

## FY14 Cooperative Research on Bering Sea Crab Species with Commercial Industry Research Foundation

Contact: Robert Foy

TOTAL PROPOSED: \$272,000

The Alaska Fisheries Science Center (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 Alaska Fisheries Science Center (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 and golden king crab (*Lithodes aequispinus*) handling mortality, and the determination of snow crab (*Chionoecetes opilio*) and Tanner crab (*Chionoecetes bairdi*) 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 Fisheries Management Plan (FMP) for Bering Sea and Aleutian Islands King and Tanner Crabs. 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 the Alaska Department of Fish and Game (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. 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 (OFL), allowable biological catch (ABC), and total allowable catch (TAC).

In FY14, we propose the following research projects based on meetings with both industry foundations to cooperatively define research priorities. The total requested funds for all crab projects is \$272,000.

### Red king crab catchability (Total = \$7,000)

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 a 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, 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 but due to the limited number of stations with red king crab an additional year of data will be

necessary to have the sample size needed to statistically assess selectivity across size and sex classes. 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 FY14.

- Send AFSC representative to participate in the side by side survey of Bristol Bay Red King Crab
  - Travel costs: **\$4,000**
- Camera mounted on BSFRF trawl w/lights
  - Supplies: **\$3,000**

#### Handling mortality (Total = \$20,000)

Crab fisheries in Alaska use baited pots to capture crab and bring them to the surface. Only males of a minimum size can be retained while females, smaller males, and crab from non-targeted species must be returned to the sea. The process of sorting and discarding non-retained crab results in discard mortality of unknown magnitude, under some conditions estimated to be up to 100%. Management regulations, recognizing the importance of considering all sources of fishing mortality, mandate that discard mortality must be considered when setting catch limits. Until recently, a rate of 50% mortality was applied to the crab discarded from pot fisheries in Alaska. In 2013, based on cooperative research with industry the handling mortality for snow crab was reduced from an arbitrarily chosen 50% to an empirically based estimate of 30%. The methodology used to assess mortality was based on a reflex response model that is also available for Tanner crab. We propose to work with industry to train observers to assess the mortality of Tanner crab during the Tanner and snow crab fisheries in FY14.

- Travel to train observers and to go to sea: **\$6,000**
- Contract observers to collect data during fishery: **\$14,000**

#### Tanner crab growth (Total = \$42,000)

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 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. We propose to work with industry to collect Tanner crab, hold them in Dutch Harbor, and assess growth per molt throughout their size range.

- Contract to send person to DH to go to sea and run experiment: **\$28,000**
- Travel to DH: **\$4,000**
- Supplies to hold crab at sea and in DH: **\$10,000**

Aleutian Islands golden king crab data mining (Total = \$105,000)

Recent cooperative interactions between the Aleutian King Crab Research Foundation, AFSC, and ADF&G have led to research prioritization for golden king crab. Currently there is no consistent index of stock abundance for Aleutian Islands golden king crab nor is there an accepted stock assessment model from which to determine fundamental target or limit reference points such as maximum sustainable yield. We propose to work cooperatively to identify methods for a fishery-independent survey based on information from recent commercial catch data and observer data. A possible specific outcome may be the systematic random sampling of recent historic data to create an “independent” annual data stream from which to fashion indices of abundance and productivity, as well as target and limit reference points.

- Post-doctoral salary: **\$90,000**
- Travel: **\$12,000**
- Supplies to support data retrieval and analysis: **\$3,000**

Red king crab larval release locations (Total = \$98,000)

Red king crab larvae spend months in the water column and have specific habitat requirements upon settlement. Because of this, the location of larval release relative to suitable juvenile habitat may be important in determining recruitment success or failure in a given year. Before modeling exercises can be done to estimate the scale of essential habitat for mature females and settled juvenile crab, data on the behavior and distribution needs to be collected. Red king crab larvae occur throughout the water column; however, it is unknown if they actively vertically migrate to influence horizontal migration. We propose working with industry research vessels to collect larval crab along the Alaska Peninsula after larval release.

- Fuel for research vessel (2 weeks at \$6K/day): **\$84,000**
- Travel to DH: **\$4,000**
- Supplies/nets: **\$10,000**