7 Norton Sound Red King Crab

Fishery information relative to OFL setting

The Norton Sound red king crab (NSRKC) stock supports three main fisheries: summer commercial, winter commercial, and winter subsistence. The summer commercial fishery, which accounts for most of the catch, reached a peak in the late 1970s at a little over 2.9 million lb. retained catch. Retained catches since 1982 have been below 0.5 million lb., averaging 0.3 million lb., including several low years in the 1990s. As the crab population rebounded, retained catches have increased to around 0.5 million lb. in recent years, but were around 0.3 million lb. in 2018.

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, but none of these surveys have been conducted every year. The assessment is based on a male-only length-based model of male crab abundance that combines multiple sources of data. A maximum likelihood approach was used to estimate abundance, recruitment, and selectivity and catchability of the commercial pot gear. The model has been updated to include the following data: total catch, catch length composition, discard length composition data from the 2018 summer commercial fishery, and 2018 winter commercial and subsistence catch. New trend data in the assessment included 2018 ADFG survey in Norton Sound. In addition, the standardized commercial catch CPUE indices were updated to include data for 1977-2018. The current model assumes a constant M=0.18 yr^{-1} for all length classes except the the > 123mm CL length-class, which had an estimated value of 0.583 yr^{-1}. Logistic functions are used to describe fishery and survey selectivities, except for a dome-shaped function examined for the winter pot fishery.

The assessment author envaulted eight model alternatives, a base model (model 18.0) that assumes fixed retention selectivity and uses retention and discards length-composition data to estimate total catch selectivity, and several other models that incorporate different stanzas (1987-1994 and 2012-2018) of size composition data from the summer and winter commercial fisheries and estimate separate retention selectivities for the summer and winter fisheries.

The CPT recommended model 18.2b which estimates commercial fishery retention selectivity using summer commercial 2012-2018 total catch length composition data, 1987-1994 summer commercial fishery discard length composition data, and 2015-2018 winter commercial fishery retention length composition data. Estimating retention selectivity did not change fit to population dynamics, but improved fits of commercial retention and tag recovery data that inform the size transition matrix and molt probabilities. Estimating separate retention selectivities for the summer and winter fisheries did not improve the model fit.

Stock biomass and recruitment trends

Mature male biomass was estimated to be at an historic low in 1982 following a sharp decline from the peak biomass in 1977. The MMB then exhibited an increase from a low in 1997 to a peak in 2010, before showing minor declines and increases close to the $B_{MSY\,\text{proxy}}$. The stock is currently estimated to be on a downward trend. Estimated recruitment was weak during the late 1970s and high during the early 1980s, with a slight downward trend from 1983 to 1993. Estimated recruitment has generally been variable, with a slight decrease in the last 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 $B_{MSY\,\text{proxy}}$, calculated as the average of mature male biomass on February 1 during 1980-2019 was 4.57 million lb. The estimated 2019 mature male biomass on February 1 using Model 18.2b is 3.12 million lb., 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}=0.118yr^{-1}, because the 2019 mature male biomass is less than $B_{MSY\ proxy}$, with the CPT choosing the default of gamma =1.0.

The CPT recommends that the OFL for 2019 be set according to model 18.2b, for which the calculated OFL is 0.24 million lb. (0.11 thousand t). The team recommends that the ABC for 2019 be set below the maximum permissible ABC. The team recommends that the SSC-endorsed buffer of 20% from the OFL be used to set the ABC at 0.19 million lb. (0.09 thousand t). The OFL is a retained catch OFL although a total catch OFL is computed as part of the assessment. The recommendation of an ABC less than the maximum permissible is recommended due to concern about model specification and unresolved competing hypotheses about whether the lack of large male crab in the fisheries and surveys is from increased natural mortality or movement out of the area.

Status and catch specifications (1000t). 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 Catch OFL	Retain catch ABC
2015	1.09	2.33	0.18	0.18	0.24	0.33	0.26
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	TBD	TBD	TBD	0.11	0.09

1: Summer commercial fishery
2: Summer commercial fishery, winter commercial fishery and subsistence fishery

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 Catch[1]	Total Catch[2]	Retained Catch OFL	Retain catch ABC
2015	2.41	5.13	0.39	0.40	0.52	0.72	0.58
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	TBD	TBD	TBD	0.24	0.19

Total retained catch during 2018 did not exceed the OFL for this stock, thus overfishing is not occurring. Stock biomass is above MSST; thus, the stock is not overfished.