A Long-term Project Investigating Female Reproductive Potential of *Chionoecetes* Crabs

Laura M. Stichert, Joel B. Webb, & Douglas Pengilly

ADF&G, Kodiak & Juneau
Outline

- Background, Justification, and Goals
- Methods
- Products
- Future Directions
Commercial Harvest

EBS snow crab have contributed nearly a quarter of the biomass of crabs commercially harvested in the United States over the past three decades.

Figure modified from Pengilly et al. (2014). Data compiled from NMFS Fisheries Statistics Division, available at www.st.nmfs.noaa.gov/st1/commercial/landings/gc_runc.html.
Background: Importance of Study

Commercial Harvest

EBS Tanner crab are not a large player on the national scale, but have been an important contributor in Alaska.

Data compiled from NMFS Fisheries Statistics Division: www.st.nmfs.noaa.gov/st1/commercial/landings/gc_runc.html
Justification

- Large male-only fishery
- Mature male biomass used as an index of reproductive potential in stock assessment
- Development of indices based on female reproductive potential identified as a research priority by:
  - NPFMC CPT and SSC
  - 2012 Snow Crab Workshop Participants (Pengilly et al. 2014)
  - Stock assessment authors for SAFE report
  - CIE review of snow crab stock assessment
- “Data poor” rationale
Justification

Measuring Reproductive Potential
Background: Prior Work

- Decades of work on female reproductive potential and mating dynamics of snow crab in the Northwest Atlantic (Bernard Sainte-Marie et al.)
- ADF&G/NOAA cooperative seasonal study in 2002–2003
- ADF&G pilot study on female reproductive potential in 2005
Goals

1) Create data time series that lays foundation to evaluate spatiotemporal variability in female reproductive potential and factors contributing to that variability

2) Analyze data to improve understanding of the relationships of female reproductive potential to male reproductive potential and stock productivity
Methods

Study Area: Annual NOAA AFSC EBS shelf trawl survey
Methods: Crab Distribution

2014 EBS Snow Crab Mature Female Distribution
Methods: Crab Distribution

2014 EBS Tanner Crab Mature Female Distribution
Methods

Sample Collection: 2007→current

• Sampled primiparous, new multiparous, and old multiparous 2007–2009
• Based on contributions to population fecundity, focused on primiparous and new multiparous from 2010 on
• Developed systematic sampling over time, with similar method since 2010
• Added targeted sampling for snow crab in southeast since 2010
Methods

Sample Collection:
• Collected crabs live when possible, otherwise frozen (2007–2011) or preserved (2012–current)
• Transported samples
• Held live crabs in flow-through seawater tanks in Kodiak and Juneau
Methods

Sample Processing: Dissect Crabs

- Removed and preserved sperm storage organ
- Collected data on:
  - female size
  - shell condition
  - egg development
  - ovary development
- Collected data on fecundity for subsample of crabs
Methods

Sample Processing: Sperm Storage

- Collected data on spermathecal load and/or sperm cell counts for subsample of crabs
## Products: Data Set

<table>
<thead>
<tr>
<th>Year</th>
<th>Snow Crab</th>
<th>Tanner Crab</th>
<th>Hybrid Crab</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>559</td>
<td>416</td>
<td>20</td>
</tr>
<tr>
<td>2008</td>
<td>693</td>
<td>289</td>
<td>47</td>
</tr>
<tr>
<td>2009</td>
<td>584</td>
<td>121</td>
<td>96</td>
</tr>
<tr>
<td>2010</td>
<td>367</td>
<td>114</td>
<td>28</td>
</tr>
<tr>
<td>2011</td>
<td>445</td>
<td>87</td>
<td>20</td>
</tr>
<tr>
<td>2012</td>
<td>704</td>
<td>166</td>
<td>88</td>
</tr>
<tr>
<td>2013</td>
<td>555</td>
<td>125</td>
<td>102</td>
</tr>
<tr>
<td>2014</td>
<td>519</td>
<td>146</td>
<td>4</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>4,426</strong></td>
<td><strong>1,464</strong></td>
<td><strong>405</strong></td>
</tr>
</tbody>
</table>

*Note:* Table includes only crabs collected through standard population-level collection procedures; additional samples exist for discrete research questions over this time.
Products: Publications

Snow Crab Fecundity
Webb et al. 2012
Snow Crab Sperm Reserves
Slater et al. 2010
• Stored sperm mass levels
• Highest in SE area
Products: Preliminary Results

Snow crab

- Low where most of population is distributed
- Similar trends by ontogeny

Primiparous

Multiparous
Future Directions

• Use data set to evaluate spatiotemporal patterns, evaluate relationships to male and female abundance and recruitment, and develop direct inputs or indirect explanatory mechanisms that can inform management

• Continue collaborations with UAF faculty through graduate studies:
  • Stichert: PhD with focus on snow crab sperm reserves
  • Knutson: MS with focus on Tanner crab
Many Helping Hands

Sample Collection – NOAA EBS Survey
  • ADF&G, NOAA, UAS survey participants

Logistics & Sample Transport
  • ADF&G Dutch Harbor staff and assistance by NOAA Kodiak Lab

Live Crab Stewardship & Sample Processing
  • ADF&G in Kodiak and Juneau, especially: Kayla Bevaart, Jassalyn Bradbury, Leslie Curran, Tara Fritzinger, Meg Inokuma, Thomas Kinsley, Mike Knutson, Nina Leacock, Laura Stichert, Andrew Olsen, & Joel Webb
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Any Questions?
References

