Crab Plan Team report

The North Pacific Fishery Management Council's Crab Plan Team (CPT) met September 19-22, 2011 at the Alaska Fisheries Science Center in Seattle, WA.

Crab Plan Team members present:

Bob Foy, Chair	***(NOAA Fisheries /AFSC – Kodiak)***
Ginny Eckert, Vice-Chair	***(Univ. of Alaska – Fairbanks)***
Diana Stram	***(NPFMC)***
Doug Pengilly	***(ADF&G – Kodiak)***
Gretchen Harrington	***(NOAA Fisheries – Juneau)***
Wayne Donaldson	***(ADF&G – Kodiak)***
Jack Turnock	***(NOAA Fisheries/AFSC – Seattle)***
Shareef Siddeek	***(ADF&G – Juneau)***
Karla Bush	***(ADF&G – Juneau)***
Lou Rugolo	***(NOAA Fisheries /AFSC – Kodiak)***
André Punt	***(Univ. of Washington)***
Bill Bechtol	***(Univ. of Alaska – Fairbanks)***
Brian Garber-Yonts	***(NOAA Fisheries – AFSC Seattle)***
Heather Fitch	***(ADF&G – Dutch Harbor)***
Steve Martell	***(Univ. of British Columbia)***

CPT members absent:
Josh Greenberg (Univ. of Alaska – Fairbanks

Members of the public and State of Alaska (ADF&G), Federal Agency (AFSC, NMFS), and Council (NPFMC) staff present for all or part of the meeting included: Jack Tagart, Brett Reasor, Lori Swanson, Dave Boisseau, Mike Woodley, Rob Rogers, Steve Hughes, Kevin Kaldestad, Anne Vanderhoeven, Pat Livingston, Guy Fleischer, Ray Nomura, Jie Zheng, Bill Prout, Linda Kozak, Scott Goodman, Hunter Burns, Gary Stauffer, Glenn Merrill, Clayton Jernigan and Tom Casey.

The attached agenda was approved for the meeting.

Administration

The team welcomes new member Dr. Steve Martell of UBC.

Agenda: Changes to the agenda include the following: add a discussion of survey catch in assessments (per total catch accounting under ACL amendments) and add 30 minutes each morning to review minutes from the previous day. Thus, each agenda item listed will start 30 minutes later than originally scheduled. *Meetings:* Timing of upcoming meetings and locations are as follows: January NPFMC crab modeling workshop (AFSC) January 9-13, 2012; May CPT meeting (Anchorage) May 7-11; September CPT meeting (AFSC) September 17-21. Further discussion will occur this week regarding stocks to be discussed at the modeling workshop, as well as workshop format.

SAFE report timing: Diana reminded the team and assessment authors of the compressed meeting timing relative to SSC review on Monday. Existing have already been distributed to the SSC, so no changes to assessment are possible during this meeting. However, errors in assessments may be updated for the final SAFE version to be posted on the Council's website in October.

BBRKC EFH update: The CPT was updated on the current status of a discussion paper on the EFH associated with Bristol Bay red king crab. To address the question about defining EFH associated with larval hatching locations AFSC scientists are seeking funding to conduct research in Bristol Bay. To address the validity of existing closure areas and their relative importance as EFH, NMFS scientists are working with industry representatives in groundfish and crab fisheries to mine existing data on crab and catch distributions. An update on this analysis will be available in 2012.

Survey overview

Bob Foy (AFSC) summarized preliminary results from 2011 NMFS survey. The standard 376 survey stations were sampled beginning June 5 in Bristol Bay and ending on July 25 in the western Bering Sea. Resampling occurred in 20 Bristol Bay stations through July 31 due to effects of cold water temperatures on the red king crab reproductive cycle. Additional data collection occurred for nine special projects including: nearshore sampling in Bristol Bay; Tanner diets; pathology; *Chionoecetes* spp. reproductive potential; hemolymph collections for monitoring of bitter crab syndrome and to study the effects of cold temperatures on hormones; genetic sampling for blue king crab stock structure and Tanner/snow crab hybridization; and finally live red king crab were collected for several ocean acidification experiments in the lab (maternal condition/reproductive success and larval condition/survival).

The cold pool did not extend as far to the southwest this year. Compared to 2010, warmer bottom temperatures were present in the southwest, at the nearshore stations along the Alaska Peninsula, and in the shallow waters around Nunivak Island. The 20 stations resampled in Bristol Bay warmed from 2-3°C in early June to 4-7°C in late July.

Abundance estimates and spatial distributions by sex and size were briefly summarized and new maps were presented which showed the percent frequency that individual stations contributed to the overall abundance estimates for each stock. The new maps were well received and a CPT member suggested that it may also be useful to see these changes over time. An additional request was made to update the centroid plots developed by Billy Ernst and to show variance in the proportion of the total survey catch in each grid cell in addition to the most recent value.

Total catch accounting

The team discussed the necessity of including survey catch into assessments for total catch accounting purposes as needed under the revised MSA. The CPT discussed how to incorporate survey or EFP catch data into the ABC process. All future assessments should include removals of historical survey catches. The team discussed how to accomplish this for the EBS trawl survey as well as ADF&G pot surveys. These removals must also account for handling mortality. Trawl survey catch is currently estimated with 100% mortality and pot survey catch was suggested to have a mortality rate of 10 – 20%. The team discussed that GOA data on that pot survey could help inform values for handling mortality for the BSAI pot survey. Bob Foy and Doug Pengilly will work to assess appropriate handling mortality rates for respective surveys and provide this information as well as survey data to authors for incorporation into the subsequent assessments.

Team members noted that these removals could be significant for some stocks (e.g. PIBKC). There are two primary surveys that need to be accounted for: the EBS trawl survey, and the ADF&G pot surveys. Some of the issues to consider are appropriate length-to-weight relationships, estimating historical time series, and a central access point for compiling these data to facilitate access by assessment authors. The team questioned to what extent additional consideration will be necessary for research permits for additional surveys or the need to tie the State permitting process tied to total catch accounting as well as what component of the catch accrues towards this. The team discussed that catch should be accounting for however the OFL is currently defined in for consistency by stock.

The team noted that it will be necessary to continue to have discussions of how best to ensure that all survey catches are included in the assessment and total catch accounting towards the OFL. It will also be important to ensure that catch is in same year as the year assumed when including the survey in the model, for example, 2010/11 survey would be included in the 2011/12 catch model year. Guidance will be sent out this winter in terms of the process for accounting for these catches in the next assessment cycle.

Stock Assessment Review

EBS Tanner crab: Assessment and OFL / ABC recommendations

Dr. Lou Rugolo presented the 2011 assessment for EBS Tanner crab. Although a model for this stock is in development, it has not yet been approved for use in providing management advice. The methodology on which the 2011 assessment is based is therefore essentially the same as that used for the 2010 assessment. However, the B_{MSY} proxy (B_{REF}) is based on the years 1974-80 rather than 1969-80, reflecting a recommendation from the February 2011 stock assessment workshop. The estimate of mature male biomass for 1974-75 is based on recalculated estimates of abundance rather than values from INPFC reports as was the case last year. Stock status is based on the calculated MMB on 15 February 2011 given the availability of catches and discards for 2010/11. The assessment also provided a projection of MMB to 15 February 2012 under a catch equal to the OFL. The author provided estimates of the breakdown of the OFL into catches of mature males, females, as well as the retained catch in the directed fishery for various levels of catch in (and hence bycatch by) the opilio fishery.

The analyst provided OFLs based on three B_{MSY} proxies: (a) 1974-80, (b) 1974-80 where the mature male biomasses are adjusted for catches under the F_{MSY} proxy rather than the actual catches, and (c) 1974-2010. The team agreed to base the 2010/11 OFL on a B_{MSY} proxy defined in terms of the years 1974-80 without the adjustment ("no bias correction" in the assessment report). In relation to the selection of a range of years to set B_{MSY}, the team recommends use of the *status-quo* (1974-80) because there was insufficient information provided in the assessment report to change the range of years recommended at the February 2011 stock assessment workshop. The team **recommends** that the analyst provide all of the information which the team identified in May 2011 related to the selection of years to define B_{MSY}, and rank each B_{MSY} alternative against each source of information. The team identified trends in recruitment as a key source of information which could inform the selection of a range of years to define B_{REF}. Recruitment estimates are not available for Tier 4 stocks, but an index of recruitment could be based on survey catch-rates for pre-recruit size-classes.

The OFL in the summary table (pg. 3 of the assessment report) does not include catches of females. An additional loss of 110t (243 thousand lbs) of females projected under assumptions for female bycatch and discard leads to a total-catch OFL of 1.57 thousand t (3.46 million lbs). The team based its recommendation for an OFL on the highest possible catch in the opilio fishery (42.77 thousand t), although the OFL was virtually unchanged if a lower catch in this fishery is assumed. The retained catch in the directed fishery depends critically on the size of the opilio fishery. The analyst reported that a bycatch in an opilio fishery with a catch of 42.77 thousand t would lead to the entire OFL being taken as bycatch given projected catches in the red king crab and groundfish fisheries. The OFL calculations are based on a predicted catch in the groundfish fisheries (both sexes) of 360t. This value reflects a declining trend in bycatch in the groundfish fisheries. Public comment to the team indicated that the reduced level of bycatch was appropriate for projection purposes owing to changes caused by rationalization of the groundfish fishery as well as shifts in Pacific cod fishery.

1. Future assessment reports should fully describe the process used to infer bycatch of females and the level of catch in the opilio fishery which corresponds to a zero catch by the directed fishery.

2. Future assessments should consider a survey time series which excludes "hot spot" re-samples throughout the time-series for consistency with how the 2011 survey was conducted.
3. Rather than sampling with replacement from the years used to calculate the B_{MSY} proxy, the uncertainty associated with this proxy should be quantified by sampling from the distributions from the survey estimates for each of the years on which the B_{MSY} proxy is based.

EBS Tanner crab: Stock assessment model

Drs Lou Rugolo and Jack Turnock presented the latest version of the TCSAM to the team. Model development started in 2010 and preliminary versions of the model were reviewed by the team and SSC three times during 2011. The authors reviewed and revised the data used in the model, extended the model to implement the suggestions by the team, the SSC and other reviewers, and provided results for several model variants. The team welcomed the new model and results, and noted that the fits to the data were markedly improved compared to those from earlier versions of the model. However, some of the implications of the assessment, specifically the very high fishing mortality rates in some years ($>2yr^{-1}$) and the marked changes in selectivity over time and among the sexes seemed unrealistic. The team **recommended** that revisions to the model should be further reviewed at the January methodology meeting. It made several **recommendations** for further model development:

1. exclude the 1995 retained length-composition data;
2. do not downweight the 1991 female discard length-composition data;
3. quantify the change in mean recruitment between the two "regimes"[1950-1973; 1974-current];
4. consider a scenario in which the β parameter of the growth model is estimated, subject to a prior based on the data for the GOA;
5. document how fishing mortalities are set for bycatch in the opilio and red king crab fisheries before discard catch biomass data are available - ideally move to an approach for specifying these bycatch levels based on the fishing mortality rate estimates for these stocks from their respective assessments;
6. include a table of correlations among the parameters;
7. consider a variant of model 2 in which survey catchability changes as a time-series, but female catchability is a multiple of that for males (37 instead of 72 parameters);
8. examine the sensitivity of the results to uncertainty in the foreign catches (and discards in the foreign fisheries);
9. fully document the priors for *M*;
10. include a likelihood profile for male survey Q in the last period in the assessment, show results for analyses with different values for male survey Q in the last period, and apply the model with the prior on male survey Q in the last period;
11. Include any new information on handling mortality rates from on-going studies by NMFS in groundfish and directed snow crab fisheries;
12. conduct runs in which a) recruitment before 1973 is constant, and b) in which it is selected so that the 1974-80 mean biomass is 30-35% of the unfished biomass – these runs will help the team select a series of years for defining the average recruitment used when computing $B_{35\%}$; and
13. conduct retrospective analyses for the various model configurations.

EBS Tanner crab: Rebuilding analyses

While the stock assessment is not yet capable of providing the basis for projections and hence a rebuilding analysis, the basic structure of the model is appropriate for this purpose. The team noted that catches in the directed fishery are computed east and west of 166^0W given the minimum sizes in these two areas. The current approach is based on different selection patterns east and west of 166^0W and the assumption that future fishing mortality will occur in proportion to the amount of survey biomass east and

west of 166^0W. The approach should be modified so that the catches rather than fishing mortality rates match the assumed split.

In relation to the alternatives for rebuilding, the team noted that current results suggest that the stock should be able to recover to the proxy for B_{MSY} within 10 years with current rates of bycatch in the groundfish and red king crab fisheries (but this needs to be confirmed by the final version of the model). The team **recommends** that further management measures to constrain bycatch in the groundfish fisheries and in the Bristol bay red king crab fishery are not necessary in conjunction with the rebuilding alternatives. The impact of these fisheries bycatch on rebuilding time frames is marginal in comparison to bycatch from the snow crab and directed Tanner crab fisheries. The team **recommends** that the alternatives should be crafted around different years, T_{target}, for recovery to the B_{MSY} proxy and, given a T_{target}, the split of the removals between the opilio and directed Tanner crab fisheries. One of the alternatives should consider the maximum possible catch in the opilio fishery by assuming that future opilio catches are the lower of the maximum permissible ABC and the output of the ADF&G control rules.

The team **recommends** that an analysis of spatial bycatch rates of Tanner crab in the opilio fishery be undertaken with the possibility of alternatives which include spatial closures to reduce Tanner crab bycatch rates in the opilio fishery.

A key component of any rebuilding analysis will be the B_{MSY} proxy. Model output, e.g. the time series of recruitment estimates and estimates of recruits per spawner from the model should provide information needed to set this proxy.

Bering Sea snow crab

Jack Turnock presented results of the eastern Bering Sea snow crab assessment. This model is currently used for setting OFL using the Tier 3 OFL control rule. The assessment includes responses to recommendations from the May 2011 CPT meeting and the June 2011 SSC meeting. Thirteen alternative assessment scenarios relative to a base (Model 0, the Sept 2010 Model) scenario were presented. Alternative scenarios explored various treatments of BSFRF survey data, natural mortality for immature male and female crabs, and natural mortality for mature male crabs. Models 8-10 included new, but not fully reviewed, information on male crab growth.

Changes to data included: (1) side by side tows from the 2010 experimental study; (2) 2011 survey biomass and length frequency; and (3) 2010/11 fisheries catch, bycatch and discard and the associate length frequency data.

Information on snow crab growth was reviewed. The CPT commented on the growth increment data from the Kodiak holding studies of crabs captured in the Bering Sea; although these are assumed to be male only data, the study indicates that both male and sexually immature crab were included.

Assessment results primarily focused on Model 7, where M was fixed at 0.23 yr^{-1} in the model. Model selection was based on the fact that the author does not believe that M can be estimated within the model and that, in cases where M was estimated, the results are not credible based on the data available for longevity. There was some disagreement among CPT members as to how the estimate of natural mortality was derived. The CPT **recommends** that additional investigations are necessary to develop a better prior for natural mortality and the assessment should better specify the derivation of the estimated longevity. For example, simulation studies should be examined to determine if M could be jointly

estimated, reliably. Team members commented that it could also be possible that M is higher than $0.23yr^{-1}$. Based on the model results, there is some confounding between catchability *Q* and *M*, therefore, a prior on *M* implies a prior on *Q* (Table 8; Figure 119 of the assessment report)

The model uses the average recruitment over the entire time series to estimate B_{35}. Model 7 ranks 7th in terms of AIC among the seven model configurations that estimate growth, but the effective number of parameters and the appropriate metric for model selection are unclear. The CPT **recommends** that a retrospective analysis be employed for help with model selection.

Fits to the NMFS trawl survey data are best for model 6, and worst for model 7. Models 8-10, are new, and the CPT has not had an opportunity to examine the new growth information that was used to fix the growth parameters within the assessment model. All of the assessments are robust with respect to estimates of trends in MMB relative to $B_{35\%}$; i.e., the stock is robustly estimated to be above $B_{35\%}$. This indicates that the stock is rebuilt.

The team endorsed the use of model 6 for stock status determination and OFL specification. This model: 1) estimated M; 2) smoothed the BSFRF data; and 3) better fit the NMFS trawl survey data.

Recommendations for next assessment:

1) add parameter bounds to Table 13;
2) add a table of parameter correlations;
3) include a plot overlaying the MMB trajectories for each of the scenarios for easier comparison (similar to Figure 87 but with all the runs);
4) the model description for the likelihood functions for the experimental data is incomplete and needs to be elaborated;
5) fix caption (legend) for Figure 24;
6) develop a more formal and reasonable model selection criterion based on statistical descriptions of the model fit to the data rather than having a zero prior for all models that don't have an M = $0.23yr^{-1}$;
7) provide retrospective estimates of Q and $B_{35\%}$; and
8) conduct further work on estimating M and the associated confounding of M, and growth with Q.

ABC deliberations:

The Team **recommends** an ABC less than the maximum permissible. This is due to multiple sources of uncertainty in the OFL that are not reflected in the model-based estimate of within-model uncertainty, σ_w, employed in the maxABC control rule. These uncertainties include: estimating M, the implications of the yet-to-be-reviewed new growth data, and structural uncertainty. These sources have not been fully considered in the calculation of maxABC. The team also expressed concern that the uncertainty in recruitment, as well as the declining trend in recruitment (indicating that biomass is likely to drop below B_{MSY} in the short-term), provides additional rationale for an ABC < maxABC.

The Team had difficulty in determining the buffer between the OFL and the ABC that appropriately addresses uncertainty. The Team considered many options for an ABC <maxABC permissible including the following options:

1) a default 10% buffer from the OFL;
2) use of the OFL from model 7 as an ABC;

3) using the recommended total uncertainty (i.e., σ_w and σ_b from the EA for amendment 38) to estimate a buffer using a P* of 0.49; and
4) using the ratios of OFL from model scenarios (e.g., use ratios between different model scenarios) to define a range of values to be used as a multiplier (buffer) for the ABC.

Despite extensive discussion of these items, the CPT was unable to recommend a specific ABC but wishes to identify the following information on uncertainty that should be captured in an ABC: a) using *M* fixed at prior value would have led to a lower OFL value; and b) use of the new growth data (which has not yet been reviewed in much detail) would have resulted in a lower value. However, the Team recognized that given the uncertainty noted, risk tolerance is required to choose an appropriate buffer based on the model results presented.

St. Matthew blue king crab

Bill Gaeuman presented the St. Matthew blue king crab stock assessment. He explained the methods used in the survey-based assessment. The estimate of biomass is high relative to historic abundance and may be at peak abundance. The team noted that the new assessment now includes all sources of fishery mortality. The assessment indicates that groundfish bycatch mortality is largely inconsequential (Figure 9). The author noted that approximately 48% of trawl survey catch occurred in one station, and that the ADF&G survey, fishery, and groundfish bycatch all occur in spatially different areas.

The author clarified that the OFL in the assessment was calculated for mature males only. The team discussed calculating the OFL in this manner and how to reconcile this with evaluating whether overfishing occurred. The team requested that the author recalculate the OFL to apply to total males. The OFL is not a total catch OFL because the OFL estimate does not include females.

The team discussed the years used to calculate $B_{MSYproxy}$ and the author recommended the period from 1989/90 to 2009/10. The team **recommends** that the assessment provide further justification for this choice of this period at the May 2012 meeting.

The author recommended an ABC below maxABC, but did not provide a recommended ABC amount. Unaccounted for scientific uncertainty for this stock relates to the estimate of natural mortality, and that the survey does not cover the stock distribution (catchability) or the location of fishery. The trawl survey is a poor indication of abundance andmay underestimate abundance. However, how the abundance index in the survey relates to the crab caught in the fishery or the total population is uncertain. The team discussed how to use this uncertainty to calculate an ABC because there is no expectation for information or analyses to resolve these uncertainties in the near future. As a result, the team **recommends** a 10% buffer for the ABC.

St. Matthew model discussion: Bill Gaeuman presented the recent developments in the stock assessment model for St. Matthew blue king crab and requested the team's input on the next steps. The team noted that the model description is very clear and well written which makes review easier. The team discussed the equations and requested clarification on a few of the parameters. The author noted that, after the work in reconstructing the model, the new model results and formulation are similar to the original model which provides confidence in the historical use of the model for specifications purposes

The author explained the changes in the model from the version the team reviewed in May 2011, including removing shell condition and decreasing the weight of the pot survey data relative to trawl

survey data. The team discussed the weighing of the different data sources; pot survey, trawl survey, and observer data (Table 5). The author notes that one (or both) of the trawl and pot surveys may not be representative of the population.

The team made **recommendations** to adopt a standardized weighting procedure based on CVs for indices and catch biomass, to provide several model configurations [along with an author-preferred model] for evaluation by the team, and to provide diagnostics to evaluate the choices. The issues of effective sample size and survey representation should be evaluated. The team noted that the report from the team's modeling workshop in 2009 (and annual SAFE guidelines) provide additional guidance for addressing these issues.

The team discussed whether or not this model should be reviewed at the January modeling workshop or at the May 2012 CPT meeting. The team intends to review the model in May for possible use in stock status determination in the 2012/13 assessment cycle.

Bristol Bay red king crab

Jie Zheng presented the stock assessment for Bristol Bay red king crab. Major changes to the assessment from September 2010, aside from the updating with data from the 2010/11 fishery year and the summer 2011 trawl survey, involve the use of assessment model Scenario 7ac, which is the Scenario 1 model from September 2010 with incorporated recommendations from the CPT in September 2010 and May 2011. Model Scenario 7ac assumes 3 levels of molting probabilities, incorporates the BSFRF biomass data, estimates effective sample sizes, estimates proportions in initial years, and (with respect to the "Bristol Bay retow data") uses only the standard survey data for males and only retow data for females for stations where retows took place. Only results for Scenario 7ac were presented.

This model also assumes that natural mortality is $M=0.18yr^{-1}$ for both sexes, regardless of size and shell condition, over the 1968–2011 period that is modeled, except that it also estimates additional naturalmortality for 1980–1984 for males, 1980−1984 for females, and 1976−1979 plus 1985−1993 for females. Additional natural mortality for males during the 1976−1979 plus 1985−1993 period was not estimated because previous model runs suggested that male natural mortality was not higher during this period. As in previous assessment reviews, the CPT asked if those periods of increased natural mortality could be related to some physical or biological mechanism or were only chosen to improve the fit because there is concern that estimable parameters are added to the model to fit the available data, without supporting evidence from outside the model. The CPT felt that the authors' response to the May 2011 comment raising this question was speculative; the authors suggested that increased mortality during those periods could be due to unknown fishing mortality or to increased predation, but offered no supporting evidence. The CPT **recommends** that the authors summarize available data on predation/mortality for the May 2012 meeting so that the CPT can assess the justification for invoking increased predation during the periods concerned.

Questions and comments concerning the use of the retow data and the standard survey data in the retow area were made by the CPT and the audience. The possibility of using the retow data as a separate survey series was raised. Zheng said that, given that the retows are performed only in unusual years (mainly unusually cold years), they are not a survey in same was as the standard survey, and hence do not represent a time-series. There were also questions on changes in densities between standard survey and retows in the resurvey area. Densities of females were markedly higher in the retow stations. There had

been speculations that the increase in female densities was due to a large-scale redistribution of females from nearshore areas outside of the surveyed area into the resurveyed area. A nearshore survey performed early during the 2011 survey provided no evidence that females were aggregated in the nearshore area until after the standard survey (a report on the nearshore survey will be given later in the meeting). Rugolo suggested that the difference in female densities between standard and resurvey tows was due to a small-scale patchy, distribution of females with the survey area and noted that females in pre-molt and pre-mating become highly aggregated (mounding), which would result in a low probability of encounter of females by the widely-spaced tows during the standard survey; after molting/mating, the females spread out and encounter probabilities for the survey become higher. Following discussion of the mechanism for effecting the observed increase in female densities in the retow survey, the CPT **recommends** that in May 2012 the assessment authors and CPT settle on the proper use of the standard and retow survey data for males (i.e., use only standard tows, an average of the standard tows and retows, or only retows) and provide a justification for the choice.

Zheng reviewed the trend in the 2011 survey data. The area-swept estimates for mature females and, especially, for mature males declined from 2010, as would be expected given the poor recruitment inferred from recent surveys; the decline for mature males is larger than for mature females and is more than expected. A large catch of juvenile males and females in eastern Bristol Bay is a hopeful sign. However, that large catch is due to only one tow, so has high uncertainty.

Zheng reviewed the results of the current estimates from the model Scenario 7ac. Differences between the 2010 assessment and current scenario 7ac were noted: Lower total biomass, mature male biomass, and mature female biomass peaks for scenario 7ac than in the 2010 assessment in the peak years of late 1970s/early 80s.

The model fit to the survey size frequency distributions was reviewed. The "bubble plots" for the size frequency distribution residuals looks adequate for males, but there is a problem for the fit of the female size distribution at larger sizes in early survey years. There was a question about the 1984 survey size distributions for males and females; there is a marked discrepancy between the model fit and the peak in the lower end of observed size distribution. Zheng explained that the peak in the observed size frequency distribution was due to a single hotspot tow. The model also fits the retained catch and directed fishery bycatch size frequencies well for males. The model doesn't fit the bycatch size frequencies for females well, however; a result attributed by Zheng to the hit or miss nature of the female bycatch.

Zheng noted a slight negative trend through time in the standardized residuals of total biomass.

Zheng presented a retrospective analysis of the Scenario 7ac estimates of MMB and noted the clear and evident downward bias (sequentially adding each terminal year results in a lower biomass estimate for recent years). The CPT emphasized the importance of this trend**,** particularly when judging the uncertainty in the estimate of recent years' MMB; i.e., from this trend, it would be reasonable to expect that next year, should the declining survey trend continue, the model will estimate the 2011 MMB to be lower than it is presently estimated.

Zheng provided a review of information relevant to choosing the reference period for recruitment used to estimate $B_{35\%}$. Much of what was presented by Zheng was not in the assessment report that was available for review. Zheng stated that if we believe that the 1976/77 regime shift had a strong effect on the stock's productivity, estimates of recruitment and productivity from after 1983 (from within the period the 1984−2011) should be used; if not, the 1969−1983 period should be used as, or be included in, the reference period. The choice is important: the stock would be considered overfished and at a level necessitating closure of the fishery if 1969−1983 is used as the reference period, whereas the stock would be estimated to be above the proxy for B_{MSY} if 1984−2011 or 1995−2011 is used. Zheng showed that the estimates for annual recruitment during 1969−1983 were much higher than the mean recruitment during 1984−2011 (a t-test is significant). Likewise, the mean of annual productivity (R/MMB, appropriately lagged) was much higher for 1969−1983 than for 1984−2011 (statistically significant). Finally, Zheng showed that the stock-recruit relationship shows a difference between the pre-1984 and post-1983 recruitments. Zheng then proceeded with a presentation (also not in the assessment report) that showed that the differences in pre-1984 and post-1983 recruitment/productivity align well with effects that can be attributed to the 1976/77 regime shift: differences align well with the time series of bottom temperatures and PDO. The differences in recruitment also align with a distribution change in mature females from between the 1970s to the 1980s-through-present, which would have an effect on recruitment (the earlier distribution of mature females would favor larval drift to the "RKC nursery area" whereas the larvae may be carried away from the nursery area with the present distribution of mature females and warmer years. Finally, the differences align well with the time series of biomass of predators (cod and yellowfin sole) and with the possible effects of the regime shift on the prey availability to red king crab larvae. In summary, the effects of the 1976/77 regime shift − spring bloom composition and timing, shift in geographic distribution of mature females, predation on juveniles – support the use of a post-1983 recruitment when computing $B_{35\%}$.

The CPT commended the authors on the presentation pertaining to choice of reference period; it is exactly the sort of information that the CPT had requested as background for choosing reference periods. However, the CPT noted that this information − which is key for choosing the reference period − was not in the assessment report that was reviewed by the CPT and distributed to the SSC for their review. This information should be seen by the SSC; accordingly, the CPT decided that the key written information from Zheng's presentation pertaining to the regime shift and recruitment period will be provided as supplemental information to the SSC for their review next week. The CPT also questioned why, given what was presented, the assessment used 1995−2011 as the reference period rather than 1984−2011. Although average recruitment during 1995−2011 is extremely close to that during 1984−2011, the later period is more justified on the basis of what Zheng presented. Moreover, being as the stock is estimated to be close to $B_{35\%}$ small changes in the reference period become important for stock status determination, so the best, most-justifiable period should be used. The CPT **recommends** that 1984−2011 be used as the reference period in the 2011 assessment, rather than 1995−2011, necessitating some changes to the stock status tables. Additionally, the CPT **recommends** that a more detailed analysis of the choice of the reference period that includes the effects presented relative to assumed time lag until recruitment be prepared for the May 2012 CPT meeting for review given the stock is estimated to be close to B_{MSY}.
Zheng ended with some projections showing that we should expect declines in catch through 2015. Beyond that, an increase after 2015 may occur, contingent on whether the high catch of juveniles in the 2011 survey reappears in future surveys.

The CPT noted that the estimates of recruitment may be confounded with the assumed periods of higher natural mortality in model Scenario 7ac, which may, in turn, have an effect on the estimated trend in productivity that is used for determination of the reference period and estimation of B_{MSY}. The CPT cannot predict at this time what, if any, the variable-M assumption has on the estimates and estimated trend in recruitment and productivity. The CPT **recommends** that an analysis be prepared for May 2012 that includes a constant-M model (i.e., no periods of increased natural mortality) so that the effect of the Scenario 7ac mortality estimates on the estimates of and trends in recruitment and R/MMB can be assessed; overall, it is **recommended** that a constant-M always be included as one of the scenarios in assessments for this stock so that the effects of, and need for, the variable-M models on the stock assessment can be assessed.

Finally, the CPT noted that the total catch column in Table 1 doesn't add up with the columns to the left; the CPT **"recommends"** that this be corrected.

ABC determination

Zheng presented the estimated probability distribution for the OFL estimate and the maximum ABC computed according to the "P* =0.49" ABC control rule. The maximum ABC (19.35 million pounds, or 8.78 thousand t) is essentially equal to the OFL (19.39 million pounds, or 8.80 thousand t). The CPT was uncomfortable with recommending the maximum ABC because it believes that the estimate of within-model variance is unrealistically low and does not capture the full extent of the uncertainty in estimate of OFL. Specifically, the assessment is based on pre-specified values for survey Q and, for several years, natural mortality. Further estimates of recruitment may be confounded with the assumed periods of higher natural mortality in model Scenario 7ac, which may, in turn, have an effect on the estimated trend in productivity that is used for determination of the reference period and estimation of B_{MSY}.

The downward bias revealed by the model 7ac retrospective analysis suggests uncertainty in the present estimate of MMB. If the unexpectedly sharp downward trend in the survey results for MMB in 2011 is real (and not due to survey error in 2011) and the retrospective pattern in MMB estimates persists, it is reasonable to expect that next year's estimate of the 2011 MMB will be lower than the current estimate. To address this uncertainty, the CPT **recommends** that the ABC for 2011 be set by using the average percent bias (2011 assessment estimate versus terminal year assessment) in the MMB estimate over the last five years. The average percent bias estimated by linear regression (estimated slope for regression of terminal year estimate on 2011 assessment estimate = 0.817) resulted in an 18.3% buffer on the OFL. Hence, the CPT's recommended ABC is,

ABC = 0.817xOFL = 0.817*19.39-million pound = 15.84-million pounds, or 7.19-thousand t.

PIRKC assessment

Bob Foy presented the 2011 PIRKC SAFE. The team discussed the recommended change in years used in the calculation of the $B_{\mathbf{MSY\ Proxy}}$ from the status quo (1991-2011) to a revised period, 2000-2011. The team reviewed results of various analyses conducted by the author following the recommendations of the CPT (May 2011) in establishing criteria to be used in estimating a $B_{\text{MSY Proxy}}$. No evidence was no found in the analysis to support a regime shift as the basis of truncating the MMB history to 2000-2011 to estimate $B_{\text{MSY Proxy}}$, nor to demonstrate a change in the reproductive potential of the stock between the 1991-2011 and 2000-2011 periods. The brief exploitation history of this stock makes it difficult to

identify a period in the MMB history that could meet the criteria of the CPT in estimating the $B_{MSY\ Proxy}$. The team recommended maintaining the status quo time period of 1991-2011 in the calculation of $B_{MSY\ Proxy}$.

The team discussed the use of the 3-yr running average in calculating the $B_{\mathbf{MSY\ Proxy}}$. It was suggested that the 3-yr average be used in estimating MMB at mating in any year t, but that the actual observed MMBs in each year over the reference period should be used to calculate the $B_{\mathbf{MSY\ Proxy}}$. This 2011/12 assessment will use the 3-yr average in estimating the MMB at mating in 2011/12 as well as the 1991-2011 average of the 3-yr running average MMBs in the calculation of the $B_{MSY\ Proxy}$. This issue will be considered in more detail by the team in May 2012.

The team discussed that the simple 3-yr average used in this assessment is problematic since it does not consider the precision in the annual MMB estimates. As calculated, the 3-yr average equally weights each of the three MMB estimates regardless of its level of its level of precision. For example, if one estimate of MMB used in the average is highly imprecise, then three consecutive indices of MMB based on the 3-yr average will be contaminated until this highly imprecise estimate drops out of the calculation. In the case of a declining stock, the 3-yr running average would be biased high and underestimate the magnitude and rate of decline.

The running 3-yr average MMBs calculated in this assessment was based on the current year and the previous two years. The team recommended that the 3-yr average should be calculated based on the current year, the previous year and the following year, not the current year plus the preceding two years. These calculations will be corrected for the next assessment. The team also discussed alternative methods for deriving a 3-yr average index of MMB – e.g., an average weighted by the inverse of the coefficients of variation of each annual MMB, a lowess smoothed index, and a weighted index in which the weights reflected the relative importance of the years in the average. This issue will be considered in more detail by the team in May 2012.

The team agreed with the author's ABC calculation, and the rationale provided in the assessment for recommending an OFL multiplier of 0.78(based upon the Status quo $B_{MSYproxy}$ years). The general issue of uncertainty in this assessment was discussed. It is unlikely that we'll have better estimates of parameters in this assessment given the data quality. The team concurred with the author on the recommendation for an ABC less than the maximum permissible.

PIBKC assessment

The author presented information relative to criteria for determining the time period for estimating the B_{MSY} proxy discussed at the May 2011 CPT meeting. Exploitation history, surplus production and ln(recruits/MMB) were examined. The author recommended the period 1975/76 – 1979/80 for estimation of the B_{MSY} proxy (recalculated during the meeting as 20,138 t). The B_{MSY} proxy in the September 2010 assessment (4,210 t) was estimated using the time period 1980/81 -1984/85 plus 1990/1991-1997/1998, i.e. excluding the period 1985/1986-1989/1990.

Based on the information presented by the author there was no evidence of a change in reproductive potential of stock. The highest exploitation rates and declines in the stock occurred in the 1980/81-1984/85 period, which was included in period used to specify the B_{MSY} proxy at the September 2010. Since there are no catch or biomass data before 1975, the higher biomass estimates in 1975-1979 are difficult to interpret relative to what true B_{MSY} might be. After much discussion the CPT recommended adding the 1975-1979 biomass data to the time series for estimation of the B_{MSY} proxy. The recommended B_{MSY} was estimated at 4,493 t using the time period 1975/76-1984/85, plus 1990/91-1997/98.

Groundfish bycatch occurs mostly in the Pacific cod fishery, followed by the yellowfin and flathead sole fisheries. Most bycatch results from pot fisheries. Currently bycatch from area 513 is included. In future, groundfish bycatch will be available by ADFG statistical areas.

Current MMB is estimated using the 3 year average survey MMB (2009, 2010 and 2011). The CPT recommends examining different methods of estimating the average MMB using a weighted average of the last three years or a smoother that accounts for variances of the individual years. The team notes that the author calculated the average MMB using a running mean rather than a mean which is centered on the year for which an estimate is needed. This should be rectified for the May 2012 assessment but the results and conclusions of the current assessment are robust to changing how the average is computed.
The groundfish bycatch time series has been re-estimated to account for 'unidentified crab" during the time period 1999-2005. This issue was highlighted to the Team in 2009 and bycatch estimates re-estimated at that time. However the assessment author did not provide historical re-estimated catch estimates in the previous assessment. The result of these re-estimated catches result in lower bycatch estimates in these years than previously reported. As a result the average catch calculation over the same time frame for the OFL calculation in previous years results in a lower average. The team noted that groundfish bycatch (0.18 t in 2010/11) has been low compared to the recommended OFL (1.16 t).

The team concurred with the author's recommendation to set the ABC below the maximum permissible Tier 4 maxABC by using a 10% buffer from the OFL consistent with the Tier 5 calculation for this OFL for this stock based on its stock status.

Aleutian Island Golden King Crab Model Based Assessment

Siddeek updated the CPT on model development to move this stock out of Tier 5 average catch management. The model has been re-formulated and cleaned-up observer data were included. The author reviewed responses to CPT and SSC comments. One aspect of note was the author's implementation of asymptotic selectivity. The CPT **recommends** that dome-shaped selectivity should also be examined for the January 2012 model draft.

When asked about inconsistencies in the time series of observed retained data, Pengilly clarified that observed retained represents dockside samples whereas observed discarded represent at sea observations (a shorter time series). In addition, at-sea observers don't always sample slightly undersized crab that may be subsequently delivered. An observer effect may also be indicated in bubble plots of residuals (e.g., Fig 14). The observer and retained data should be treated similar to the EBS Tanner assessment, namely, the model is fit to the catch length-compositions for the retained catch (from dockside sampling) and to the length-compositions for the total catch (from observers) as this eliminates effects of observers assigned animals as discarded when they are actually landed. Fishery retained and bycatch CPUE were standardized by separating CPUE into two time periods and ignoring soak times longer than the 95th percentile (≥456-hr before for 1985–2004 and ≥936 hr for 2005–2010). The public expressed concern about long soak times skewing the assessment owing to reduced catch from bio-twine degradation. Given the need for the bait to be effective, it was further noted that survey data was limited to soak times of 30–140 hrs. The authors could examine model sensitivity to further restrictions on long soak times.

The author discussed optimization scenarios and weighting factors for the EAG (Table 2) and WAG (Table 9). The CPT **recommends** the listing of sigmas instead of absolute weights as being more informative for factors such as L_{50} and β. Also, the team **recommends** specifying weights for the penalties on L_{50} and β from the standard errors from the analysis on which the estimates for these parameters were based. Three scenarios were examined, differing by weighting applied to pot survey CPUE, mean CPUE ratio, molt L_{50}, and β components of the negative log likelihood functions. The CPT discussed some of the model likelihood components. In particular, there may be an excessive number of

penalty functions for aspects that might not be justified. An example is the mean CPUE penalty ratio (Eq. 37) for the pot fishery; because pot fishery CPUE is already incorporated into the model (Eq. 12), the CPUE penalty ratio represents additional inclusion of the same data. There was also substantial discussion about the QQ parameters. Many lambdas are listed in formulas, but their values are not presented in tables. The authors should be fitting the model to the data and not using lambdas to simply improve model fit. For example, Eq. 18 estimates catch, but another likelihood function treats catch data as being without error. The CPT was concerned by the very high weight (effectively a CV of 0.05 assigned to the estimates of legal male biomass). If such estimates (or preferably the associated exploitation rates) are to be included in the assessment, they should be weighted by their estimation variance. Also, care should be taken to ensure that the estimates pertain to the whole stock and not just a subset of the population. In examining parameter estimates, the CPT noted many estimates appear to be constrained, or nearly so, by bounds, particularly for the EAG (Table 4 and negative Hessian gradients in Table 7); the author noted that many bounds had been expanded. The CPT **suggested** expanding bounds or reducing weighting factors.

The CPT also noted:

1. large confidence intervals in early time series discarded CPUE data (Fig. 4b, perhaps due to small number of potlifts);
2. poor fit to fishery CPUE trend in post-rationalized years (Figs. 4a and 26);
3. poor fit to pot survey CPUE (Fig. 4c);
4. extremely good fit to retained catch length frequencies (Fig. 5);and
5. poor fit to groundfish discards for small crab sizes (Fig. 7).

There was insufficient time to provide a full discussion of the WAG. The CPT **requested** the model be updated and brought to the January 2012 workshop, with a preliminary distribution to André and Steve.

Crab B_{MSY}

André Punt presented his current NPRB project: "Evaluating methods for determining overfishing levels for Bering Sea and Aleutian Islands crab (BSAI) stocks". The project will run from September 2011 to February 2013, with the following three objectives: (a) develop and evaluate proxies for estimating the productivity of crab stocks (i.e. F_{MSY}), (b) assess how well simple assessment methods can estimate time-series of mature male biomass and hence proxies for F_{MSY}, and (c) develop and evaluate methods for estimating the reference biomass B_{ref}

For objective a, André evaluated two methods for estimating B_{MSY} and F_{MSY} based on estimated surplus production using simulated data. He then applied one of the candidate methods to actual data from Bristol Bay red king crab, EBS snow crab, and EBS Tanner crabs. He will be applying the surplus production model to all surveyed crab stocks with abundance data (in addition to the above three stocks, Pribilof red and blue king, St. Mathew blue king, and Norton Sound red king crab).

Regarding objective b, André Punt is fitting a simple five-size-class model to male-only data and estimating all management parameters as well as producing a number of diagnostic statistics. The candidate stocks are: Bristol Bay red king, EBS snow, EBS Tanner, Pribilof red king, Pribilof blue king, St. Mathews blue king, Aleutian Islands golden king, and Norton Sound red king crabs. Andre plans to compute $F_{35\%}$ and compare biomass projections under $F_{35\%}$, M, and the current B_{MSY} proxy (γM) for Tier 4 stocks. The final outcome of this project is to address the question whether $F_{35\%}$, M, or a multiple of M(γM) is a good proxy for F_{MSY} for these crab stocks. André plans to complete the simulation evaluation by February – March 2012 and present initial final results for all objectives at the May 2012 CPT meeting.

Ecosystem Considerations

Liz Chilton provided an overview of changes to the Ecosystem chapter for the SAFE. These changes primarily include supporting documentation on the ecosystem indicators section of the document. The CPT complimented the authors on the document and are enthusiastic about the possibilities for ecosystem information can be included in crab management. Information requested by the team to be added to the May 2012 Ecosystem chapter includes the following.

- Include historical information on sea surface and/or air temperature information throughout the Bering Sea (previous to the M2 mooring) that go back as far as possible, ideally to 1969.
- Include information from Aydin's group on stomach content analysis with regards to crab. Encourage Aydin's group to examine stomach contents from observers to get data from other seasons.
- Provide a time series of PDO, sea ice, benthic production, and other environmental indices, for as long a time period as possible, in a format that can be available for stock assessment authors to correlate these indices with crab population dynamics.
- Refine information on benthic productivity to develop an indicator of benthic productivity, including spatial variation.
- Consider spatial information on ecosystem indicators.
- Discuss and justify time lags used in this document.

In the future the final Ecosystem chapter will be produced in May so that stock assessment authors can include this information in stock assessments and analysis for September.

Bristol Bay Nearshore Survey

Scott Goodman (BSFRF) and Liz Childers (NMFS) provided an overview of the joint NMFS-BSFRF Bristol Bay RKC nearshore trawl survey research results from Summer, 2011. Liz reviewed the sampling design and study implementation, noting that the survey employed standard survey and sampling protocols, differing principally from typical surveys by extending the sampling area with additional nearshore stations to investigate whether the standard survey is missing large concentrations of crab in nearshore areas. Scott discussed survey results and presented figures depicting survey catch densities spatially and with respect to sea temperature measurements, noting that the survey did not find higher densities in south of survey area, contrary to expectations, and did not catch many mature females. Scott also noted the relatively high sea temperatures during the survey time period, which limited the utility of the survey in identifying an association between RKC movement nearshore in response to sea temperature.

The CPT discussed use of the survey results in the BBRKC stock assessment. The particularly high incidence of small (<65mm) juvenile females associated with a single tow was discussed, and it was noted that the BBRKC stock assessment had not incorporated the survey data for crab in that size range. Jack questioned whether the survey results were affected by net performance in nearshore benthic conditions and recommended investigating potentially systematic differences in female catch incidence, e.g., in leg 3. Bob appealed to CPT members for recommendations regarding the utility of replicating or modifying the survey in the future, noting that two research questions suggested/left unanswered by the

study findings were 1. what is going on during the regular survey with respect to juvenile female, and 2: are there crab nearshore in cold water years? No additional recommendations were made by the CPT.

Economic SAFE

Brian Garber-Yonts provided a brief summary of economic status of fisheries and a walk-through of the economic section of the SAFE. Currently the economic chapter focus is on summarization of fishery economics (employment, labor income, and wholesale and ex-vessel values) over the past five years and not based on research findings or projections, though there is effort for future reports to include economic projections. Catch and earnings data are taken from fish ticket and COAR data. Author clarified that revenue is based on FOB (Alaska) from COAR data. The CPT recommends adding evaluation of expenses, such as product shipping and vessel fuel costs. The author has been working on obtaining this information, however such data is difficult to obtain and hopefully will be more accessible in the future. The CPT recommends that a balance between a brief summary of economic trends as well as a detailed discussion should be provided.

Increased prices in recent years have somewhat offset the economic effects of lower harvests. The CPT noted that the prices in 2010 went up for Bristol Bay red king crab but decreased for Bering Sea snow crab. Data is presented by calendar year, not fishery year. COAR data is released on a calendar year basis and is not available until well after the calendar year is over. The CPT recommends an estimate be provided from available data from the most recent fisheries that can be updated later; the CPT is more interested in economic trends than exact values.

Wholesale values are more variable than ex-vessel values; author noted this is because the processing section involves varying markets and products. Snow crab values are more based on Canadian snow crab then Bering Sea snow crab because of Canadian production is vastly higher than Alaskan snow crab production. CPT noted that Aleutian Islands golden king crab values are more varied than in other fisheries, author stated that this is likely more volatile because it is a relatively small fishery. Author noted the difficulty of reporting catcher-processor vessel values due to confidentiality issues involved with there being only five catcher-processors in the Bering Sea-Aleutian Islands crab fleet, and is working on ways to pool the catcher-processor data with other sectors, however permission may be needed from catcher-processors to disseminate some confidential information.

A future workshop is planned that will address improving data presented to be most useful. A potential SAFE document containing economic statuses of all Alaska fisheries will also be discussed at the workshop. The author noted that work is being done to streamline production of the economic SAFE chapter to provide for an earlier distribution date.

The CPT appreciated receiving the report and recommended attaching the summary provided as an appendix to the CPT report rather than including in the SAFE introduction at this time as it was not received in advance such that that team could fully review and discuss the material prior to including in the SAFE report. The team intends to include this type of information in the introduction to next year's SAFE report.

New Business

Model workshop

The Council has scheduled a crab modeling workshop for January 9-13, 2012 at the AFSC. This workshop will involve participation from crab and groundfish stock assessment authors, CPT members, SSC members and other invited participants. It will be hosted by the Council and open to the public. Steve Martell will chair the workshop and work with Council staff to produce the recommendations report from the workshop.

The team identified the two highest priority stocks for consideration at the workshop as Tanner crab and AIGKC. The format of the assessment review is intended to be a split-format review of both models. Model documentation and code must be provided at least 2 weeks in advance of the meeting (week of December 12th), with the authors expected to come to the meeting with a series of scenarios and questions for consideration at the workshop. Models are intended to be run real-time during the meeting to best facilitate feedback and problem-solving during the workshop week.

The workshop will also include a half-day meeting and discussion of the OFL pdf workgroup to establish a set of guidelines for estimating the pdf of the OFL for purposes of setting the maxABC according to the Council's maxABC control rule. Diana will coordinate with the 'pdf workgroup' previously identified to prepare for the workshop discussion.

Steve and Diana will work together to lay out a description of the overall modeling workshop objectives and draft agenda to circulate to the participants and to post on the Council's website.

Total catch OFL white paper

The team requested that Doug Pengilly provide a document to the CPT in May regarding the issues in establishing Tier 4 total catch OFLs and the allocative versus policy implications of doing so. Doug will work with stock assessment authors to compile the relevant issues, referencing the work done in the EA for amendment 24 which provides the rationale for the current use of a total catch OFL for all stocks. This paper will be distributed to the CPT prior to the May meeting as well as to the SSC for their consideration.

May meeting documentation and expectations for models

Full assessment reports will be provided in May for the AIGKC and 3 Tier 5 stocks. Note that the AIGKC assessment will include both the proposed model-based assessment as well as the current Tier 5 formulation. White papers describing developing models are to be prepared for the following stocks: Tanner crab and SMBKC. A white paper describing alternative methodologies for weighted averaging for the surveyed stocks such as the Pribilofs will be prepared for discussion and recommendations on the approach for the 2012 assessments at the May meeting. Any other major changes in assessment models or methodologies should be discussed at the May meeting with discussion papers prepared in advance of the meeting.

Other issues

Pribilof Island red king crab stock: The author highlighted that the current MMB/B_{MSY} ratio is 0.501. The team discussed the potential that the estimated survey-based MMB for this stock next year could drop it below MSST based on one survey data point. The team discussed the need for careful consideration of the year sets for these survey-based stocks given the potential ramifications of the time frames on the perception of stock status. This will be discussed further at the May 2012 meeting in conjunction with updated documentation and discussion of the B_{MSY} criteria.

Membership: The team discussed membership of the plan team and the role of economic participation on the plan team. The team would benefit from increased involvement of the team economists in discussions and appreciates the input provided by them at the plan team meetings. The team encourages all members to prioritize their scheduling such that they are able to participate in the entire plan team meeting, while understanding that work-related conflicts may preclude participation at times.

The meeting adjourned at 5pm Thursday September 22.

North Pacific Fishery Management Council Crab Plan Team Meeting

September 19-22, 2011

AFSC, Seattle WA

DRAFT AGENDA 8/17/2011 vers

Monday, Sept 19		**Traynor Room**
9:00	**Administration**	• Introductions, approve agenda, SAFE assignments, update on model workshop January 2012, review scheduling for May/September 2012 meetings, BBRKC EFH update
9:30	**Survey overview**	• Results of 2011 summer survey
	Break 10:30-10:45	
10:45	**Tanner crab**	• Final assessment, OFL and ABC recommendation, update on model progress, discussion of rebuilding plan alternatives and time frame for analysis
Noon		Lunch
1:00	**Tanner crab (cont).** Break 3:00 – 3:15	
3:15	**Snow crab**	• Final assessment, OFL and ABC recommendation
Tuesday, Sept 20		
9:00	**Snow crab (cont as necessary)** Break 10-10:15	• Final assessment, OFL and ABC recommendation (cont)
10:15	**BBRKC**	• Final assessment, OFL and ABC recommendation (cont)
Noon		Lunch
1:00	**St Matthew BKC**	• Final assessment, OFL and ABC recommendation; model description review
	Break 3:00-3:15	•
3:15	**St Matthew BKC (cont)**	• Final assessment, OFL and ABC recommendation; model description review
4:00	**PIRKC**	• Final assessment, OFL and ABC recommendation
4:45	**PIBKC**	• Final assessment, OFL and ABC recommendation
Wednesday, Sept 21		
9:00	**PIBKC (cont as necessary)**	• Final assessment, OFL and ABC recommendation (cont)
9:45	**Ecosystem Considerations** Break 10:15-10:30	• Review ecosystem indicators, finalize introduction section
10:30	**Economic SAFE**	• Review chapter, review/revise summary document (for inclusion in SAFE)

11:15	**AIGKC**	• Model review
Noon		Lunch
1:00	**AIGKC (cont as necessary)**	• Model review
2:00	**Crab B_{MSY}** Break 2:45-3:00	• Update on UW crab project; broader discussion of Bmsy proxy criteria and time frames based on results of current assessments and guidelines for upcoming assessment cycle
4:00	**BB nearshore survey**	• NMFS/BSRFR nearshore Bristol Bay survey overview

Thursday, Sept 22

9:00	**New business**	• Model workshop (January 9-13 AFSC): selection of stocks for review, format of workshop, other items for discussion (pdf of OFL)
9:30	**SAFE report**	• Finalize introduction sections
Noon		Lunch
1:00	**SAFE report (cont) /CPT minutes**	• Finalize introduction sections • Finalize minutes by section
5:00	Break 3:00 – 3:15 Adjourn	

Attachment: **Economic Status of the Fishery: Summary of economic conditions in the FMP crab fisheries**

The BSAI crab fisheries managed under the NPFMC's crab FMP are currently prosecuted by a fleet of approximately 100 catcher vessels and five catcher processors, and landed principally at 18-20 processing facilities throughout the region. Across all fisheries managed under the NPFMC's crab FMP, the total sold, retained catch during calendar year 2010 was approximately 70 million pounds (32×10^3 *t*), with an ex-vessel value of over $170 million (Table X1). Total finished pounds reported by processors in 2010 across all FMP crab species and product forms was approximately 45 million pounds (20.5×10^3 *t*), with an estimated first wholesale value of over $270 million (F.O.B Alaska). Total ex-vessel production for 2010 was reduced in volume relative to the previous year by 14 percent, corresponding to reductions in the TAC in the 2009/2010 snow crab and 2010/2011 Bristol Bay red king crab fisheries. Due to an upturn in first wholesale and ex-vessel prices in the red king crab and golden king crab markets, the reduced TAC's were somewhat offset, resulting in an overall 7.75 percent decrease in economic value accruing to the harvest sector relative to 2009. Total catch was approximately 3 percent above the average for 2005-2009, and aggregate gross revenue was decreased by 5.5 percent relative to the same period.

Reported data for finished production indicates that output in 2010 was reduced relative to 2009 by 11.3 percent. Estimated sales value of total production in 2010 increased by approximately 6 percent. Both first wholesale volume and sales value in 2010 were above the average for the previous five years (by 2 percent and 7 percent, respectively). Data for individual fisheries for 2005-2010 is presented in Table X1. The relative trends in production volume and revenue across the four largest crab fisheries in the harvest and processing sector are illustrated in Figure X1 below. Unweighted mean ex-vessel and first wholesale prices are displayed in Figure X2. Error bars (one standard deviation) in the figures depict the range of cross-sectional variation in prices over time, with the greater variation in wholesale prices reflective of both the effect of greater volatility of world market prices as well as the broader range of products, markets, and sales conditions observed in processed crab sales.

The most recent employment data available for crab fisheries is for the 2009 calendar year fisheries managed under the rationalization program, as reported in the BSAI Crab Economic Data Report program. Data for crew participation and payment by fishery is presented in Table X2. In 2009, approximately 715 unique individuals were employed as fishing crew (including deckhands, vessel captains, and other positions requiring commercial fishing crew or other form of licensure) on 88 fishing vessels prosecuting the IFQ and CDQ crab fisheries. Participation as crew members in individual crab fisheries is indicated by counts of share recipients by fishery, with individual crew members participating in multiple fisheries. In 2009, EDR records indicate 1,130 share recipients aggregated over crab fisheries. Based on average crew size reported in eLandings, the total number of crew positions on active crab vessels in

Total crew and captain payment amount is reported annually for rationalized fisheries in the crab EDR. Total share payments to crab vessel crews totaled approximately $25.5 million in 2009, with an additional payment to vessel captains of $11.4 million (noting that reported values for captain pay may to some degree reflect payments associated with vessel ownership and/or IFQ royalties as well as in-season labor contribution). Somewhat fewer vessels operated in 2009 that 2008, which combined with a reduction in average payment per vessel of approximately four percent resulted in a reduction of over 20 percent in total crew and captain share payments relative to 2008.

Table X3 presents data on crab processing labor employed in the crab fishery. It is estimated that nearly 830 thousand hours of processing labor was expended on crab production in 2009, generating $10.5 million in labor income. Most processing facilities that receive crab landings do not exclusively process crab, however, and it may difficult to attribute crab processing labor to specific employment effects. The high degree of variance in the measure of crab processing labor hours likely reflects variation in ability to track labor input by species for reporting compliance, as well as variation in use of processing labor.

Additional detail on economic conditions in the fishery is provided in the 2011 Economic Status Report (AFSC, forthcoming). Statistics on harvesting and processing activity, revenue, labor employment, labor compensation, operational costs, and quota usage and disposition among participants in the fisheries are provided in the report. Additionally, this report provides a summary of BSAI crab-related research being undertaken by the Economic and Social Sciences Research Program (ESSRP) at the Alaska Fisheries Science Center.

Table X1: Harvest and Processing Sector Production, Gross Revenue, and Average Prices, FMP Crab Fisheries, 2005-2010[1]

	Harvest Sector Gross Ex-vessel				Processing Sector Gross 1st Wholesale			
	Vessels	Landed volume million pounds (10^3 mt)	Total revenue $ million	Weighted average $/pound	Plants	Finished production million lbs (10^3mt)	Total revenue $ million	Weighted average $/pound
Aleutian Islands Golden King - Eastern and Western								
2005	9	4.44 (2.01)	$14.88	$3.36	6	3.03 (1.37)	$21.51	$7.10
2006	7	5.24 (2.38)	$11.20	$2.14	6	3.13 (1.42)	$15.50	$4.95
2007	6	5.44 (2.47)	$11.60	$2.13	6	3.42 (1.55)	$21.12	$6.17
2008	5	5.73 (2.6)	$18.07	$3.15	6	3.41 (1.55)	$25.05	$7.34
2009	5	5.51 (2.5)	$13.70	$2.48	8	3.3 (1.5)	$19.07	$5.78
2010	5	6.09 (2.76)	$17.42	$2.86	8	3.74 (1.7)	$28.99	$7.76
Bristol Bay Red King								
2005	89	18.14 (8.23)	$98.05	$5.41	16	12.3 (5.58)	$127.12	$10.33
2006	81	15.55 (7.05)	$65.02	$4.18	14	9.17 (4.16)	$78.99	$8.62
2007	73	20.17 (9.15)	$98.23	$4.87	17	13.09 (5.94)	$125.04	$9.55
2008	79	20.13 (9.13)	$107.68	$5.35	15	13.31 (6.04)	$138.33	$10.39
2009	70	15.78 (7.16)	$78.45	$4.97	15	10.4 (4.72)	$97.85	$9.41
2010	65	14.73 (6.68)	$92.58	$6.28	15	9.8 (4.45)	$132.17	$13.48
Eastern Bering Sea Snow								
2005	167	24.86 (11.28)	$55.08	$2.22	20	17.71 (8.03)	$83.22	$4.70
2006	78	38.02 (17.25)	$50.20	$1.32	13	24.92 (11.3)	$82.37	$3.31

1 Source: BSAI Crab Economic Data Reports database, CFEC Commercial Operators Annual Report database, and ADF&G eLandings database. Landed volume is calculated from commercial (sold) pounds recorded on fish tickets. Ex vessel revenue is the calculated using CFEC-adjusted landed values on commercial crab landings and average price is the weighted average value per pound calculated over individual fish ticket entries. EDR data provides the only stock-specific source of data for finished production volume and value. For years/stocks for which EDR data is unavailable (NSR; 2010, pre-2005), processed volume by stock is estimated by applying average product recovery rate to ex-vessel pounds recorded by processor in fish tickets. Weighted and unweighted wholesale prices are estimated by species from COAR data on FOB Alaska first wholesale price. Total wholesale value is estimated by applying weighted average wholesale price by species to estimated volume.

	Harvest Sector Gross Ex-vessel				Processing Sector Gross 1st Wholesale			
	Vessels	**Landed volume million pounds (10^3 mt)**	**Total revenue $ million**	**Weighted average $/pound**	**Plants**	**Finished production million lbs (10^3mt)**	**Total revenue $ million**	**Weighted average $/pound**
2007	68	34.76 (15.77)	$62.58	$1.80	16	22.66 (10.28)	$99.66	$4.40
2008	78	62.23 (28.23)	$112.84	$1.81	16	41.02 (18.61)	$176.80	$4.31
2009	77	57.69 (26.17)	$87.46	$1.52	16	35.97 (16.31)	$133.50	$3.71
2010	68	47.84 (21.7)	$54.05	$1.13	12	30.68 (13.91)	$100.19	$3.27
Eastern Bering Sea Tanner								
2005	4	0.26 (0.12)	$0.51	$2.00	4	0.18 (0.08)	$0.86	$4.81
2006	45	0.99 (0.45)	$1.63	$1.64	9	0.72 (0.33)	$2.89	$4.01
2007	29	2.25 (1.02)	$4.08	$1.82	8	1.46 (0.66)	$6.90	$4.73
2008	30	2.33 (1.06)	$4.24	$1.81	10	1.34 (0.61)	$6.06	$4.54
2009	18	2.14 (0.97)	$3.67	$1.72	10	1.39 (0.63)	$5.63	$4.06
2010	4	0.37 (0.17)	$0.55	$1.47	6	0.24 (0.11)	$0.98	$4.04
Norton Sound Red King								
2005	31	0.4 (0.18)	$1.67	$4.19				
2006	29	0.44 (0.2)	$1.29	$2.91				
2007	31	0.32 (0.14)	$1.00	$3.18				
2008	9	0.03 (0.01)	$0.07	$2.39				
2009	10	0.03 (0.01)	$0.14	$4.63				
2010	16	0.32 (0.15)	$1.37	$4.28				

		Harvest Sector Gross Ex-vessel			Processing Sector Gross 1st Wholesale			
	Vessels	**Landed volume million pounds (10^3 mt)**	**Total revenue $ million**	**Weighted average $/pound**	**Plants**	**Finished production million lbs (10^3mt)**	**Total revenue $ million**	**Weighted average $/pound**
Pribilof Island Golden King								
2005	4	--	--	--	--	--	--	--
2010	1	--	--	--	--	--	--	--
Saint Matthews Blue								
2009	7	0.45 (0.2)	$1.07	$2.38	3	--	--	--
2010	11	1.25 (0.57)	$5.16	$4.12	6	0.82 (0.37)	$9.49	$11.50
Total – All FMP Crab Fisheries								
2005		48.1 (21.82)	$170.20			33.23 (15.07)	$232.71	
2006		60.24 (27.33)	$129.33			37.94 (17.21)	$179.75	
2007		62.94 (28.55)	$177.50			40.63 (18.43)	$252.72	
2008		90.82 (41.2)	$244.35			59.07 (26.79)	$346.24	
2009		81.97 (37.18)	$185.72			51.06 (23.16)	$256.05	
2010		70.7 (32.07)	$171.33			45.28 (20.54)	$271.81	

Table X2: Crab vessel crew participation and share payment income[2]

		Crew participants		Deck crew positions		Crew share payment $ millions		Captain share payment $ millions	
Fishery	Obs	Total	Vessel mean (sd)	Total	Vessel mean (sd)	Total payment	Vessel mean (sd)	Total payment	Vessel mean(sd)
Aleutian Islands Golden King - Eastern and Western									
2005	10	72	7.2 (2.58)	58	5.8 (1.14)	$1.87	$0.17 (0.13)	$1.01	$0.09 (0.07)
2006	6	48	7.92 (2.58)	38	6.33 (0.52)	$0.87	$0.12 (0.09)	$0.48	$0.07 (0.04)
2007	6	40	6.67 (1.21)	38	6.33 (0.52)	$1.14	$0.19 (0.15)	$0.56	$0.09 (0.07)
2008	4	--	--	--	--	$1.83	$0.37 --	$0.77	$0.15 --
2009	5	43	8.6 --	31	6.2 --	$1.93	$0.39 --	$1.13	$0.23 --
Bristol Bay Red King									
2005	84	493	5.87 (1.04)	472	5.61 (0.82)	$12.39	$0.15 (0.09)	$6.51	$0.08 (0.05)
2006	79	465	5.89 (1.06)	445	5.63 (0.83)	$8.77	$0.11 (0.06)	$4.45	$0.06 (0.03)
2007	70	419	5.99 (0.86)	407	5.81 (0.79)	$11.92	$0.17 (0.08)	$5.94	$0.08 (0.04)
2008	76	473	6.22 (1.11)	454	5.97 (0.94)	$14.14	$0.19 (0.13)	$6.39	$0.09 (0.04)
2009	70	435	6.21 (1.01)	424	6.06 (0.98)	$9.66	$0.14 (0.06)	$4.57	$0.07 (0.03)
Eastern Bering Sea Snow									
2005	150	857	5.71 (0.73)	N/C	N/C	$11.10	$0.07 (0.03)	$5.71	$0.04 (0.02)
2006	74	448	6.05 (1.19)	418	5.65 (0.78)	$6.08	$0.08 (0.05)	$3.04	$0.04 (0.02)
2007	65	400	6.15 (1.08)	377	5.79 (0.79)	$9.01	$0.14 (0.09)	$4.28	$0.07 (0.03)
2008	74	489	6.61 (1.41)	450	6.07 (0.95)	$16.05	$0.22 (0.13)	$7.64	$0.1 (0.05)
2009	77	522	6.78 (1.82)	492	6.39 (1.66)	$13.17	$0.17 (0.1)	$5.83	$0.08 (0.04)

2 *Source: NOAA Fisheries, Alaska Fisheries Science Center. BSAI Crab Economic Data.*
Crew and captain payments reflect amounts paid for harvesting labor. Where applicable, these figures include post-season adjustments, bonuses, and deductions made to labor payments for shared expenses such as fuel, bait, and food and provisions. Payments to harvest crew and captains for IFQ are excluded. 2009 data is summarized over all harvesting sectors (CVCP) to preserve confidentiality. Cells displaying "—" are suppressed for confidentiality purposes, and N/C indicates that data was not collected for the fishery. Data reported in aggregate over all crab fisheries in Table X2 omits missing values where there are indicated. As a result, direct comparison of values over time is limited in instances where missing values are present.

Eastern Bering Sea Tanner									
2005	4	--	--	--	--	--	--	--	--
2006	25	143	5.72 (1.02)	140	5.6 (1)	$0.23	$0.01 (0.01)	$0.13	$0.01 (0.01)
2007	22	131	5.95 (0.84)	118	5.36 (0.66)	$0.62	$0.03 (0.02)	$0.32	$0.02 (0.01)
2008	26	162	6.23 (1.31)	149	5.73 (1.12)	$0.52	$0.02 (0.03)	$0.30	$0.01 (0.02)
2009	14	96	6.86 (2.54)	87	6.21 (1.48)	$0.55	$0.04 (0.05)	$0.34	$0.02 (0.03)
Saint Matthews Blue									
2009	7	40	5.71 (0.76)	39	5.57 (0.79)	$0.16	$0.02 (0.02)	$0.07	$0.01 --
All Crab Fisheries									
2005		1422		529		$25.36		$13.23	
2006		1104		1041		$15.95		$8.09	
2007		990		940		$22.69		$11.11	
2008		1124		1053		$32.54		$15.10	
2009		1136		1073		$25.46		$11.94	

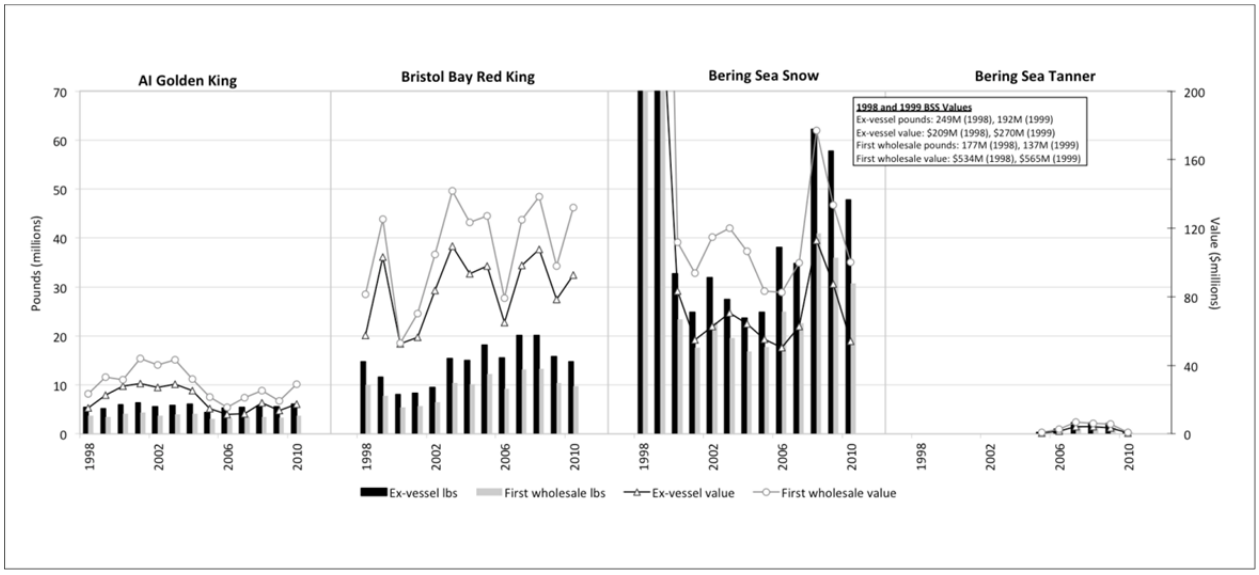
Table X3: Crab Processing Labor and Income[3]

		Crab Processing Labor			
Fishery	Obs	Total Man-hours (1000)	Average per plant mean (sd) (1000)	Total Labor payment ($1000)	Pay per hour
Aleutian Islands Golden King - Eastern and Western					
2005	4	--	--	--	--
2006	6	47.15	7.86 (11.58)	$510.99	12.66
2007	5	71.97	14.39 --	$770.34	13.25
2008	6	37.85	6.31 (6.35)	$554.19	12.13
2009	4	--	--	--	--
Bristol Bay Red King					
2005	11	201.82	18.35 (17.02)	$2,386.11	13.47
2006	11	180.16	16.38 (15.38)	$2,065.67	11.87
2007	11	260.51	23.68 (20.39)	$2,868.82	13.24
2008	11	244.92	22.27 (21.06)	$2,809.21	10.19
2009	10	198.90	19.89 (17.01)	$2,281.84	10.88
Eastern Bering Sea Snow					
2005	13	301.98	23.23 (16.62)	$3,805.65	11.65
2006	10	445.35	44.54 (34.78)	$4,749.05	11.45
2007	10	442.21	44.22 (37.81)	$5,170.08	11.18
2008	12	712.38	59.37 (77.49)	$8,936.86	10.26

3 *Source: NOAA Fisheries, Alaska Fisheries Science Center. BSAI Crab Economic Data.*
Processing labor payments exclude payments to salaried workers employed by processors. Where applicable, these figures include bonuses and deductions to labor payments for shared expenses such as food and provisions. Benefits and indirect expenses paid on behalf of processing workers are excluded. Note that observations for pro-rata statistics (pay per plant, worker, and finished pounds) may differ from the number of observations for total labor payments due to observations that are missing data for the denominator variable (average number of processing positions, processing man-hours, finished production lbs) in the fishery-year of interest. Outlier observations in the 2008 data have been excluded for pay per worker and pay per hour statistics. Data for EAG and WAG fisheries are summarized together as the 'AIG' fishery. Where a submitter reported separate labor payments and processing positions in the two fisheries, we use the maximum reported number of processing positions, rather than the sum of processing positions over the two fisheries, to calculate pay per worker statistics. All other variables used in pro-rata statistics for the AIG fisheries are treated cumulatively. 2009 data is summarized over all processing sectors (SFCP) due to confidentiality.

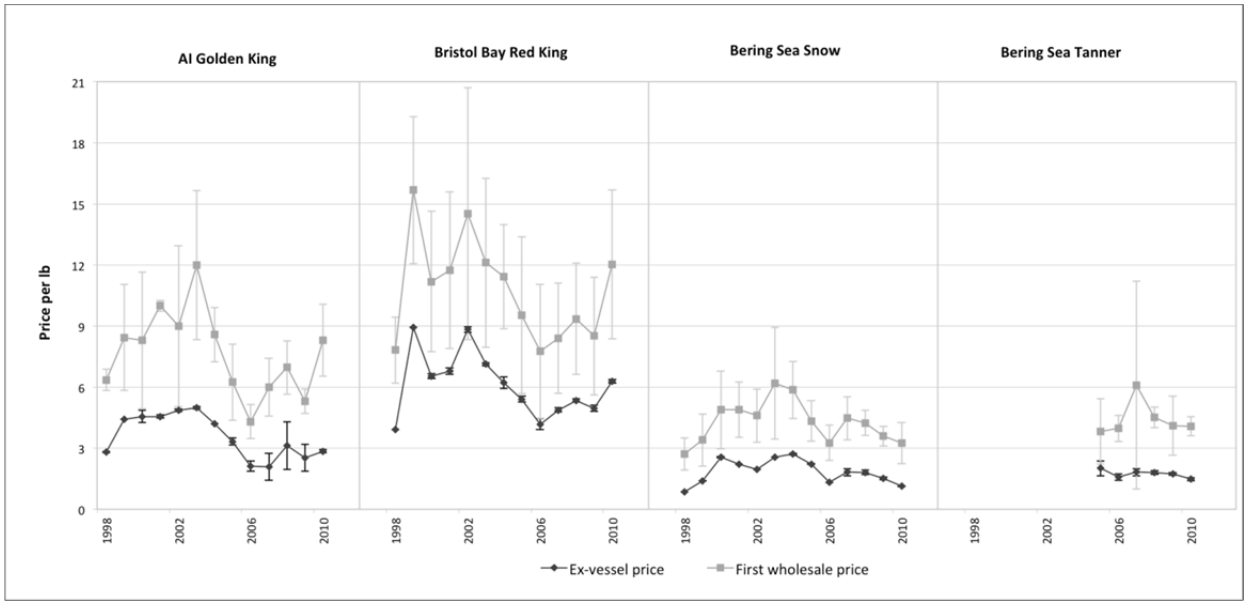
2009	10	600.07	60.01 (50.91)	$7,014.28	10.79
Eastern Bering Sea Tanner					
2005	7	8.34	1.19 (1.53)	$92.37	11.29
2006	8	14.00	1.75 (1.67)	$148.68	10.74
2007	7	34.90	4.99 (3.31)	$365.99	10.73
2008	8	27.02	3.38 (3.01)	$439.62	10.73
2009	7	29.32	4.19 (2.26)	$297.54	10.44
Pribilof Island Golden King					
2009		--	--	--	--
All Rationalized Crab Fisheries					
2005		512.14		$6,284.13	
2006		686.66		$7,474.40	
2007		809.59		$9,175.23	
2008		1022.17		$12,739.87	
2009		828.29		$10,483.59	

Figure X1: Ex-vessel and first wholesale production and value, BSAI crab, 1998-2010



Source: CFEC Commercial Operators Annual Report database and ADF&G eLandings database.

Figure X2: Ex-vessel and first wholesale production and value, BSAI crab, 1998-2010



Source: CFEC Commercial Operators Annual Report database and ADF&G eLandings database