom trawl surveys.
● Collect more chela-carapace length data, especially at the small size range, to improve the size at maturity estimate.
● Continue to address CIE recommendations (e.g., jittering).

GMACS

Dr. Andre Punt updated the CPT on progress regarding GMACS, a generalized platform for conducting crab stock assessment models. GMACS is generalized in the sense that it is (relatively) easy to add new features (e.g. types of selectivity patterns, assumptions about time-trends in M), inputs are in the form of three input files: .DAT, .CTL, and .PRJ files (none of the parameters of the model are "hardwired") and that it is easy to conduct phasing and placing bounds on parameters. GMACS is open-source (on GitHub), automatically produces diagnostic plots to evaluate fits and summarize model results, can be used to evaluate sensitivity to alternative assumptions, and generates pseudo data sets to test model performance. The hope is that GMACS will improve transparency by allowing multiple programmers to see code, standardize diagnostics, sensitivity analyses, etc. Thus far, GMACS has been used for the last two assessments for Saint Matthew Island blue king crab (single sex; three size-classes; limited fleets). GMACS

is being considered for application in September 2019 for Bristol Bay red king crab (two sexes; 26 size-classes; multiple fleets; many data types). For the BBRKC assessment, much of the basic coding in GMACS is completed (and tested), but a major extension is needed to allow for a terminal molt (required for snow and Tanner crab). In principle, inclusion of a terminal molt should not impact the input files much or the results of current assessments.

GMACS Core file structure includes input and output files. Input files include 1) **GMACS.DAT** files that contains the names of three files: a data file (e.g. "x.DAT"), a control file (x.CTL), and a projection file (x.PRJ), 2) the **data file** that contains the dimensions of the problem and all the data, 3) the **control rule** that contains the specifications of the model (e.g. which parameters to estimate, selectivity patterns to assume, bounds, phases, etc.), and 3) the **projection file** that specified how OFLs will be computed and projections undertaken. Output files include 1) **Checkfile.rep**: a file that repeats much of the input (this file saves considerable development time by helping to work out bugs in the read-in files), 2) **Gmacs_in.dat & gmacs_in.ctl:** data and control rules reformatted, and 3) **Gamsall.out**: the output file in generalized format.

Multiple changes occurred in GMACS since the September 2018 CPT meeting (and even the January 2019 workshop). These changes include: instantaneous mortality is now correctly implemented, there are now additional options for selectivity, retention and growth (all selected in the CTL file), input files were modified so that only data appear in the DAT file and all parameter specification is via the CTL file, OFLs can be computed using crab harvest control rules, and projections undertaken and all base models converge with low final maximum gradients and there is no evidence for differentiability issues.

Dr. Punt discussed the differences and implications for using instantaneous F (fishing mortality occurs in a single instant: an individual crab cannot be "re-caught") vs continuous F (fishing mortality occurs continually over a given time span: an individual crab can be "re-caught") in the assessments. GMACS currently uses an instantaneous F, but can assign various Fs for different fisheries depending on the duration of the fishery. The difference in MMB trajectories between the original BBRKC assessment (continuous F) and the GMACS (instantaneous F) is minimal.

High priority next steps include finalizing the implementation of the MCMC sampler output dump, giving the entire program a careful final check, finalizing the implementation of the calculation of reference points (Tier 3 and 4; $F_{35\%}$), finalizing the implementation of the calculation of OFLs, and creating a forecast file (Tier, buffer, etc). Medium priority next steps include finalizing implementation of labels in the code (e.g. MALES instead of 1), assigning sex- and length-class-specific basal M, implementing a fished and unfished initial size-structure option, checking to make sure graphical summaries still work, testing Pribilof Island red king crab, updating the SMBKC assessment, updating the BBRKC assessment, and producing a technical appendix for the model specifications. Other recommendations for future work in GMACS include implementing the AIGKC assessment in GMACS, implementing terminal molt in the snow and Tanner crab assessments, and implementing NSRKC in GMACS.

For the May 2019 CPT meeting, the plan is conduct do a bridging analysis for BBRKC to make sure no issues arise in the results. Assuming there are no problems, the BBRKC assessment will be conducted in GMACS for CPT evaluation at the September 2019 CPT meeting. The next stock assessment to be conducted in GMACS is Pribilof Islands red king crab.

SMBKC

In October 2018, the NMFS sent a letter to the Council to inform them that the St. Matthew Island blue king crab (SMBKC) stock was overfished, and the Council will need to prepare and implement a rebuilding plan within two years. Rebuilding scenarios and some aspects of the assessment model were discussed but discussions were somewhat limited by the absence of federal members of the Plan Team. The Plan Team compiled a list of discussion points for rebuilding the SMBKC stock and made general recommendations for consideration at the February SSC meeting. At the February meeting, the Council may be able to begin drafting alternatives for the rebuilding plan with further review and consideration by the Plan Team at the May 2019 CPT meeting. Additionally, the Board of Fisheries will be briefed by Council staff at its March 2019 meeting. Additional analysis and research of identified rebuilding parameters will be discussed at the May Plan Team meeting.

The CPT recommends the following need to be considered (with current suggestions) in the development of the rebuilding plan for the SMBKC stock: 1) the range of years to compute average bycatch mortality in the groundfish fisheries is recommended to be the most recent 5-year average but it is also recommended to compare the recent 5-year average to the long-term average, 2) using 2015/16 (the last year of a directed fishery) to compute selectivity in the directed fishery, 3) using 2017/18 for specifying weight-at-length, 4) for estimating recruitment, randomly select model estimates from the last rebuilding period for this stock (1998 – 2008). Using a Ricker and/or Hockey stick S-R model to estimate recruitment was also discussed. However, the lack of a strong S-R relationship for SMBKC was acknowledged. Nevertheless, it will be desirable to provide results based on a stock-recruitment function to the February 2019 SSC meeting. As such, randomly selecting model estimates of recruits from a defined period is the current recommended approach.

It is recommended to begin the rebuilding analysis under various scenarios for fully-selected fishing mortality (F) for directed fishery and groundfish discard fisheries F: F=0 for all fisheries (including the groundfish fisheries), groundfish bycatch mortality only (no directed fishery), and groundfish bycatch mortality plus a directed fishery (as directed by state harvest control rules). The maximum time to rebuild (T_{MAX}) is 10 years if rebuilding can occur with 50% probability under zero fishing mortality. If rebuilding cannot be achieved within 10 years under zero fishing mortality, the target will be 10 years plus one mean generation (defined as the average age of spawners in an unfished state). During the meeting, generation time was calculated at 11.59 years, assuming an age-at-recruitment of 5 years. The estimated age of recruitment (to the model) was discussed by the CPT and it was generally agreed that 5 years is likely too low. Age of recruitment is generally thought to be 6 to 8 years. The range of years that should be used to calculate B_{MSY} was also discussed. While the full time-series is currently used, whether the timespan should include the early part of the timeseries (i.e., high population productivity) was questioned, as it may not be representative of current stock conditions.

For the purpose of producing rebuilding scenarios, the CPT recommends that the stock-recruit relationship be calculated using model estimates of B_{MSY} and adjust equilibrium recruitment until MMB at F_{MSY} equals the B_{MSY} proxy. Initial projections were calculated during the meeting and probability of rebuilding by year was compiled using F=0 (no directed fishery, no groundfish bycatch), F that included groundfish bycatch only, and F=0.18 when recruitments were sampled from the years 1998 to 2008. Initial projections show

that there is no scenario in which the stock will rebuild to B_{MSY} within 10 years, with or without groundfish bycatch mortality. However, the stock had a slightly higher probability of rebuilding at F=0 than with groundfish bycatch mortality.

The Plan Team would appreciate guidance on the following issues: In defining what "rebuilt" means for this stock, should rebuilt mean 1 or 2 or more years of model-based MMB being above B_{MSY}? The two-year benchmark previously used for other crab stocks (e.g. snow crab) was tied to sampling error associated with the survey, which is not expected to be as much of an issue for this stock as MMB will be based on model outputs, and the model accounts for all years of the survey. It was also determined that there is a need to reexamine and perhaps redefine B_{MSY} for this stock. Currently, B_{MSY} is defined using the entire time period which may not be realistic. Modelling a stock-recruitment relationship may prove helpful in determining an appropriate B_{MSY} in the current regime.

The Plan Team identified the following management actions that should be considered in the rebuilding plan: state harvest strategy revisions, area closures (include assessment of critical habitat areas relative to groundfish fishing locations), and PSC limits. CPT members identified several topics for discussion and action recommendations be addressed at the May 2019 meeting.

1. Explore current state and federal closures and rationale for those closures. Currently state waters (0-3 nmi) surrounding St Matthew, Hall, and Pinnacle Islands are closed to fishing. Additionally, the federal St. Matthew Island habitat conservation area is closed to non-pelagic trawl vessels. The Plan Team would like to review the history and rationale for implementation of these closure areas and whether additional closures would be beneficial. Although bycatch mortality in the fixed gear groundfish fisheries is considered trivial in the stock assessment, preliminary analysis shows that it may be an impediment to rebuilding.
2. Review the spatial extent and size/sex composition of blue king crab groundfish bycatch in order to assess if fishing restrictions or additional area closure may be beneficial. Additionally, it may be helpful to look at the size/sex composition of discards in the most recent years of the directed fishery in order to assess area or habitat utilization of the stock.
3. Review information on habitat surrounding St Matthew Island.
4. Review information on the basis for B_{MSY} for this and other king crab stocks.

Going forward, the GMACS development team needs to coordinate logistics for handing over the St. Matthew Island blue king crab assessment to a new stock assessment author. The Plan Team was also notified that there is no Saint Matthew Island state pot survey planned for 2019. Due to budgetary restrictions and the depressed stock, the state plans on returning to a triennial survey schedule.

Tanner crab MSE

Madison Shipley presented an update to the Tanner crab MSE that she is developing for her MS thesis at UW. The goal of the Tanner crab MSE is to evaluate a range of harvest control rules to identify a sustainable harvest plan. Madi reviewed her proposed timeline and project development, focusing on establishing a range of harvest control rules, what performance metrics to use to evaluate these rules, and her overall simulation structure for projections under each strategy. There was discussion among Plan Team members

and the public regarding the performance metrics to be included, but overall a range of biological and economic metrics will be considered.

Six harvest control rules that are proposed for consideration for this MSE are:
- Male only ramp – a strategy only using mature male biomass, which "ramps" up the exploitation rate as the MMB increases compared to the average MMB
- Female "floating dimmer" – which would also have ramps as a function of MMB that would be scaled based on the level of female mature biomass
- Female "blocked dimmer" – similar to the previous HCR, but there are blocks based on the female mature biomass instead of a free floating dimmer
- Female "ramp" – the exploitation rate on males is based solely on mature female biomass
- ABC rule – the TAC would equal to or less than the estimated ABC
- ELM rule – TAC would be 30 – 50 % of the exploitable legal males (ELM), consideration would need to be made for new shell and old shell crab here

Madi is currently working on finalizing her scenarios and performance metrics so that she can run simulations this spring. She hopes to present results to the CPT this coming September.

AIGKC

Aleutian Islands Golden King Crab
Shareef Siddeek briefed the CPT on the updates to the assessment for AIGKC and the proposed scenarios for the May 2019 assessment. The basic structure of the assessment (male-only length-based assessment fitted to catch, fishery-dependent CPUE, length-composition data and tagging data, unfished equilibrium in 1960, with *M* estimated, and stage-2 weights based on Francis weighting) is the same as for May 2018. The three proposed scenarios are:
- 18_0: the scenario on which the 2018 assessment was based.
- 18_1: as for 18_0, but with CPUE based on data with fewer gear codes.
- 18_1a: as for 18_1, but with pot bycatch rate scaled by the amount of bycatch.

The CPT supports the approach for identifying factors for inclusion in the CPUE standardization, which accounts for both improved model fit according to AIC as well as ensuring that including factors increases the explained variance appreciably (hybrid method). However, further work on defining "areas" for inclusion in the standardization is required, which may allow year*area interactions to be quantified.

The 2018/19 fishing year is not yet finished so the assessment projected the biomass forward to 2019/20 using the three-year mean retained catch, modelled predicted pot fishery bycatch and recent three-year mean groundfish bycatch.

In relation to model scenarios for the May 2019 assessment, the CPT recommends:
- The projection for the 2018/19 fishing year should be based on setting the retained catch to the 2018/19 TAC (because catches closely mimic the TACs for AIGKC) and assuming that groundfish bycatch for 2018/19 equals the recent three-year mean groundfish bycatch. The assumed removals should be listed in Table 2 (with annotations that the catches concerned are assumed). No catch composition data for the 2018/19 fishing year should be generated based on averaged past data.

- Scenario 18_1a should be dropped because the suggested approach for adjusting pot bycatch is plausible at the individual pot level, but not at the total bycatch level.
- Add a new scenario based on a revised definition of "area" when conducting the CPUE standardization – consideration should be given to including an interaction between year and the revised area definition in the standardization model. If an area*year interaction is supported, the final index should be an area-weighted index.

In relation to the results presented, the CPT requests that:
- The next assessment should report results from the May 2017, September 2017, and May 2018 assessments as well as those from the new scenarios to enable an evaluation of the impact of changes to the model and the data.
- The increase in MMB in the last year of the assessment for the EAG is caused by a large recruitment three years ago, but this increase is not reflected in the standardized CPUE – the analysts should identify what in the data (e.g. the length-compositions) are the cause of the increased recruitment. Showing the fits to the length-composition data may help identify whether there is a basis in the data for higher estimated recruitment.
- The results of the three scenarios are hard to distinguish in the figures. Whether they are actually different needs to be checked.
- The time-trajectories for dynamic B_0 should be clearly labelled in figures such as 17 and 18.
- The survey data will not be included in the assessment formally until the 2020 assessment. However, there would be value in plotting the length-composition data from the survey as it may provide evidence in support of the large estimated recent recruitment.

NSEDC meeting

On Thursday, January 24, the CPT visited the Norton Sound Economic Development Corporation's (NSEDC's) Nome office and hatchery facility which is housed in a repurposed reindeer processing plant. The Team was provided with a presentation on NSEDC interests and activities by several of their staff including Chief Operating Officer Tyler Rhodes, Research and Development Director Wes Jones, Special Projects Coordinator John Baker, Fishery Biologist Ashley Dunker. Additional comments were provided by other staff including students Dawn Wehde and Renae Ivanoff, fisherman Adam Bockman, and Council Chairman / NSEDC Vice President & Quota & Acquisitions Manager Simon Kinneen.

Within Norton Sound and around St. Lawrence Island, the NSEDC is primarily involved in salmon, halibut, and red king crab fisheries. They maintain a small scale chum and coho salmon hatchery program at the facility, with releases going into the local Snake River system. Halibut fishing by small boat operations occur from St. Lawrence and needs there are accommodated by prioritizing fishing on the island early in the season. The corporation supports a wide range of community needs through employment, access to fishery resources, fuel needs, small business support, education and other social benefits, and direct financial assistance.

There was discussion about the challenges associated with prosecution of the winter commercial red king crab fishery in Norton Sound. The fishery supports an export market of live crab that goes mostly to Korea. During the winter, red king crab are harvested through holes that are cut into the sea ice on Norton Sound, and air temperature, wind, and ice melt must be properly dealt with to maintain a high product quality.

Besides supporting a successful commercial red king crab fishery in Norton Sound, there was interest expressed in future fisheries for St Lawrence blue king crab (not included in the Federal FMP) and Hanasaki crab (*Paralithodes brevipes*).

NSRKC fishery and research

Justin Leon (ADF&G – Nome) provided an overview of the Norton Sound red king crab fishery. The commercial fishery consists of summer and winter components, and there is a subsistence fishery at similar times. In 2018, the spatial distribution of both the winter and summer catch throughout the Sound was different from the last five years, with more catch coming from further east in the Sound around Golovin and Elim and less from Nome. Also, in 2018 there were issues with early sea ice retreat limiting the opening of the winter commercial fishery. Justin also provided a summary of the Council's tier management system and the data that are used in the Norton Sound RKC assessment model. He also listed some of the knowledge gaps such as: uncertainty regarding the value for natural mortality, the lack of a spawner-recruit relationship, how female data can be used, location of the rearing grounds, and the consequences of a portion of the stock inside the closure line.

Jenefer Bell (ADF&G – Nome) followed Justin with some highlights of the research challenges for this stock and solicited advice from the Plan Team on these knowledge gaps. The main topics covered were: improvements in the trawl survey design, male size at maturity, disappearance of large males, and handling and bycatch data from observers.

The ADF&G summer trawl survey design is based on core stations, which are sampled every year, and other tiers of stations that are sampled as time and resources allow. In 2018 the plan was to have an annual survey, so these stations were reprioritized to encompass 60 core stations. The biggest challenge for this survey is how to deal with untrawled survey stations. In the past these were given a zero density, but the goal would be to provide some estimate for these stations. The Plan Team suggested correlation analysis with covariates (temperature, bathymetry, etc.) and the implementation of the VAST model for this data set.

Functional male maturity is unknown for the Norton Sound RKC stock, although physiological maturity occurs at 50mm carapace length. Borrowing from the study of red king crab around Kodiak, the size of functional maturity could be around 71 mm carapace length (using a similar relationship with the size of functional maturity of females to males). Some data have been collected on chela height to carapace length ratios, but the Plan Team suggested that more data are needed, especially in the smaller size classes (50 – 100 mm).

The most challenging aspect of the Norton Sound RKC stock is the lack of large males in the survey or fishery data. Males above 123mm carapace length drop off rapidly in both commercial and survey data. Currently, the assessment model deals with this by estimating a larger natural mortality for the two largest size classes. However, it is unknown whether these crabs are dying or moving out of the area. Discussion with members of the public provided guesses as to the location of these large male crabs, including nearshore waters - which are closed to commercial fishing and not covered by the typical survey, or movement out of the Sound –either to the west or south.

The final topic covered for NSRKC was data collection from the observer program, both on handing mortality and bycatch composition. The observer program is valuable for being able to track recruitment pulses and estimating retention in the model. However, observer-sampled pots are a small percentage of the fleet, about 1%, and constraints on the small size of NSRKC fishing boats make increasing coverage unrealistic. Jenefer said that recent discussions with the industry have produced the idea of an observer logbook where fisherman could self-report total catch for some pots. It was also suggested from the industry to look at the differences in retention for different pot escape mechanisms – e.g., rings vs mesh. The Plan Team suggested working with the industry to examine pots with closed escape rings to get a better idea of the entire population.

Overall, this was a good discussion on research challenges and improvements, with participation from both the public and Plan Team.

NSSP Plant Tour

On Thursday, January 24, the CPT took a tour of the Norton Sound Seafood Products plant. The Team was provided with an overview of plant activities by Josh Osborne who works there as a processing supervisor. Josh said that during the height of the summer commercial fishery, the plant employs approximately 40 people in the main processing building. Norton Sound red king crab are offloaded at the dock next to the plant and are run through a series of plant operations prior to packaging as either live or frozen product. The plant can hold up to 12,000 pounds of live crab at one time and can output as much as 30,000 pounds of frozen product per day at maximum capacity.

From Nome, live crab are flown to Anchorage, where they are checked for condition and then sent primarily to South Korea, or to a much lesser extent domestic markets. Crab destined for sale as frozen product are split and then graded into two market categories based on shell condition. After cooking, the crab are cooled quickly in a cold water brine bath and are then sealed with a fresh water ice glaze to prevent freezer burn. Almost all of the frozen crab is sold overseas in Japan. NSSP also processes halibut caught in Norton Sound as well as around St Lawrence Island. The plant is also beginning to develop processing capabilities for Pacific cod.

Crab Pot Fishery viewing

NSEDC staff, ADFG staff, CPT members and other interested members of the public were able to take snowmachines offshore onto the sea ice for a demonstration of winter NSRKC fishery operations, including how to cut a hole in the ice and drop a crab pot. Charlie Lean of NSEDC demonstrated core sampling technique and obtained a core that showed striations that appear from freeze-thaw cycles and algal growth within the ice. The Team was exceptionally grateful to everyone that helped to facilitate the excursion.

Wrap up and Items for May CPT meeting

Diana Stram led discussion of planning for SMBKC and the May CPT meeting. Items for discussion include:

- SMBKC assessment and rebuilding
- Tanner crab: Assessment issues for May
- BBRKC: bridging analysis for GMACS application; scenarios for Sept
- Snow crab scenarios for Sept
- Assessment and Catch issues:
- Dockside data sampling and incidental catch/effort reporting, CIF data
- Catch estimation and observer data (determining effort, estimating discards via subtraction method, future assessment data needs)
- Standardizing the method of total catch estimation from observer data for different assessment models (Tanner, snow, AIGKC, and BBRKC)
- Assessment issues
- Crab partial offloads
- Basis for B_{MSY}: Most recent year MMB (Tier 4) or recruitment (Tier 3) across assessments
- VAST: Implications across crab assessments
- Economic SAFE
- Final AIGKC assessment
- Final PIBKC assessment
- CIE review overviews of AIGKC, NSRKC
- Roadmap for GMACS moving forward-strategic discussion of planning