Project Title: FY16 Cooperative Research on Bering Sea Crab Species with Commercial Industry Research Foundations and Resource Agencies $173K

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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.

Based on meetings with industry foundations and resource agencies to define cooperative research priorities, we propose the following research projects in FY16. **The total requested funds for all crab projects are $173,000.**

<u>Tanner crab catchability</u> (Total = $66,000)
In June, 2013, 2014, and 2015 AFSC and BSFRF scientists collaborated to assess the catchability of Bristol Bay red king crab in in the AFSC bottom trawl survey. A side-by-side survey was conducted with two industry vessels "shadowing" two AFSC vessels during the standard bottom trawl assessment of crab. The survey was successful in each year providing a range of results specific to red king crab. In the process of collecting data on red king crab, Tanner crab were also collected from a small portion of their range. Thus far, the data suggest that catchability of Tanner crab is not equal between the different gear types.

To assess and manage the stock biomass of Tanner crab in the Bering Sea, 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 Tanner crab to the survey gear is unknown. However, recent cooperative research on snow crab and red king crab suggests that the selectivity of crab species by the standard survey gear is less than one and is size and sex specific. We propose to collaborate with industry by providing scientific staffing for data collection and analysis aboard industry funded vessels during the AFSC bottom trawl survey in FY16.

- Support to support data collection, analysis, and publication: **$35,000**
- Send AFSC representatives to participate in the side by side survey of Tanner crab
  - Travel costs: **$5,000**
- Camera supplies for trawl mount
  - Supplies: **$6,000**
- Charter fuel: **$20,000**

Crab growth (Total = $107,000)

The stock assessments for snow, Tanner, and red king crab depend 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 and 2015 studies were conducted by AFSC and BSFRF scientists to assess Tanner crab growth. To date, previous projects were successful at collecting growth data for sub-adult crab and those data are successfully informing the stock assessment models. A request has been made through the NPFMC to continue to develop the growth increment relationships for larger crab. In addition, the NPFMC has requested addition growth data be collected to support the red king crab stock assessment model. An MOU between industry and AFSC, which is currently under legal review within DOC, will allow industry funds to be spent earlier in the year so that this study can be completed in 2016. We propose to work with industry to collect Tanner and snow crab, hold them in Dutch Harbor, and assess growth per molt throughout their size range. Red king crab will be collected in Bristol Bay and sent to the Kodiak laboratory to conduct growth studies.

- Staff overtime at sea: **$10,000**
- Support to support data collection, analysis, and publication: **$25,000**
- Contract to send person to DH to go to sea and run experiment: **$25,000**
- Charter Fuel: **$28,000**
- Travel to DH: **$9,000**
- Supplies to hold crab at sea and in DH: **$10,000**

Crab tagging development (Total = $10,000)

The Bering Sea crab industry has identified an interest in funding research to better understand crab movements. Previous crab tagging projects have assessed movement of red king crab and snow crab using tags that require recapture in order to collect data. As such, the recapture rate is

very low (often <1%) resulting in statistically limiting analyses. In 2010, a pilot study was conducted to develop a miniaturized acoustic transponder and was tested on red king crab to track tagged crab using multi-beam sonar. In FY16 we propose to revisit the technology development and engage additional colleagues from the University of Washington Applied Physics Laboratory to develop a future plan, supported by industry, for a long term crab tagging program. Costs in this year are limited to travel to support project design and development to come from other sources.