Project Title: Cooperative Research on Bering Sea Crab Species with Commercial Industry Research Foundations and Resource Agencies

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The Alaska Fisheries Science Center (AFSC) crab scientists have worked cooperatively with the University of Alaska, Alaska Department of Fish and Game (ADF&G), and other agencies to assess and manage crab stocks in the Bering Sea and Aleutian Islands and the Arctic Fishery Management Plan regions. The AFSC and the Bering Sea Fisheries Research Foundation (BSFRF) have been working cooperatively on research relative to Bering Sea king, snow, and Tanner crab surveys, biology, and assessment since 2004. The AFSC and the newly formed Aleutian King Crab Research Foundation began working cooperatively in 2013. These cooperative projects have focused on the evaluation of alternative survey methodology for Bristol Bay red king crab (*Paralithodes camtschaticus*), the experimental determination of the trawl efficiency of the AFSC's Bering Sea survey trawl, the tagging of both snow crab and red king crab to determine movements of these stocks within the survey area, the assessment of red king crab in the nearshore waters of Bristol Bay, the estimate of snow crab, Tanner crab (*Chionoecetes bairdi*) and golden king crab (*Lithodes aequispinus*) handling mortality, and the determination of snow crab (*Chionoecetes opilio*) and Tanner crab growth increments in the field and in the laboratory. Research projects were prioritized based on level of importance for the survey and assessment of crab stocks in the eastern Bering Sea consistent with the FMP for Bering Sea and Aleutian Islands King and Tanner Crabs and with consideration for the goals of the Arctic FMP. This research is a cooperative effort not only with the commercial industry but also with other agencies cooperatively managing these crab stocks. As outlined in the FMP, the Alaska Board of Fisheries and the North Pacific Fishery Management Council jointly manage ten crab stocks in the Eastern Bering Sea with research and assessment conducted by ADF&G and the NOAA Fisheries Service. In this partnership, the AFSC is responsible for providing biomass estimates from the annual eastern Bering Sea bottom trawl survey for these stocks. The AFSC and ADF&G stock assessment scientists then utilize these biomass estimates along with catch data and other biological information to determine the status of the stock and to estimate the overfishing limit, allowable biological catch, and total allowable catch.

In FY15, research was conducted to support red king crab catchability and Tanner crab growth studies.

<u>Red king crab catchability</u>

To assess and manage the stock biomass of red king crab in Bristol Bay, scientists currently use a length based stock assessment model to approximate survey biomass trends and to establish biological reference points. Catchability is an important parameter in the assessment model describing the relative ability of a survey to estimate the population abundance. The catchability of crab in the survey is a function of both availability and selectivity of the crab to the bottom trawl gear. Currently the selectivity

of red king crab to the survey gear is unknown. However, recent cooperative research on snow crab suggests that the selectivity of crab species by the standard survey gear is less than one and is size and sex specific. In June, 2013 and 2014, AFSC and BSFRF scientists collaborated on a side-by-side survey with two industry vessels "shadowing" two AFSC vessels during the standard bottom trawl assessment of crab. The survey was successful in 2013 but due to the limited number of stations with red king crab an additional year of data was necessary to have the sample size needed to statistically assess selectivity across size and sex classes. Confounding results due to the addition of two new vessels and to above normal bottom temperatures in 2014 suggest that additional surveys are required to assess the effects of vessel and environmental conditions on selectivity. In May 2015 we providing scientific staffing for data collection and analysis aboard industry funded vessels that conducted a trawl survey alongside the AFSC bottom trawl survey in Bristol Bay. In addition, AFSC cameras were mounted on the industry net to assess crab behavior relative to crab density and environmental conditions. Data analysis continues on the project with a planned presentation at the NPFMC meeting in September at which time the data will be assessed to determine if addition sample data are needed in FY16.

Tanner crab growth

The stock assessment for Tanner crab depends upon the values of various parameters and functional relationships in the length based population assessment model used to manage crab stocks. One of the most influential of these parameters is the growth per molt (increase in size) as a function of carapace width. This study is intended to collect the growth per molt data needed to estimate this functional relationship. A similar study was conducted on snow crab in 2011 with the empirical data incorporated into the stock assessment process in 2013. In 2012, studies were initiated by AFSC and BSFRF scientists to assess Tanner crab growth. Unfortunately, the data collection was limited by sea ice and only a small portion of the size distribution was covered. In 2014, funds were not able to be used for this study due to the timing of the availability of the funds. In spring 2015, over 400 crab were collected and brought to Dutch Harbor where they were held in net pens at the Westward Seafood's docks. Crab were monitored for growth (pre and post molt) over the period of 45 days. Those growth data will be presented at the fall 2015 NPFMC meeting and provided to authors for incorporation into the stock assessment model.