Aleutian King Crab Research Foundation Report to the NPFMC Crab Plan Team
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The Aleutian King Crab Research Foundation (AKCRF) was formed in early 2012 by the Quota Share holders in the Aleutian Islands golden king crab (GKC) fishery. The mission of AKCRF is:

> ***Promoting scientific research activities essential for the conservation and management of Aleutian Islands king crab.***

Articles of Incorporation, filed on March 27, 2012, and a set of Bylaws define the structure and function of AKCRF. It is organized as a 501(c)(6) non-profit corporation in the State of Alaska, and has an elected slate of officers. Currently Rip Carlton is President. Some of the participants in AKCRF also hold shares in the Aleutian Islands red king crab fishery and therefore, while the primary focus is GKC, the foundation also supports improved research for red king crab.

So far, the foundation has focused its activities on assisting the Alaska Department of Fish and Game (ADF&G) and National Marine Fisheries Service (NMFS) gain information needed to fill major gaps in the knowledge of GKC, these activities include: 1) providing samples to NMFS for laboratory work related to growth, handling mortality, and ocean acidification, 2) obtaining the gear and providing the ship time to allow ADF&G to conduct a comparison of standard commercial crab pots with small mesh pots in order to determine the selectivity of commercial pots and identify existence and relative abundance of female and undersized male golden king crab, 3) having Paul Starr participate in the Crab Plan Team's (CPT) model workshops (most recently January 14 – 17, 2014), and reviewing and providing feedback on the golden king crab model being developed by ADF&G, 4) assisting with the development of a stock assessment survey by providing scientific assistance as well as vessel time and expertise to plan and carry out a survey, and 5) assisting the community of Adak in working toward a red king crab survey in the Adak area.

This report focuses on AKCRF efforts over the last 6 months to help develop an Aleutian Islands GKC survey. AKCRF organized three meetings to work on development of a survey and has worked closely with ADF&G in the design of the survey.

November 21, 2013: AKCRF organized a meeting in Seattle with Jeff Regnart (Director of Commercial Fisheries, ADF&G) and Chris Siddon (Chief of Marine Research, ADF&G) to explore ways of reinstating and improving the Aleutian Islands GKC survey, which had not been carried out since 2006 because of insufficient funding. To demonstrate AKCRF commitment to improved research and the survey in particular, this meeting was attended by representatives of virtually all the vessels and quota share holders including Rip Carlton (President), Dick Powell (Quota Share holder), Rex Capri (Alaska Trojan), Mark Henkel (Erla N), Edward Poulsen (Quota Share Holder), and Dick Tremaine (Siu Alaska).

Also representing AKCRF were Scott Goodman (Natural Resource Consultants (NRC)), Linda Kozak (Golden King Crab Coalition), and John Hilsinger (AKCRF Science Advisor).

Chris Siddon identified means by which he thought a valid survey could be carried out by the fleet and he committed to working on designing it himself; vessel owners made a long term commitment of both their vessel time and their GKC fishing expertise to help design and carry out such a survey. Following this meeting, AKCRF contracted with Scott Goodman who has substantial experience developing Bering Sea crab surveys to assist Chris Siddon in development of the survey.

January 13, 2014: A follow up meeting was held in Anchorage to discuss design of the survey in more detail and to include more participants from the foundation, fleet, ADF&G, and NMFS. AKCRF representatives included Rip Carlton, Dick Powell, John Hilsinger, Dick Tremaine, Scott Goodman, and Paul Starr (a modeling expert with substantial experience designing surveys). NMFS was represented by Bob Foy (Director, Kodiak Lab). ADFG was represented by Chris Siddon, Karla Bush (Extended Jurisdiction), Doug Pengilly (Fishery Scientist), Wayne Donaldson (Regional Management Biologist), and William Gaeuman (Crab Observer Project).

After much discussion, participants agreed on the goal for the meeting as follows:

> *ADF&G, AKCRF, and NMFS to work together to develop a framework around which to design a cooperative survey that will provide a reliable index of abundance for Aleutian Islands golden king crab as well as collect other biological information necessary to meet the goal of moving this stock from Tier 5 to Tier 4.*

The group recognized that moving golden king crab into Tier 4 would also require estimates of the biomass that produces maximum sustained yield (B_{msy}) and growth data, but that moving to Tier 4 was a reasonable goal to work toward. Participants agreed that a presentation of the survey design could be ready to present to the CPT at its May meeting, but also recognized that it would probably take 5 years to produce useful information, and 10 years, to gather all the necessary information.

While a stock assessment model exists for golden king crab, it has not been approved due to issues with the model and with developing a reliable index of abundance. It was noted that currently the only available index of abundance is provided by the commercial catch per unit effort (CPUE) and that data is not suitable because it indicates the index of abundance is flat and it is not possible to determine if the crab abundance is stable or if the fishery is hyperstable because of the way fishing is conducted under rationalization. There was agreement that a reliable abundance index is the most import element in the model and an index of abundance from a survey is needed to make a model work. ADF&G staff noted that having both recruit and pre-recruit abundance indices would be necessary for making short term management decisions.

Participants agreed that there would need to be a long term commitment to a survey, as well as periodic meetings to assess how the survey is working and make any necessary changes. Because of the level of investment by the industry in this fishery, they are committed to helping develop a survey that works. Participants also agreed that the survey should be designed around what information is needed, rather than what is feasible to collect. The survey should be designed to assess the entire area (both eastern and

western Aleutians – EAG and WAG, respectively). Once the overall survey is designed, then an implementation strategy can be developed, such as starting with a smaller area (referred to as a "pilot survey" or "proof of concept") to provide proof that the survey works and to identify elements of the survey plan that need to be improved. It was recognized that in order to get a good index of abundance, the survey should be made as independent of the fishery as possible, and the previous grid design should be disposed of in favor of meaningful stratification with random sampling.

Chris Siddon showed data on the distribution and relative abundance of crab throughout the entire area based on the commercial fishery. The entire fishing area is roughly 234,000 square kilometers (a little larger than Minnesota). Before actually designing the survey, this data needs to be analyzed to see how variable the catch is, which will determine how many stations must be sampled. This is essentially done by taking the commercial catch data and subsampling it to get the coefficient of variation (CV) to see whether 30, 40, 50, or more stations need to be fished in order to bring the CV to the desired level. The group discussed the area that Chris labeled Area H as a potential area to survey during the first year. Final decisions on sampling area and sampling design will depend on the results of the variance analysis.

Chris Siddon and Scott Goodman agreed to work together to design the survey.

March 18, 2014: AKCRF organized a meeting during the Alaska Board of Fisheries shellfish meeting to discuss progress on the survey design. AKCRF was represented by Rip Carlton, Mark Henkel, Rex Capri, Dick Powell, Dave Fraser (ACDC), Linda Kozak, Dick Tremaine, and John Hilsinger. ADF&G was represented by Jeff Regnart, Chris Siddon, Forrest Bowers (Deputy Director of Commercial Fisheries), Steve Honnold, (Westward Regional Supervisor), Wayne Donaldson, Doug Pengilly, Heather Fitch (BS/AI Area Management Biologist), and Mary Schwenzfeier (Crab Observer Project Leader). Chris Siddon described progress made on survey design, what feedback was needed from the fleet, and what still had to be made.

Two options for the survey were discussed:

> Option 1 – Independent survey of golden crab habitat carried out preseason.
> Option 2 – Survey carried out by the fleet during fishing operations, which would expand the area normally fished as necessary to include GKC habitat not normally fished during the commercial fishery.

In order to assess the concept of using the fleet (Option 2), existing observer data was analyzed in enough detail to determine that it is not high enough resolution to answer some important questions. In order to design the survey and know how many pots to sample, the variability in catch from pot to pot within a string of gear as well as the variability in catch between strings of gear in different areas is needed. Since the observers normally sample only one or two pots per string, it is not possible to determine the variability between pots and between strings. Two avenues for collecting this information were discussed. First was getting copies of the vessel logs for the EAG for analysis of the variability in catch within and among strings (three GKC vessels agreed to do this; 2 EAG and 1 WAG). Analysis first focused on logs from the two EAG vessels because that is where the first pilot project will occur. The second discussed was sending a sampler out to the WAG to sample actual catches during the remainder of the fishery. This would provide catch by pot as well as indicate how many pots could be sampled in a day

without impacting fishing operations. The remaining vessel fishing in the WAG agreed to take a sampler for the approximately three remaining weeks of fishing. Other needed information from the skippers is the length of the gear strings so the proper station size can be determined. This information is available from the logs provided by the vessels.

Based on the observer data, Chris Siddon suggested station locations and sizes everywhere for which there is observer data. Rip Carlton carefully reviewed Chris's charts and said almost the whole area that Chris laid out is currently fished and that having the commercial boats do a survey of that area is very doable.

Questions remaining to be answered include: 1) whether and how to incorporate the small mesh pots into the survey, which needed consultation with other ADF&G staff and 2) how many pots need to be sampled per string. ADF&G had expert samplers available that were sent out this spring to sample remaining catches from the WAG aboard the remaining commercial vessel still fishing. The purpose of sampling was to see if a sampler can adequately sample the requisite number of pots without unacceptably slowing the fishing operation.

The group then discussed the concept of the preseason survey (Option 1). It is likely the strings of gear would likely be shorter than commercial strings – maybe 10 pots rather than 50. Once the survey is designed it will be possible to assess the cost of an independent survey and determine its feasibility. If a preseason survey is determined to be the best, GKC vessels are willing to carry it out if technical issues related to test fish funds and assignment of quota share can be worked out.

In closing the meeting, it was agreed the three skippers will provide log book information that provides latitude and longitude as well as catch for each pot. Time needed to sample each pot will be determined from the sampler carried aboard the remaining WAG vessel. Skippers agreed to review the proposed station chart for the areas they would fish, and any closed areas in the EAG for protection of things like coral need to be identified so they can be excluded from the survey.

March – April, 2014: In order to get the information on the pot to pot catch variability and indication of how many pots can be sampled in a day, ADF&G provided a sampler who spent about 3 weeks aboard the Aleutian Number 1 while it fished for golden king crab in the WAG. This data is now available and being used by ADF&G in the survey design.

Summary: The AKCRF is committed to improving the research and management for Aleutian Islands golden and red king crab. One of the most critical information needs is a reliable index of abundance. Efforts to date to use commercial CPUE have not yielded positive results because it appears that changes in CPUE over time are not directly related to changes in actual abundance. Therefore, the most likely way to gather relative abundance information is to have a survey that includes GKC habitat for the entire area. AKCRF committed to assist the ADF&G in designing and carrying out such a survey. To that end, AKCRF organized three meetings to discuss and plan the survey and provided professional technical assistance by Scott Goodman and Paul Starr. AKCRF has carried ADF&G samplers aboard their vessels to gather information critical to designing the survey. AKCRF vessels have also committed to carrying out the survey over the long time frame necessary to gaining useful results.

Acknowledgements: AKCRF would like to acknowledge the commitment of ADF&G staff, particularly Chris Siddon, to designing and carrying out this survey. Doug Pengilly, Wayne Donaldson, and Karla Bush have also been very helpful in providing suggestions and information necessary for successfully designing and conducting such a survey. We would also like to acknowledge the commitment of Bob Foy of NMFS toward helping design this survey.