# 7 Norton Sound Red King Crab

*Fishery information relative to OFL setting*

This stock supports three main fisheries: summer commercial, winter commercial, and winter subsistence. The summer commercial fishery, which accounts for the majority of the catch, reached a peak in the late 1970s at a little over 2.9 million pounds retained catch. Retained catches since 1982 have been below 0.5 million pounds, averaging 0.3 million pounds, including several low years in the 1990s. As the crab population rebounded, retained catches have increased to around 0.4 million pounds in recent years.

*Data and assessment methodology*

Four types of surveys 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. To improve abundance estimates, a male-only length-based model of male crab abundance was previously developed 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: 1980–2012 winter pot survey; 2013/2014 winter commercial and subsistence catches; revised commercial catch CPUE for 1977-2014; and the 1976–2014 triennial trawl survey data. The current model assumes a constant $M=0.18yr^{-1}$, except for a fixed value of $0.648yr^{-1}$ for the largest length class. Logistic functions are used to describe fishery and survey selectivities, except for a dome-shaped function examined for the winter pot fishery. The model timeline was also revised to have the assessment year start February 1.

The author summarized six model run alternatives, with the base model (Model 0) and alternatives originating from the 2014 modeling workshop. The CPT selected Model 6 as the recommended configuration based on several attributes: one selectivity for the NMFS and ADF&G trawl surveys and one selectivity for all commercial fisheries; inclusion of winter survey data as a means of informing the winter fishery harvest (this had negligible impact on model results); and estimation of a growth matrix inside the model (separated for newshell and oldshell crab).

*Stock biomass and recruitment trends*

Mature male biomass was estimated to be at an historic low in 1982 following a crash from the peak biomass in 1977. The MMB then exhibited an increase from a recent low in 1997 to a peak in 2010, before declining in recent years. 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 increase in recent years.

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

The team recommended Tier 4, stock status a, for Norton Sound red king crab. The CPT recommended the authors recommendation of Model 6 for use in estimating retained catch. Model-based total catch estimates were provided; however, these estimates were model-generated from limited observer data and the team did not recommend their use in generating a total catch OFL. Thus the OFL and ABC are based on retained catch only.

The estimated abundance and biomass in 2015 using Model 6 are:
Mature male biomass: 5.13 million lb with a standard deviation of 0.87 million lb.

The $B_{MSY\ \text{proxy}}$, calculated as the average of mature male biomass during 1980-2015, was $B_{MSY\ \text{proxy}} = 4.81$

million lb. The $F_{MSY\ proxy}$ is M =0.18 $yr^{-1}$ and the $F_{OFL}$=0.18$yr^{-1}$, because the 2015 mature male biomass is larger than $B_{MSY\ proxy}$ with the CPT choosing the default of gamma =1.0.

The maximum permissible ABC would be 0.721 million lb, based on retained catch. The CPT recommended an ABC less than the maximum permissible due to concerns with model specification, lack of bycatch data as well as issues noted with the M employed for the largest length group. The CPT recommended an ABC = 80% of the OFL (20% buffer) of 0.577 million lb.

*Status and catch specifications (1000 t) of Norton Sound red king crab*

| Year | MSST | Biomass (MMB) | GHL | Retained Catch | Total Catch | OFL | ABC |
|---|---|---|---|---|---|---|---|
| 2010/11 | 0.71 | 2.47[A] | 0.18 | 0.19 | 0.22 | 0.33 | |
| 2011/12 | 0.57 | 2.13[A] | 0.16 | 0.18 | 0.20 | 0.30 | 0.27 |
| 2012/13 | 0.80 | 2.08[A] | 0.21 | 0.21 | 0.21 | 0.24 | 0.22 |
| 2013/14 | 0.93 | 2.27[A] | 0.23 | 0.16 | 0.16 | 0.26 | 0.24 |
| 2014/15 | 1.09 | 2.33[B] | TBD | TBD | TBD | 0.33 | 0.26 |

*Status and catch specifications (million lb) of Norton Sound red king crab*

| Year | MSST | Biomass (MMB) | GHL | Retained Catch | Total Catch | OFL | ABC |
|---|---|---|---|---|---|---|---|
| 2010/11 | 1.56 | 5.44[A] | 0.40 | 0.42 | 0.46 | 0.73 | |
| 2011/12 | 1.25 | 4.70[A] | 0.36 | 0.40 | 0.43 | 0.66 | 0.59 |
| 2012/13 | 1.76 | 4.59[A] | 0.47 | 0.47 | 0.47 | 0.53 | 0.48 |
| 2013/14 | 2.06 | 5.00[A] | 0.50 | 0.35 | 0.35 | 0.58 | 0.52 |
| 2014/15 | 2.41 | 5.13[B] | TBD | TBD | TBD | 0.72 | 0.58 |

A – Estimated biomass in May for the year concerned.
B – Estimated biomass on February 1.

Total catch in 2014/15 did not exceed the OFL for this stock, thus overfishing is not occurring. Stock biomass is above MSST; thus, the stock is not overfished.

*Additional Plan Team recommendations*

The CPT has the following recommendations for the next assessment:

- more comprehensive description of the survey data;
- trawl survey CPUE standardization method needs to be explained.