

## **7 Norton Sound red king crab**

### ***Fishery information relative to OFL setting***

During the 2024 fishery, 4,834 crab (6.20 t) were harvested in the winter commercial fishery and 140,379 crab (196 t) were harvested in the summer commercial fishery. In the winter subsistence fishery, 5,681 crab (7.06 t) were caught, while 4,708 crab (6.04 t) were retained. Because the total catch mortality for this stock was below the 2024 OFL of 332 t, overfishing did not occur.

### ***Data and assessment methodology***

During the last three decades, information from summer trawl, summer pot, winter pot, and preseason summer pot surveys have been periodically collected for NSRKC. The summer trawl surveys provide data on annual abundance and size/shell condition compositions, while the others have contributed to life history knowledge. Time series of standardized CPUE from the summer commercial fishery provide additional indices of abundance. Tag return data provide information on growth. Retained catch data are available from fish tickets for the winter and summer commercial fisheries, as well as from subsistence catch reports. Retained catch size-composition data are generally available for the summer commercial fishery, but only limited data are available for the winter commercial fishery. Limited data on discards are available from summer commercial fishery observer data and subsistence catch reports.

The assessment has been updated to include the following new data for 2024: retained catch for the winter and summer commercial fisheries, length-shell compositions for the summer commercial fishery, total and retained catch for the winter subsistence fishery, standardized CPUE time series, and survey abundance and shell condition/size composition data from the 2024 ADF&G summer trawl survey.

The assessment is based on a length-based model of male crab abundance in the GMACS framework that combines these multiple sources of data. Logistic functions are used to describe fishery and survey selectivities, except that a dome-shaped function used for the winter pot fishery. The ADF&G trawl survey is assigned a catchability of 1, with catchabilities estimated for other surveys and the standardized CPUE indices. Molting and growth are combined into a size-transition matrix. The model allows for length-dependent natural mortality.

The assessment author presented results from two models (21.0 and 24.0) for consideration by the CPT for status determination and OFL/ABC calculation. Model 21.0 was the accepted model from the 2024 assessment (updated with 2024 data). It assumed a constant  $M$  of  $0.18 \text{ yr}^{-1}$  for all length classes except the largest (i.e.,  $>123\text{mm CL}$ ), for which  $M$  was estimated at  $0.61 \text{ yr}^{-1}$ . Model 24.0 was implemented in the GMACS framework and parameterized as close to model 21.0 as possible, with  $M$  for the largest length class estimated at  $0.58 \text{ yr}^{-1}$ . The most salient difference was that model 24.0 estimated values of  $F$  for each fishery, while 21.0 subtracted observed catches for each fishery from the model-estimated abundance. Overall, the two models are similar in terms of data fit and estimates of selectivity, natural mortality, and transition probability. The CPT recommended adopting model 24.0 for setting harvest specifications for this stock.

### ***Stock biomass and recruitment trends***

Estimated mature male biomass was low in 1982 following a sharp decline from the peak biomass in 1977. MMB increased from a historic low in 1996 to a peak in 2010, after which it fluctuated about the  $B_{MSY}$  proxy. Estimated MMB increased to its highest level since the late 1980s in 2022 (2,880 t) after its lowest estimated level in 2019 (1,139 t). Estimated MMB has decreased over the past three years to 2,150 t for 2025. Estimated recruitment has generally been variable; recruitment in 2020 was the highest since the late 1970s, but it has since decreased. The ADF&G trawl survey showed a decrease in abundance from 2023 (3.4 million males) to 2024 (1.4 million males). Standardized CPUE from the 2024 summer commercial fishery, 2.63, was larger than that for 2023 (2.00). The NMFS Northern Bering Sea survey was not conducted in 2024.

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

The CPT recommends that this stock remain in Tier 4. Using model 24.0, the Tier 4  $B_{MSY}$  proxy was calculated as the average of mature male biomass on February 1 during 1980-2025 and equaled 1,960 t. The estimated 2025 mature male biomass on February 1 was 2,370 t, which is above the  $B_{MSY}$  proxy, placing Norton Sound red king crab in status category 4a. The corresponding  $F_{MSY}$  proxy for NSRKC is  $M=0.18$  yr<sup>-1</sup> (using the default gamma =1.0), as is the associated  $F_{OFL}$  because the 2025 mature male biomass is greater than the  $B_{MSY}$  proxy. In 2023, the CPT recommended adopting a retained catch OFL due to the lack of new information on discard mortality; the SSC rejected this recommendation and based the OFL on total catch mortality as in 2022. To maintain consistency with recent practice, the CPT recommends a total catch OFL for 2025. Consequently, the 2025 Tier 4a total catch OFL is 284 t (0.628 million lb).

The CPT recommends that the ABC for 2025 be set below the maximum permissible ABC. In 2024, the SSC endorsed using a buffer of 30% for the ABC given concerns regarding the assessment. The sources of uncertainty identified in 2024 are still relevant. These include:

- uncertainty regarding biological characteristics:
  - $M$  and size-at-maturity are borrowed from other stocks;
  - impact of seasonal movement on survey estimates;
  - uncertainty in stock vs. survey areas;
- shortage of discard data on which to base estimates of total catch mortality;
- estimates of total catch mortality rely on *ad hoc* methods to estimate discards;
- discrepancies between the ADF&G and NOAA NBS survey estimates that remain unresolved;
- a few parameters are at bounds;
- the model consistently overestimates the proportion of large crab; and
- whether the high estimate for  $M$  in the largest size class is reasonable remains unresolved

The CPT recommends using the same ABC buffer as was endorsed by the SSC in 2024: 30%.

The resulting ABC is 199 t (0.440 million lb).

*Status and catch specifications (million lb.)*

<b>Year</b>	<b>MSST</b>	<b>Biomass (MMB)</b>	<b>GHL</b>	<b>Retained Catch Mortality<sup>1</sup></b>	<b>Total Catch Mortality<sup>2</sup></b>	<b>OFL<sup>3</sup></b>	<b>ABC<sup>3</sup></b>
2020	2.28	3.67	0.17	Conf.	Conf.	0.29	0.20
2021	2.26	5.00	0.38	0.007	0.007	0.63	0.35
2022	2.08	5.33	0.34	0.34	0.36	0.67	0.40
2023	2.65	5.29	0.39	0.43	0.44	0.680	0.480
2024	2.20	5.52	0.48	0.46	0.47	0.733	0.513
2025	2.36	4.72				0.628	0.440

*Status and catch specifications (1000 t)*

<b>Year</b>	<b>MSST</b>	<b>Biomass (MMB)</b>	<b>GHL</b>	<b>Retained Catch Mortality<sup>1</sup></b>	<b>Total Catch Mortality<sup>2</sup></b>	<b>OFL<sup>3</sup></b>	<b>ABC<sup>3</sup></b>
2020	1.04	1.66	0.08	Conf.	Conf.	0.13	0.09
2021	1.03	2.27	0.14	0.003	0.003	0.29	0.16
2022	0.95	2.42	0.15	0.15	0.16	0.30	0.18
2023	1.20	2.40	0.18	0.19	0.20	0.310	0.220
2024	1.00	2.50	0.22	0.21	0.215	0.332	0.233
2025	1.08	2.15				0.284	0.199

Notes:

<sup>1</sup>2019:2020: Refers to commercial fisheries only; 2021-2024: refers to all (commercial + subsistence) retained catch

<sup>2</sup>2019:2020: Do not include discard mortality (total retained catch only); 2021-2024 include estimated discard mortality

<sup>3</sup>OFL/ABC are total catch values in 2021-2025