Pribilof Islands blue king crab (*Paralithodes platypus*) recruitment limitation as a potential bottleneck to rebuilding from overfished status

Crab Plan Team, September 15, 2020

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https://www.sfos.uaf.edu/research/pribsbluesmuse/
https://www.instagram.com/pribsbluesmuse/
Funding and Support
What are we doing here? (virtually and literally)

If I were to ask you to describe Pribilof Island blue king crab, what comes to mind?

Mature Male Biomass (t)
Early Life History and Settlement

Shallow, cold water king crab

(photo NOAA-AFSC)
Objectives

1. Quantify supply and abundance of early juvenile stages of blue king crab and red king crab.

2. Assess habitat availability in nearshore St. Paul Island areas relative to historical survey sites.

3. Identify juvenile king crab predators and predation potential.

(relative comparisons to MMS OCSEAP 1983/84 Study, Armstrong et al. 1987)

Communicate meaningfully and engage with local residents in research and communicate our results to fishery managers to inform fishery management and rebuilding efforts.
1. Abundance
Blue king crab (2-5mm CL)

Methods:
Historical - Bottom Trawls / Rock Dredges
Today - YOY collector bags (SAC) / diver surveys

Results:
Historical (YOY, N = 514 YOY)
Total BKC Caught (N = 3,005)

2017-19 (N = 8 YOY)
Total BKC Caught (N = 8)
1. Abundance

Blue king crab (2-5mm CL)

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Results:
Historical (YOY, N = 514 YOY)
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Results:
Historical (YOY, N = 514 YOY)
Total BKC Caught (N = 3,005)
1. Abundance
Red king crab (2-5mm CL)

Methods:
Historical - Bottom Trawls / Rock Dredges
Today - YOY collector bags (SAC) / diver surveys

Results:
Historical (YOY, N = 14 YOY)
Total BKC Caught (N = 87)
1. Abundance

Red king crab (2-5mm CL)

Methods:
Historical - Bottom Trawls / Rock Dredges
Today - YOY collector bags (SAC) / diver surveys

Results:
Historical (YOY, N = 14 YOY)
Total BKC Caught (N = 87)

2017-19 (N = 145 YOY)
Total BKC Caught (N = 192)
1. Abundance

1. Quantify supply and abundance of early juvenile stages of blue king crab and red king crab.

2. Assess habitat availability in nearshore St. Paul Island areas relative to historical survey sites.

3. Identify juvenile king crab predators and predation potential.

Conclusions:

• BKC juvenile abundance is limiting and severely depressed
• RKC juvenile abundance is 2 orders of magnitude above BKC and increased in area
• BKC / RKC SAC catch overlap
2. Benthic Habitat

Methods:
Historical - Bottom Trawl / Rock Dredge notes
Today - Diver and camera surveys

Results:
Historical (NPRB 1321)
2. Benthic Habitat

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Historical - Bottom Trawl / Rock Dredge notes
Today - Diver and camera surveys

Results:
Historical (NPRB 1321)
2. Benthic Habitat

Methods:
Historical - Bottom Trawl / Rock Dredge notes
Today - Diver and camera surveys

Results:
• 87% matching at repeat sample sites from 1980s to today
• Qualitative substrate complexity
2. Benthic Habitat

Results:
- CPUE estimates
- IDW interpolation
- Modeling substrate ~ depth, biological community

Rocky (Large)  Mud / Sand (Small)  Intact Shell Hash Type I
2(a). Pelagic Habitat

- Oceanography
  - Tidbit / CTD SSTs from nearshore areas

- Air Temps from St. Paul Airport NWS

- Weather
  - 2018 Storms
1. Quantify supply and **abundance** of early juvenile stages of blue king crab and red king crab.

2. Assess **habitat** availability in nearshore St. Paul Island areas relative to historical survey sites.

3. Identify juvenile king crab **predators** and predation potential.

Conclusions:

- Benthic habitat is non-limiting and relatively unchanged
- Intact shell hash (Type 1) regions need more BKC assessment
- Pelagic habitat (SST) has warmed compared to 1980s
4. Predation

Methods:
Historical - NA

Today
• Diver / camera survey CPUE estimates
• Juvenile red king crab tethering experiments in situ
• Fish Stomach / Diet Analysis
4. Predation

**BKC... RKC Tethering Experiments**

- **RKC Predation vs. Survival**
  - High predation observed with high fish densities
  - RKC ‘hiding’ behavior increases with high fish densities

![Graphs showing predation rates and natural behavior](image-url)
4. Predation

BKC... RKC Tethering Experiments

• Fish Presence and Behavior
  • Predator species more diverse at natural site

• Kelp greenling, wolf eel, and pygmy rock crab confirmed predation events
4. Predation
Fish Diet Analysis

- Fish Stomach Samples
  - Commercial halibut (N = 61) from F/V Bay Rose
  - Small fish diver/hookline caught (N = 55)

- Diet Analysis
  - Halibut
    - 21% crab (empties excluded)
  - Small Fishes
    - Few crab, but full inverts
3. Predation

1. Quantify supply and abundance of early juvenile stages of blue king crab and red king crab.
2. Assess habitat availability in nearshore St. Paul Island areas relative to historical survey sites.
3. Identify juvenile king crab predators and predation potential.

Conclusions:
• Predation is likely non-limiting
• Density dependent predation in trials
• Behavioral responses of crab under increased risk is evident
Summary and Next Steps

- Juvenile BKC abundance is limiting, RKC may not be limiting
- Benthic habitat is non-limiting and relatively unchanged over time
- Pelagic habitat is warming with delayed stratification
- Predation is likely non-limiting, is density dependent, and behavioral responses are evident in at risk juvenile RKC

Next steps

- Science
  - Are juvenile BKC more abundant in deep Shell Hash Type I areas? Last Refuge?
  - Further enhancement strategies?

- Policy
  - Community and stakeholder engagement on what’s next for PIBKC and PIRKC
Thank you and Questions

Literature Cited


Coming soon to St. Paul! Community softball field banners (8x4ft)