7   *Norton Sound Red King Crab*

Fishery information relative to OFL setting

The Norton Sound red king crab (NSRKC) stock supports three fisheries: summer commercial, winter commercial, and subsistence. The summer commercial fishery, which accounts for most of the catch, reached a peak in the late 1970s at a little over 1.313 kt retained catch. Retained catches since 1982 have been below 0.227 kt, averaging 0.136 kt., including several low years in the 1990s. As the crab population rebounded, retained catches increased to 0.231 kt in 2016, but decreased 69% to 0.073 kt. in 2019.

Data and assessment methodology

Four types of surveys for NSRKC have occurred periodically during the last three decades: summer trawl, summer pot, winter pot, and preseason summer pot. The assessment is based on a length-based model of male crab abundance that combines multiple sources of data. A maximum likelihood approach was used to estimate quantities relevant in management. The model has been updated to include the following data: total catch, catch length composition, discard length composition data from the 2019 summer and winter commercial fisheries (retained size composition data were not collected for the winter fishery due to low harvest). The standardized commercial catch CPUE indices were updated based on data for 1977-2019 and 14 new tag recoveries were included in the assessment. The current model assumes a constant M=0.18 yr^{-1} for all length classes except the >123mm CL length-class, which had an estimated value of 0.58 yr^{-1}. Logistic functions are used to describe fishery and survey selectivities, except for a dome-shaped function used for the winter pot fishery.

The assessment author presented six model alternatives, including a base model (model 19.0) that was adopted in 2018 and several other models that examine the influence of tagging data on estimated molting probability, the validity of assumptions about trawl survey q, and the assumptions of size-dependent natural mortality.

The CPT recommended the base model 19.0.

Stock biomass and recruitment trends

Estimated mature male biomass was at an historic low in 1982 following a sharp decline from the peak biomass in 1977. MMB increased from a low in 1997 to a peak in 2010, after which it fluctuated about the $B_{MSY \, proxy}$. Estimated MMB is currently near the low in 1982. Estimated recruitment has generally been variable and the most recent recruitment estimate is one of the largest since the late 1970s, but will not be corroborated until it enters the fishery in several years.

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

The team continues to recommend Tier 4 for Norton Sound red king crab. The $B_{MSY \, proxy}$, calculated as the average of mature male biomass on February 1 during 1980-2019 was 2.068 kt The estimated 2020 mature male biomass on February 1 using Model 19.0 is 1,660 t which is below the $B_{MSY \, proxy}$ for this stock, placing Norton Sound red king crab in status category 4b. The $F_{MSY \, proxy}$ is M =0.18 yr^{-1} and the F_{OFL}=0.141yr^{-1}, because the 2020 mature male biomass is less than $B_{MSY \, proxy}$ using the default gamma =1.0.

The CPT recommends model 19.0 to set the OFL for 2020, resulting in an OFL of 0.287 million lb. (0.13 thousand t). The team recommends that the ABC for 2020 be set below the maximum permissible ABC. The team recommends that the SSC-endorsed buffer of 20% from the OFL be increased to 25% given very low fishery CPUE and unusually large numbers of old-shell males in the fishery. The resulting ABC is 0.100 kt. The OFL is a retained catch OFL. The author calculated a total catch OFL as part of the assessment, but it is not used because no way to estimate discards from the fishery monitoring program has been adopted.

Status and catch specifications (kt). 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)	GHL	Retained Commercial Catch	Total Retained Catch	Retained OFL	Retained ABC
2016	1.03	2.66	0.24	0.23	0.24	0.32	0.26
2017	1.05	2.33	0.23	0.22	0.24	0.30	0.24
2018	1.09	1.85	0.13	0.14	0.15	0.20	0.16
2019	1.03	1.41	0.07	0.04	0.04	0.11	0.09
2020	1.04	1.66	TBD	TBD	TBD	0.13	0.10

Status and catch specifications (million lb.) 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)	GHL	Retained Commercial Catch	Total Retained Catch	Retained OFL	Retained ABC
2016	2.26	5.87	0.52	0.51	0.52	0.71	0.57
2017	2.31	5.14	0.50	0.49	0.50	0.67	0.54
2018	2.41	4.08	0.30	0.31	0.34	0.43	0.35
2019	2.24	3.12	0.15	0.08	0.08	0.24	0.19
2020	2.28	3.67	TBD	TBD	TBD	0.29	0.22

Total retained catch during 2019 did not exceed the OFL for this stock, thus overfishing is not occurring. Stock biomass is above MSST; thus, the stock is not overfished.