8 Aleutian Islands Golden King Crab

Fishery information relative to OFL setting

The directed fishery has been prosecuted annually since the 1981/82 season. Retained catch peaked in 1986/87 at 14.7 million lb and averaged 11.9 million lb over the 1985/86-1989/90 seasons. Average harvests dropped sharply from 1989/90 to 1990/91 to a level of 6.9 million lb for the period 1990/91–1995/96. Management based on a formally established GHL began with the 1996/97 season. The 5.9 million lb GHL established for the 1996/97 season, which was based on the previous five-year average catch, was subsequently reduced to 5.7 million lb beginning in 1998/99. The GHL (or TAC, since 2005/06) remained at 5.700 million lb for 2007/08, but was increased to 5.985 million lb for the 2008/09-2011/12 seasons, and to 6.290 million lb starting with the 2012/13 season. The TAC was reduced to 5.545 million lb for the 2016/17 season and increased to 6.356 million lb for the 2018/19 season. This fishery is rationalized under the Crab Rationalization Program.

Total mortality of AI golden king crab includes retained catch in the directed fishery, mortality of discarded catch, and bycatch in fixed-gear and trawl groundfish fisheries, though bycatch in other fisheries is low compared to mortality in the directed fishery. Retained catch in the post-rationalized fishery (2005/06-2018/19) has ranged from 5.245 million lb in 2006/07 to 6.536 million lb in 2018/19. Total mortality ranged from 5.427 to 7.396 million lb for the same period.

Data and assessment methodology

The assessment for AI golden king crab establishes a single OFL and ABC for the whole stock; however, separate models are evaluated for EAG and WAG owing to different abundance trends in each area. A modeling framework based on only fisheries data for AI golden king crab was under development for several years with model assumptions and data inputs refined by reviews by the SSC and CPT. The CIE also reviewed the model and stock assessment in June 2018. The current modeling framework was recommended by the CPT in September 2016 and approved by the SSC in October 2016.

The model-based stock assessment involves fitting male-only population dynamics models to data on catches and discards in the directed fishery, discards in the groundfish fishery, standardized indices of abundance based on observer data, fish ticket data, length-frequency data for the directed fishery (landing and total catch), and mark-recapture data. These data are complete through the 2018/19 season.

The assessment authors examined five model scenarios for EAG and five model scenarios for WAG in this assessment cycle. Model 18_0 was the base model last year (Model 17_0) with new data in the 2017/18 fishing season. Model 18_1 is the same as Model 18_0 except the number of gear codes was reduced for fishery CPUE standardization. Model 19_0 is the same as Model 18_0 with new data from the 2018/19 fishing season. Model 19_1 is the same as Model 18.1 with new data from the 2018/19 fishing season. Model 19_2a is the same as Model 19_1 plus a year and area interaction factor during years 2005/06 - 2018/19 for EAG, and Model 19_2 is the same as Model 19_1 plus a year and area interaction factor during years 1995/96 - 2018/19 for WAG. The authors recommended Model 19_1 or Models 19_2/19_2a for a base model for overfishing determination.

The CPT considered Models 19_0, 19_1, and 19_2/19_2a (all include the 2018/19 fishery data). Model 19_1 is preferred over Model 19_0 due to simplification of gear codes and the fact that model performances were very similar. Models 19_2 and 19_2a include a year and area interaction factor which may be important for fishery CPUE standardization. However, the CPT has concerns about the current area footprint calculation and with not using the year and area interaction factor during 1995/96-2004/05 for EAG due to high estimated log(CPUE) variances. It appears that further improvement is needed for Models

19_2 and 19_2a before adoption as the base model. The CPT recommends base model 19_1 for OFL and ABC determination for 2019/2020.

This is the only crab assessment that relies solely on fishery CPUE as an index of abundance, with the CPUE index standardization process subject to past CPT and SSC review. The CPT recommended that the model be used to provide management reference points based on the Tier 3 control rule in January 2017 and this tier recommendation was endorsed by the SSC in February 2017.

An industry-ADF&G collaborative survey has been conducted for this stock during 2015-2018. A preliminary model using the first two years' index from this survey was evaluated in the assessment in 2018; however, additional index development is needed before the model with the survey data is suitable to provide management advice.

Stock biomass and recruitment trends

Estimated mature male biomass (MMB) for the EAG decreased from high levels until the 1990s after which the trend has been increasing. In contrast, the MMB for WAG increased from a low in the 1990s until 2007/08 and then declined again. There has been a slight increase in MMB in WAG since 2014. Recruitment for the EAG was variable and high during 2014-2016 while recruitment for WAG is lower in recent years than during the 1980s. Stock trends reflected the fishery standardized CPUE trends in both areas.

Summary of major changes

The assessment model recommended by the CPT is similar to the model used in the previous assessment. There were minor changes in the CPUE standardization that had minor effects on assessment results.

Tier determination/Plan Team discussion and resulting OFL and ABC determination

The CPT recommends that this stock be managed as a Tier 3 stock in 2019/20. A single OFL and ABC is defined for AIGKC; however, separate models are available by area. The CPT recommends that stock status be determined by adding the estimates of current MMB and B_{MSY} by area. This stock status is then used to determine the ratio of F_{OFL} to $F_{35\%}$ by area, which is then used to calculate the OFLs by area which are then added together to calculate an OFL for the entire stock. The SSC has concurred with this approach. The stock is currently estimated to be above B_{MSY} in both areas therefore no adjustment is needed to the F_{OFL} to determine the combined OFL for both areas.

The CPT recommends that the B_{MSY} proxy for the Tier 3 harvest control rule be based on the average recruitment from 1987-2012, years for which recruitment estimates are relatively precise.

Status and catch specifications (1000 t) for Aleutian Islands golden king crab (scenario 19_1). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2015/16	N/A	N/A	2.853	2.729	3.076	5.69	4.26
2016/17	N/A	N/A	2.515	2.593	2.947	5.69	4.26
2017/18	6.044	14.205	2.515	2.585	2.942	6.048	4.536
2018/19	5.880	17.848	2.883	2.965	3.355	5.514	4.136
2019/20		15.944				5.249	3.937

Status and catch specifications (million lb) for Aleutian Islands golden king crab (scenario 19_1). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2015/16	N/A	N/A	6.290	6.016	6.782	12.53	9.40
2016/17	N/A	N/A	5.545	5.716	6.497	12.53	9.40
2017/18	13.325	31.315	5.545	5.699	6.487	13.333	10.000
2018/19	12.964	39.348	6.356	6.536	7.396	12.157	9.118
2019/20		35.150				11.572	8.679

Total fishery mortality in 2018/19 was 7.396 million lb, less than the OFL of 12.157 million lb, thus overfishing for the 2018/19 season did not occur.

Additional Plan Team recommendations

The CPT recommended additional assessment work in a number of areas. Additional development is needed for fishery CPUE standardization, including further development in year-area interactions. The chela measurement data should be reanalyzed using recently collected fishery and survey data to better estimate the maturity of AIGKC. The bias of retrospective biomass estimates for EAG needs to be checked and investigated for any model misspecifications. Uncertainty of recruitment estimates in the terminal years should be assessed to determine how many years of recruitment estimates in the terminal years are excluded for $B_{35\%}$ estimation. Use of GMACS for the AIGKC assessment should be explored. Finally, additional work is needed to obtain an index using the cooperative pot survey data for use in the EAG assessment model.