



Photos by Jared Weems (UAF)
Emblems by James Kelly (Decaffinated Designs)

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



**AKCRRAB
Program**



**CITY OF
Saint Paul
ALASKA**





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?

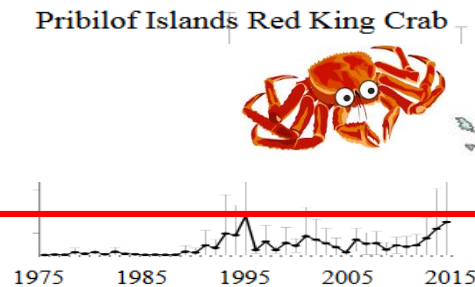
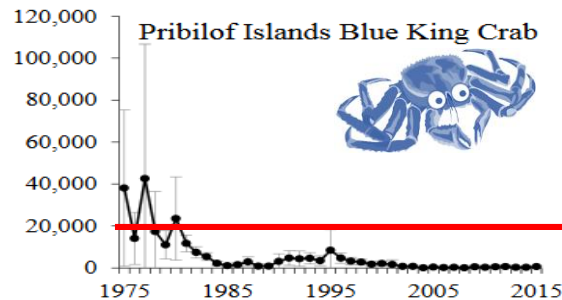


2019 Stock Assessment and Fishery Evaluation Report
for the Pribilof Islands Blue King Crab Fisheries of the
Bering Sea and Aleutian Islands Regions
William T. Stockhausen (AFSC, NMFS)
07 May, 2019

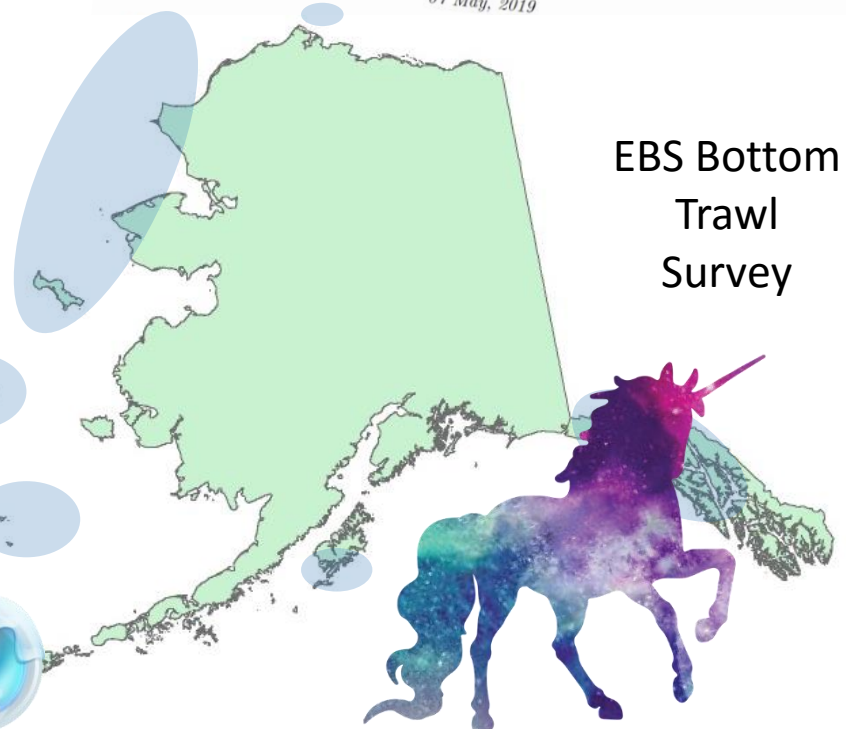
C4 PIBKC SAFE
OCTOBER 2019

EBS Bottom
Trawl
Survey

Mature Male Biomass (t)

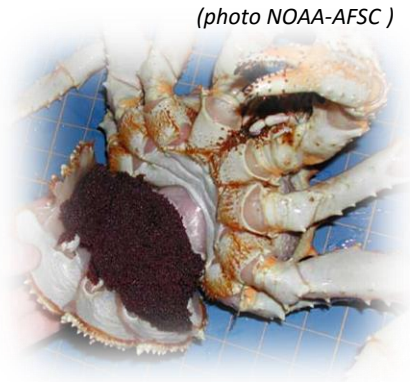


NPFMC 2015



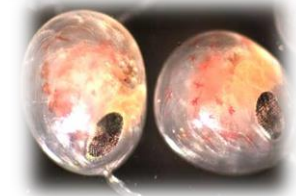


Early Life History and Settlement



(photo NOAA-AFSC)

**Shallow,
cold water
king crab**



(photo NOAA-AFSC)



(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.

*You ...
Listening right now!*



1. Abundance

Blue king crab (2-5mm CL)

Methods:

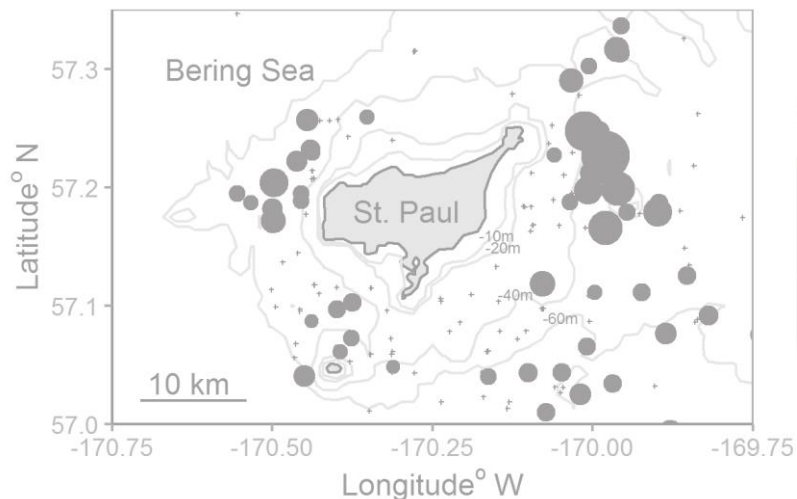
Historical - Bottom Trawls / Rock Dredges

Today - YOY collector bags (SAC) / diver surveys

Results:

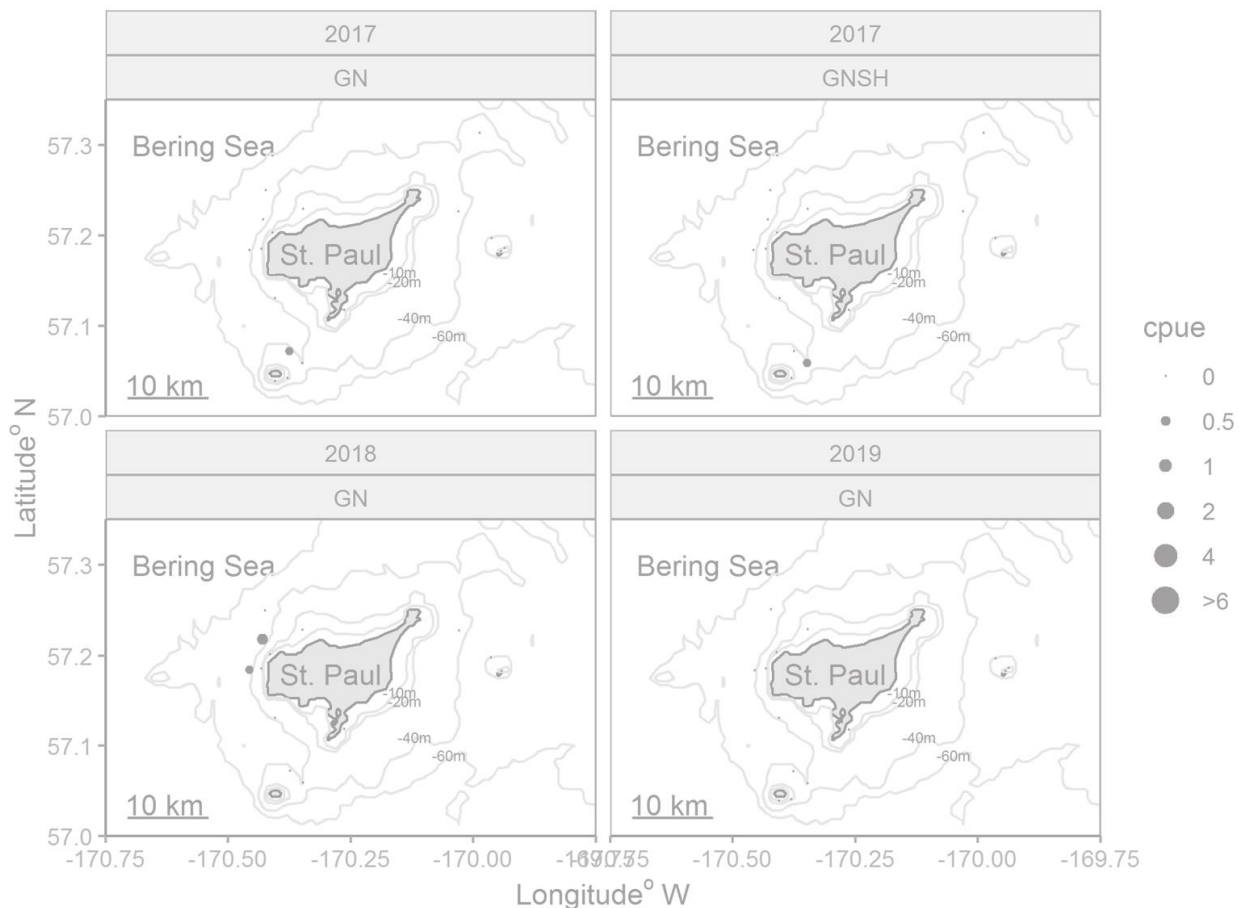
Historical (YOY, N = 514 YOY)

Total BKC Caught (N = 3,005)



2017-19 (N = 8 YOY)

Total BKC Caught (N = 8)





1. Abundance

Blue king crab (2-5mm CL)

Methods:

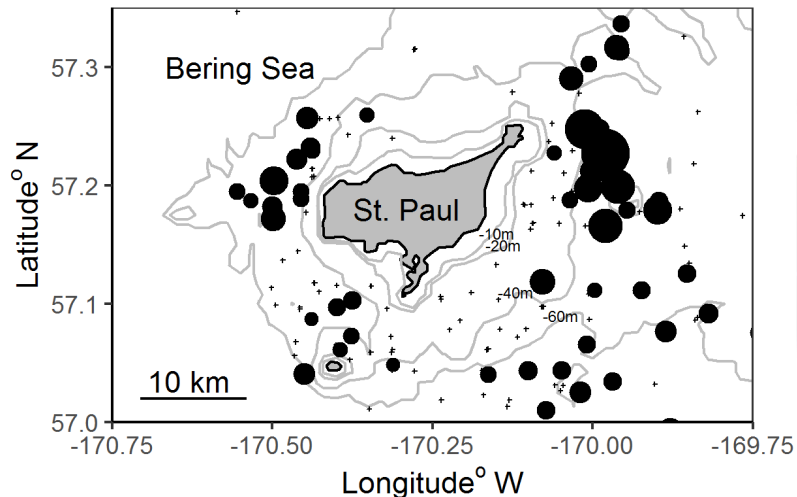
Historical - Bottom Trawls / Rock Dredges

Today - YOY collector bags (SAC) / diver surveys

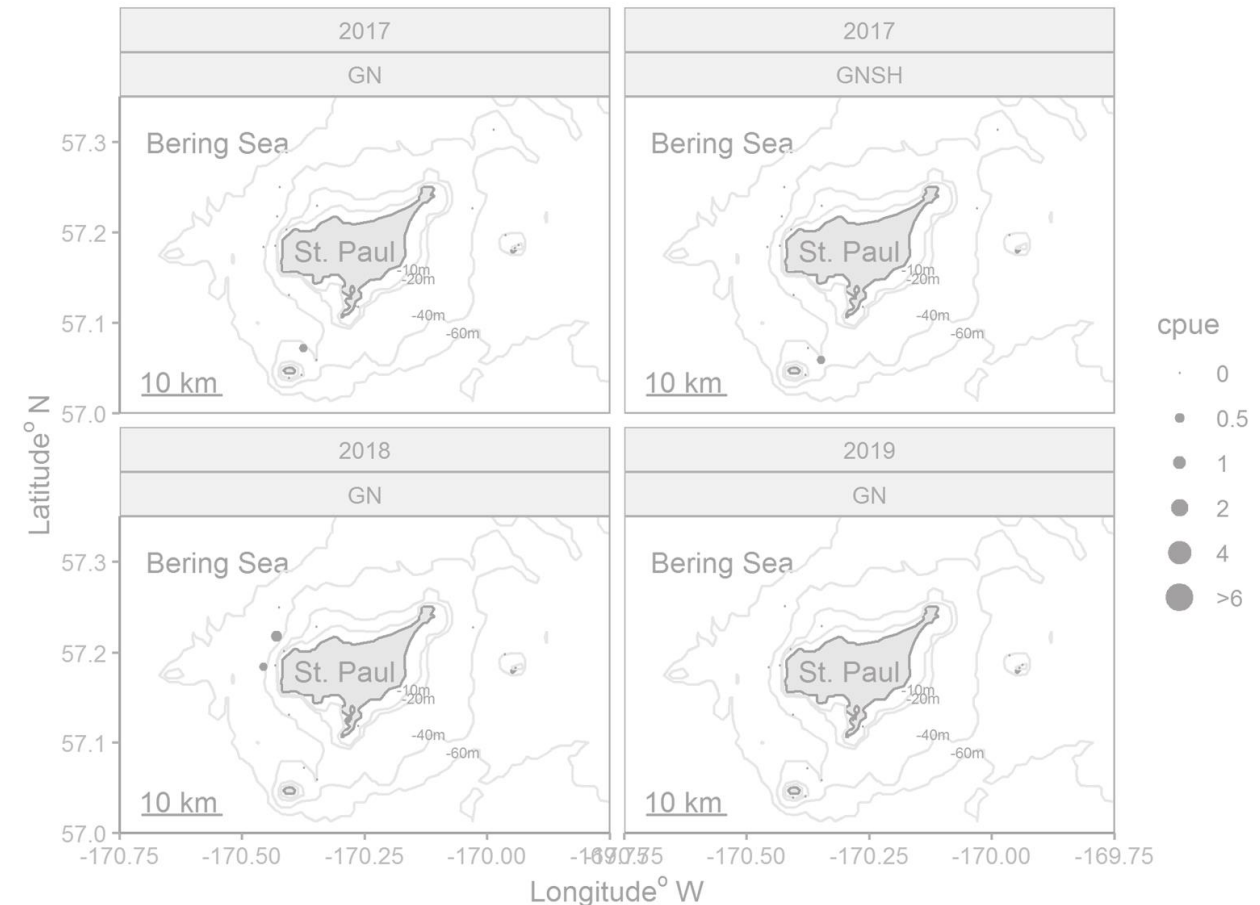
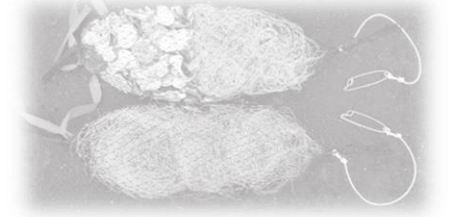
Results:

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1. Abundance

Blue king crab (2-5mm CL)

Methods:

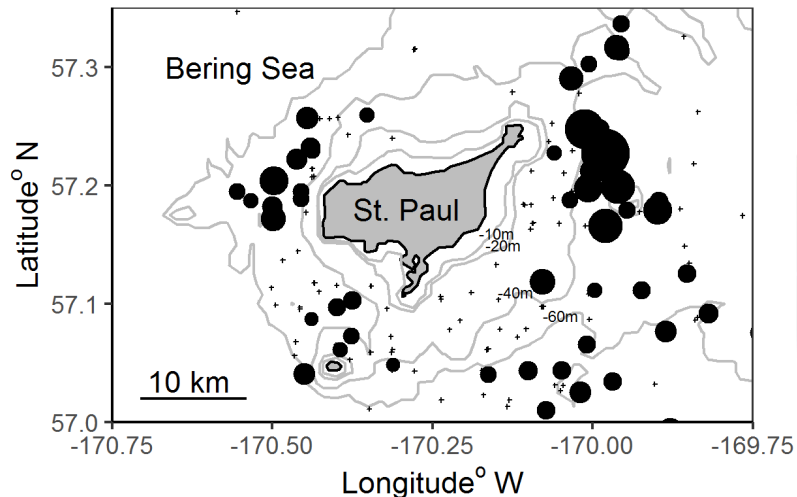
Historical - Bottom Trawls / Rock Dredges

Today - YOY collector bags (SAC) / diver surveys

Results:

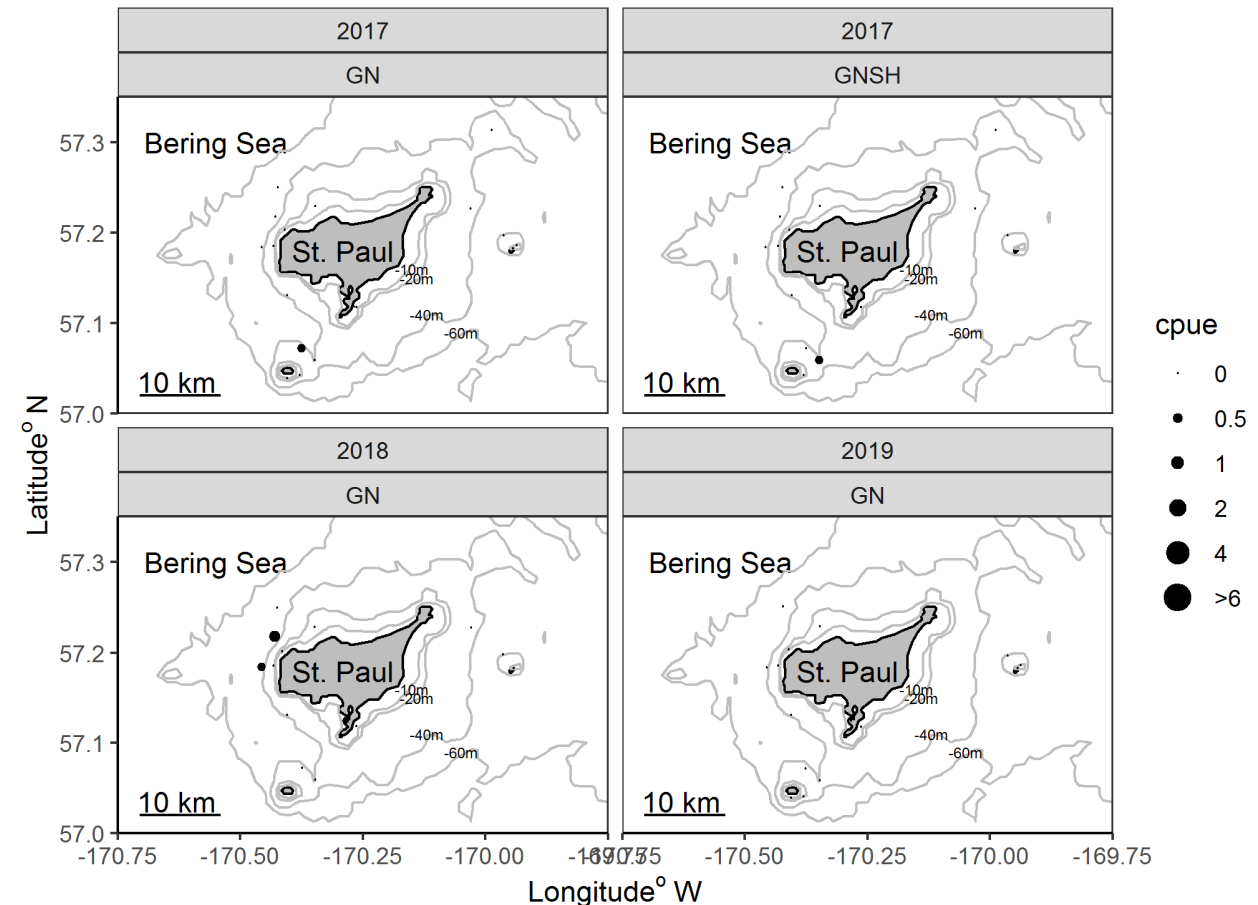
Historical (YOY, N = 514 YOY)

Total BKC Caught (N = 3,005)



2017-19 (N = 8 YOY)

Total BKC Caught (N = 8)





1. Abundance

Red king crab (2-5mm CL)

Methods:

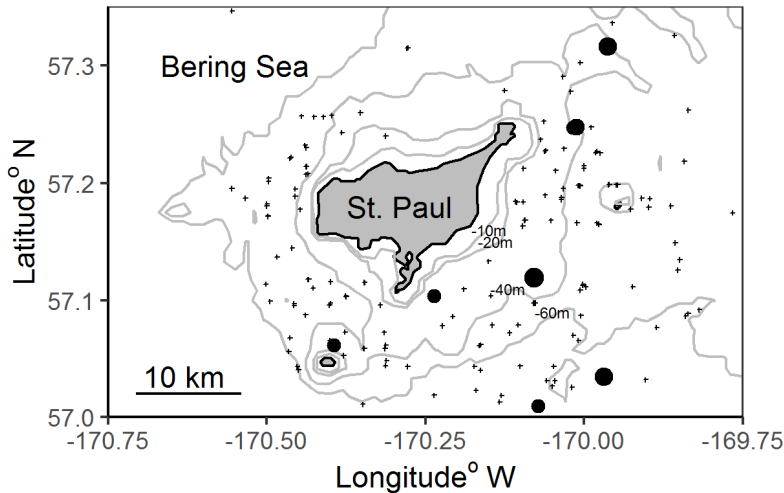
Historical - Bottom Trawls / Rock Dredges

Today - YOY collector bags (SAC) / diver surveys

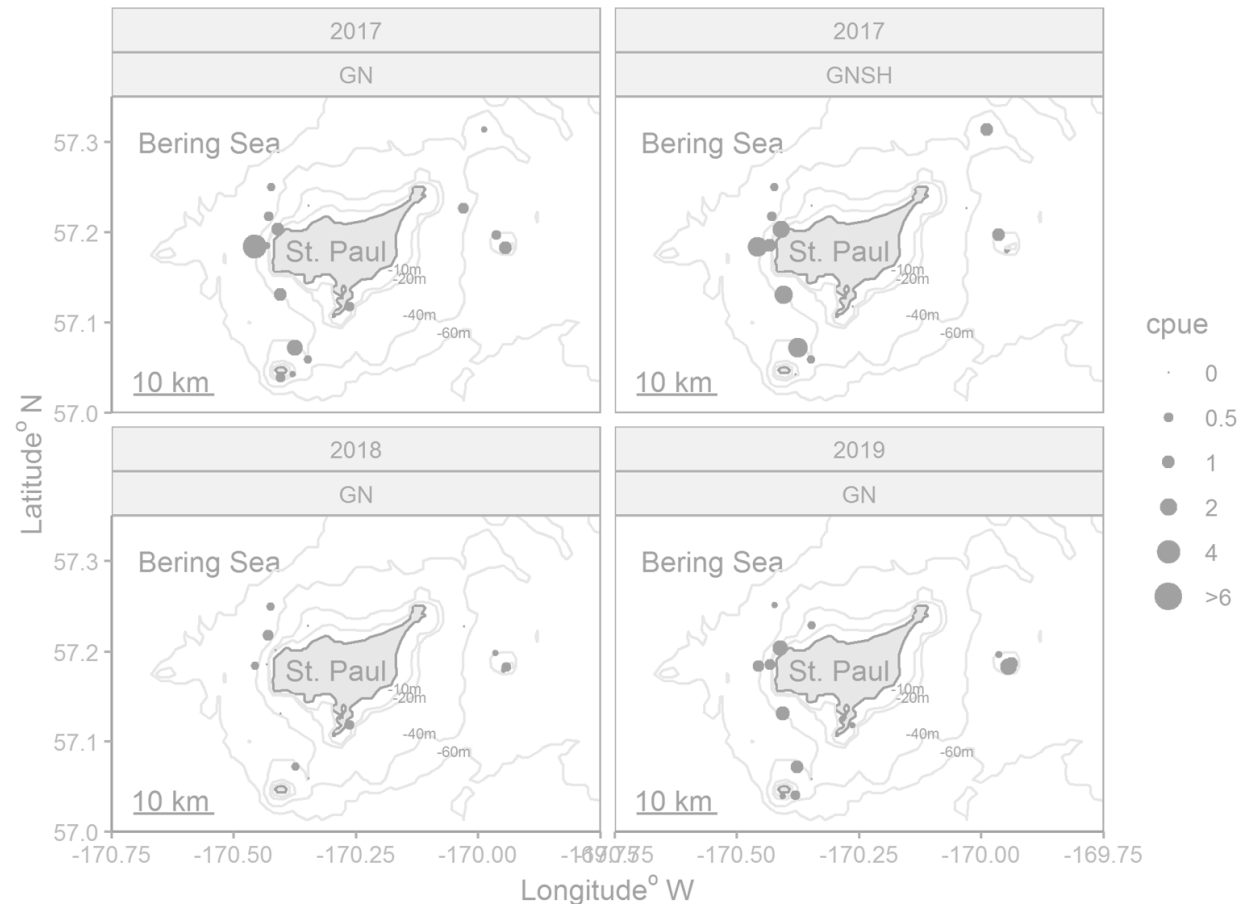
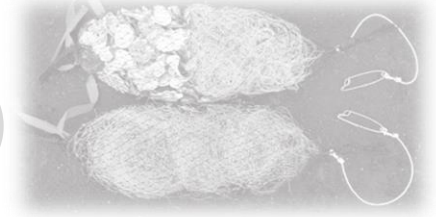
Results:

Historical (YOY, N = 14 YOY)

Total BKC Caught (N = 87)



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





1. Abundance

Red king crab (2-5mm CL)



Methods:

Historical - Bottom Trawls / Rock Dredges

Today - YOY collector bags (SAC) / diver surveys

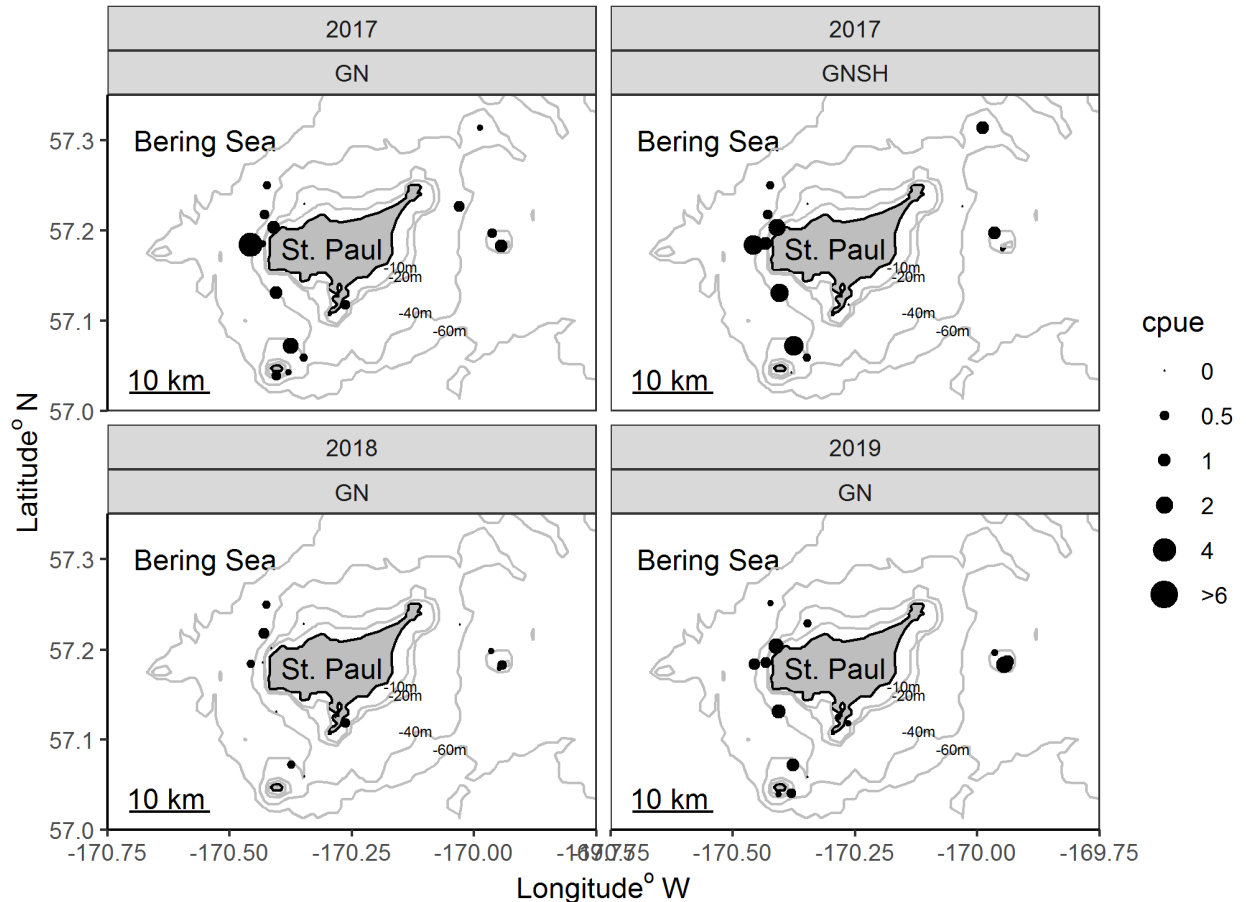
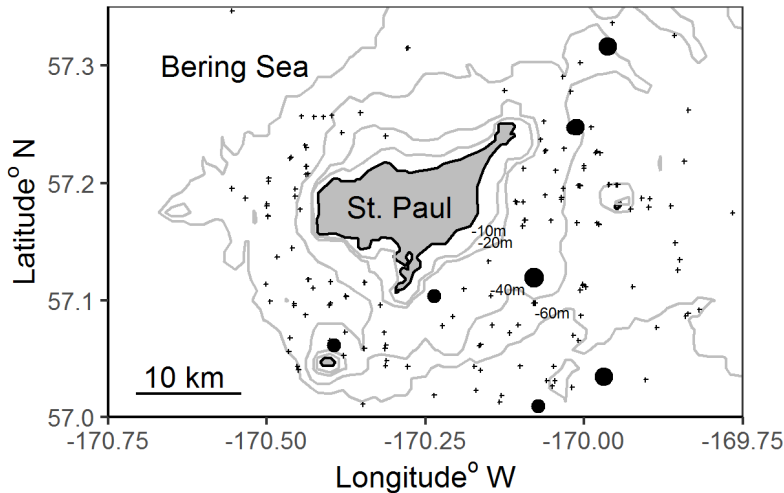
2017-19 (N = 145 YOY)

Total BKC Caught (N = 192)

Results:

Historical (YOY, N = 14 YOY)

Total BKC Caught (N = 87)





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

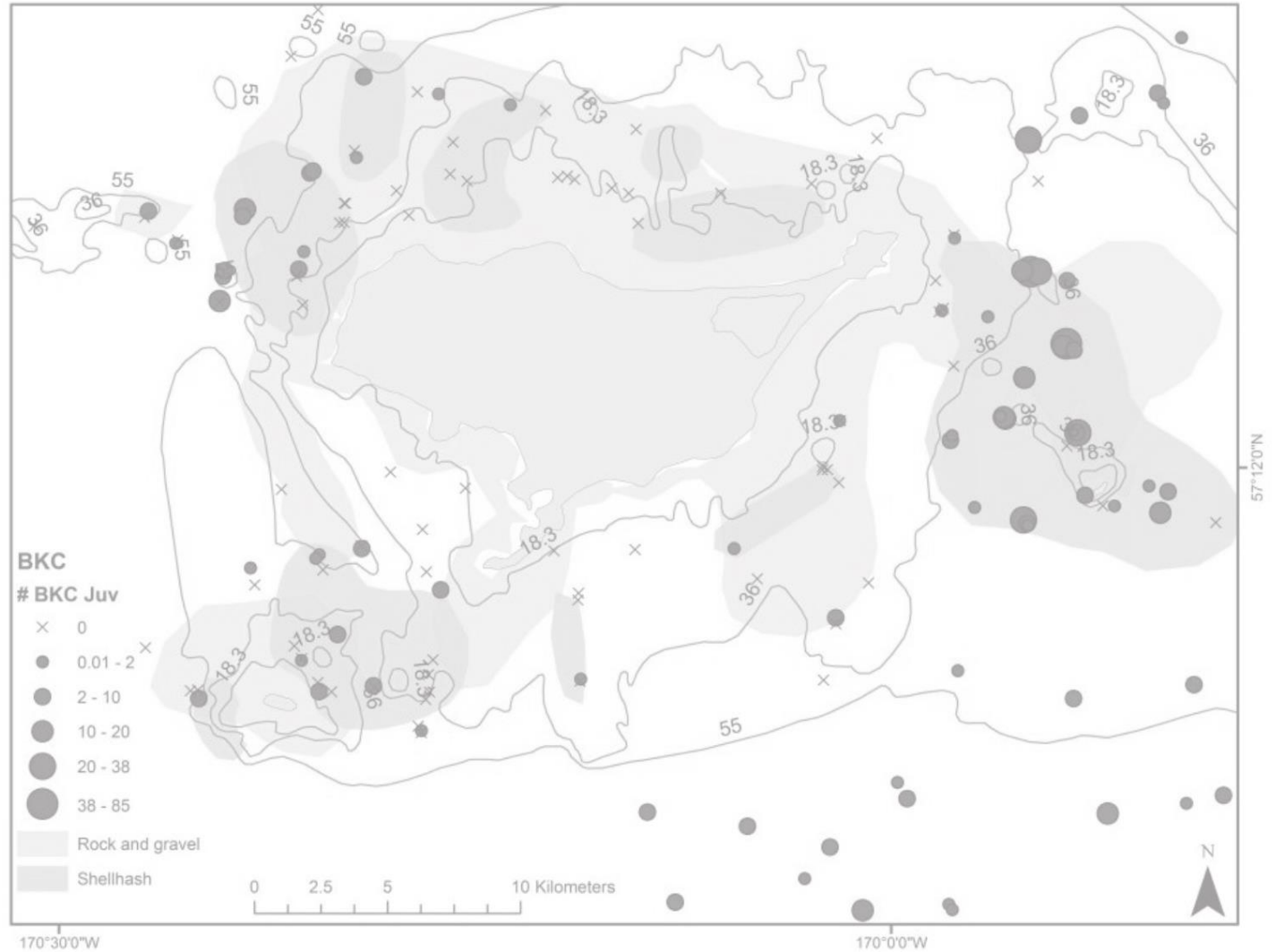
Methods:

Historical - Bottom Trawl / Rock Dredge notes

Today - Diver and camera surveys

Results:

Historical (NPRB 1321)





2. Benthic Habitat

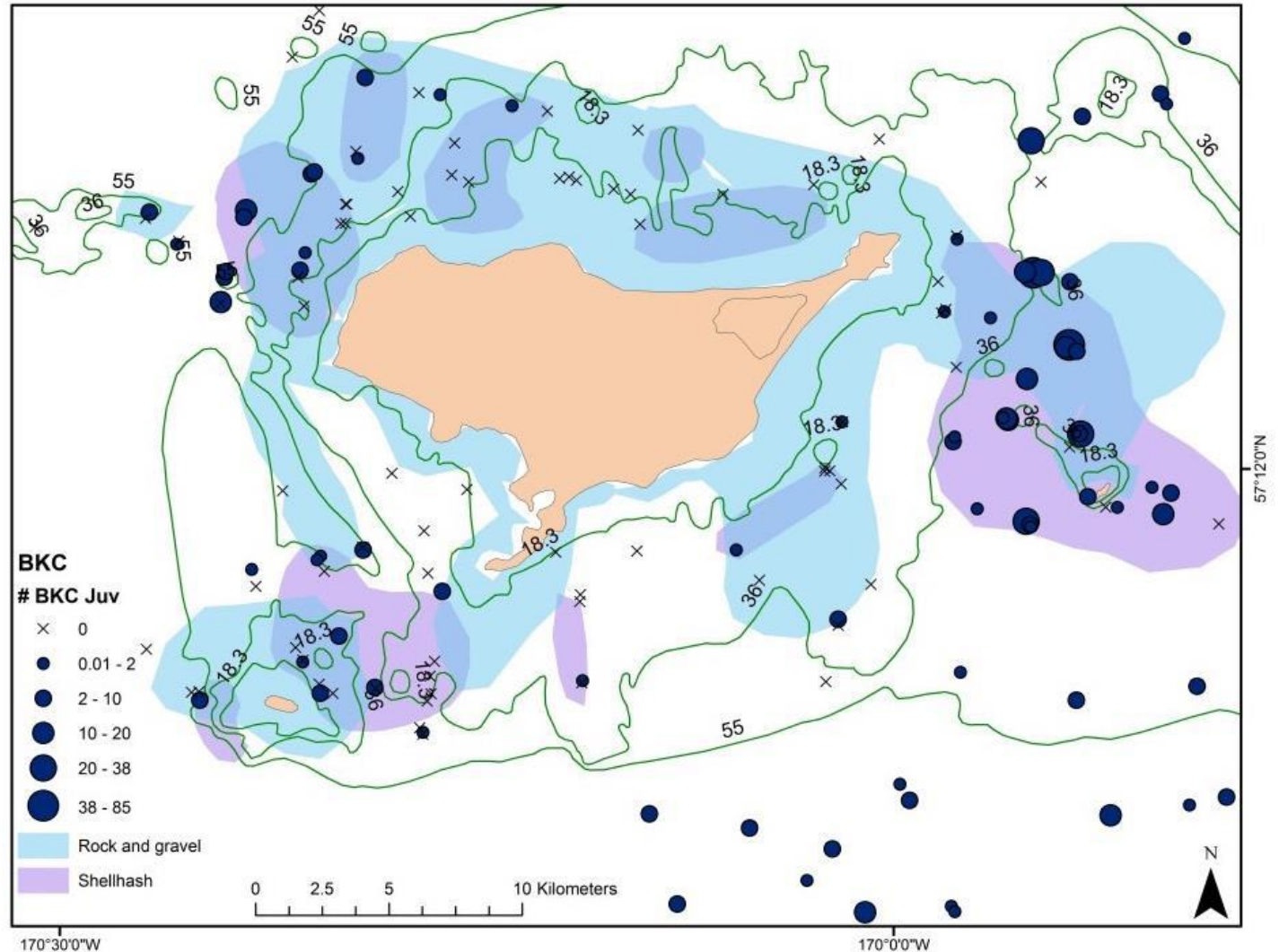
Methods:

Historical - Bottom Trawl / Rock Dredge notes

Today - Diver and camera surveys

Results:

Historical (NPRB 1321)





2. Benthic Habitat

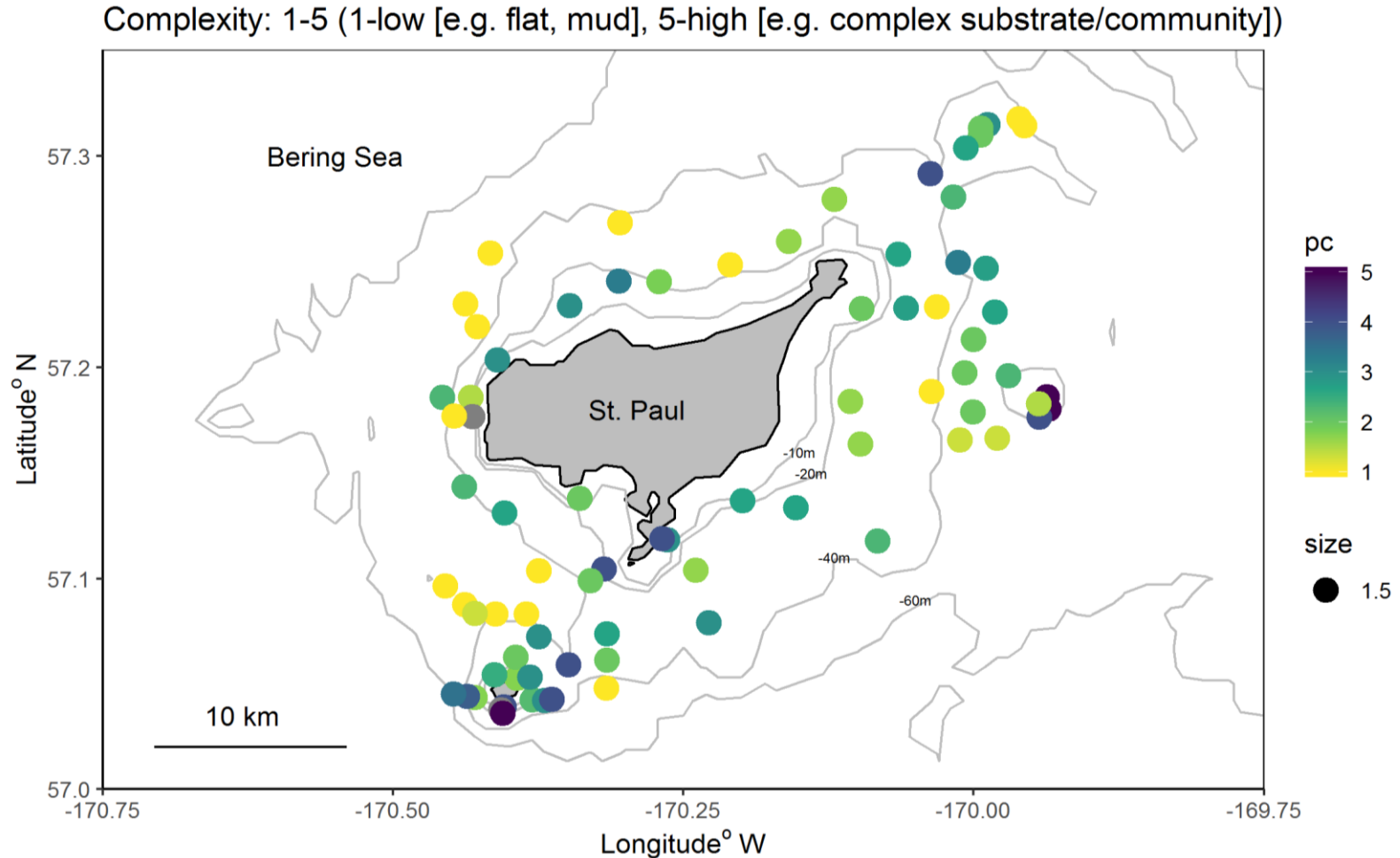
Methods:

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





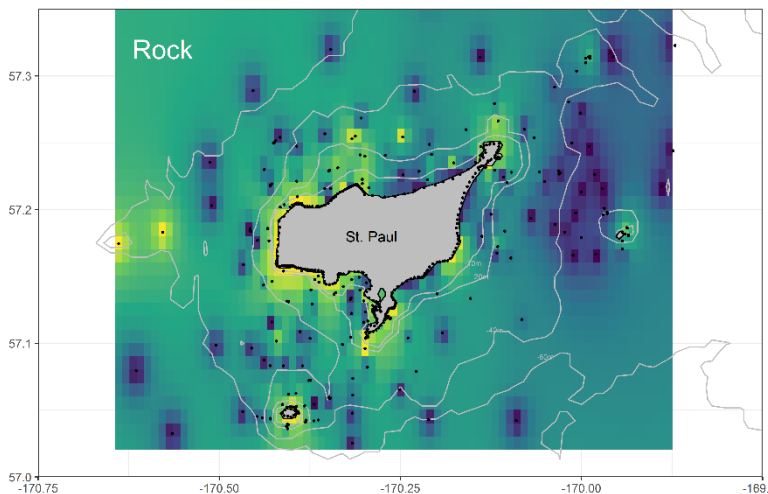
2. Benthic Habitat

Results:

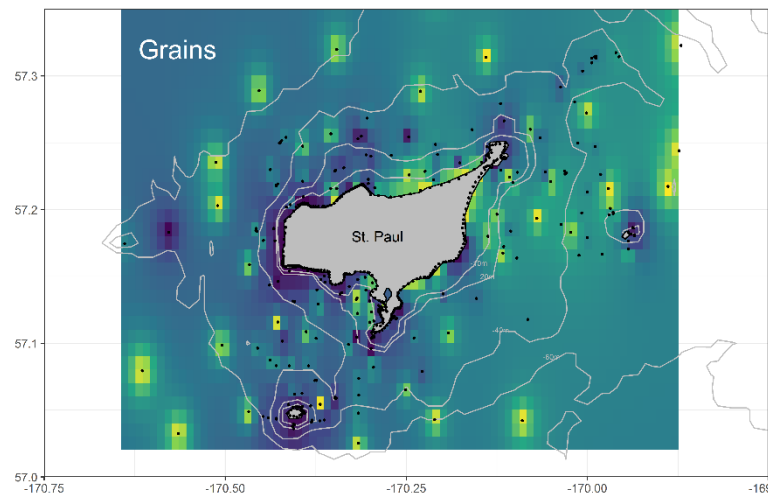
- CPUE estimates
- IDW interpolation
- Modeling substrate \sim depth, biological community



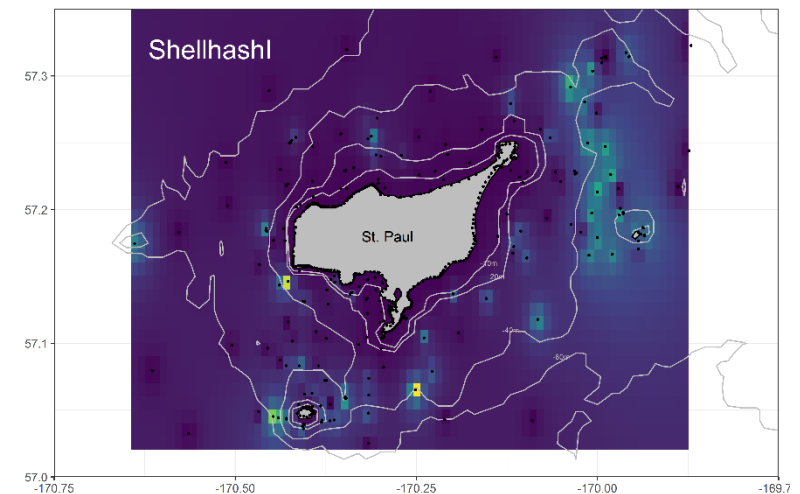
Rocky (Large)



Mud / Sand (Small)



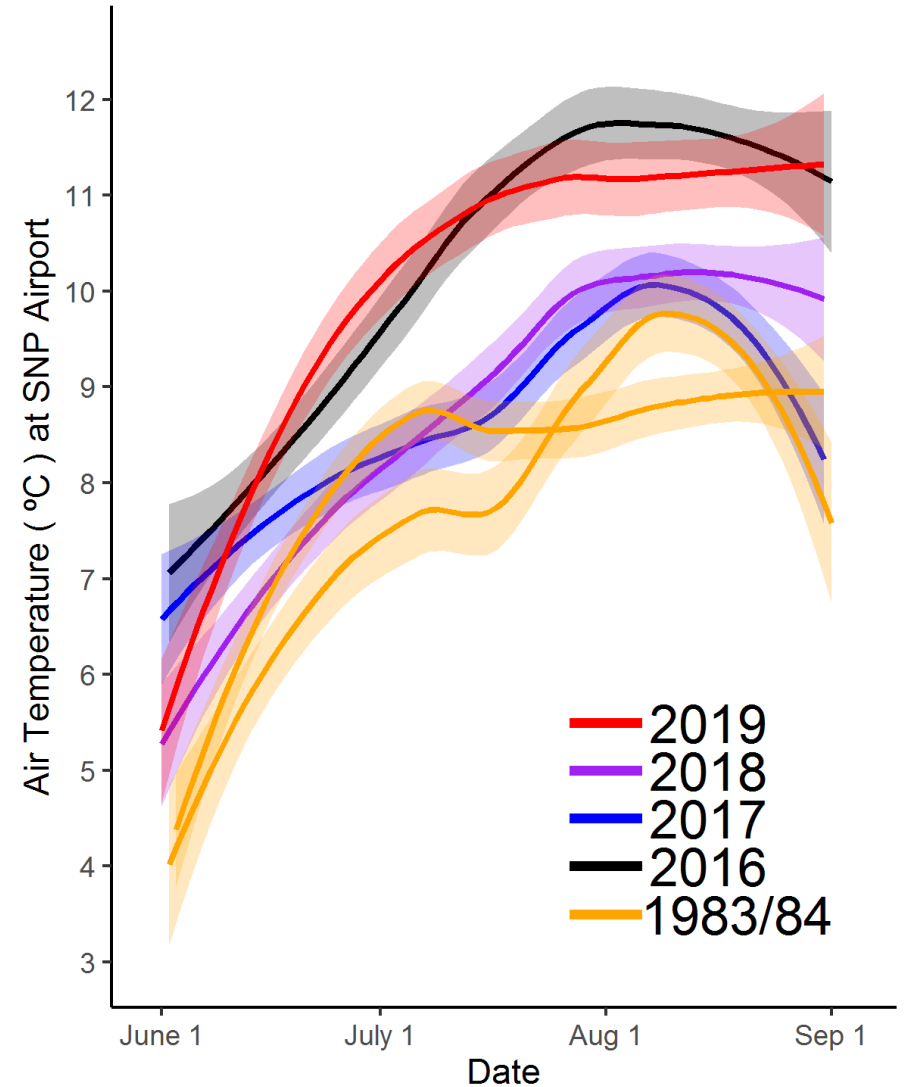
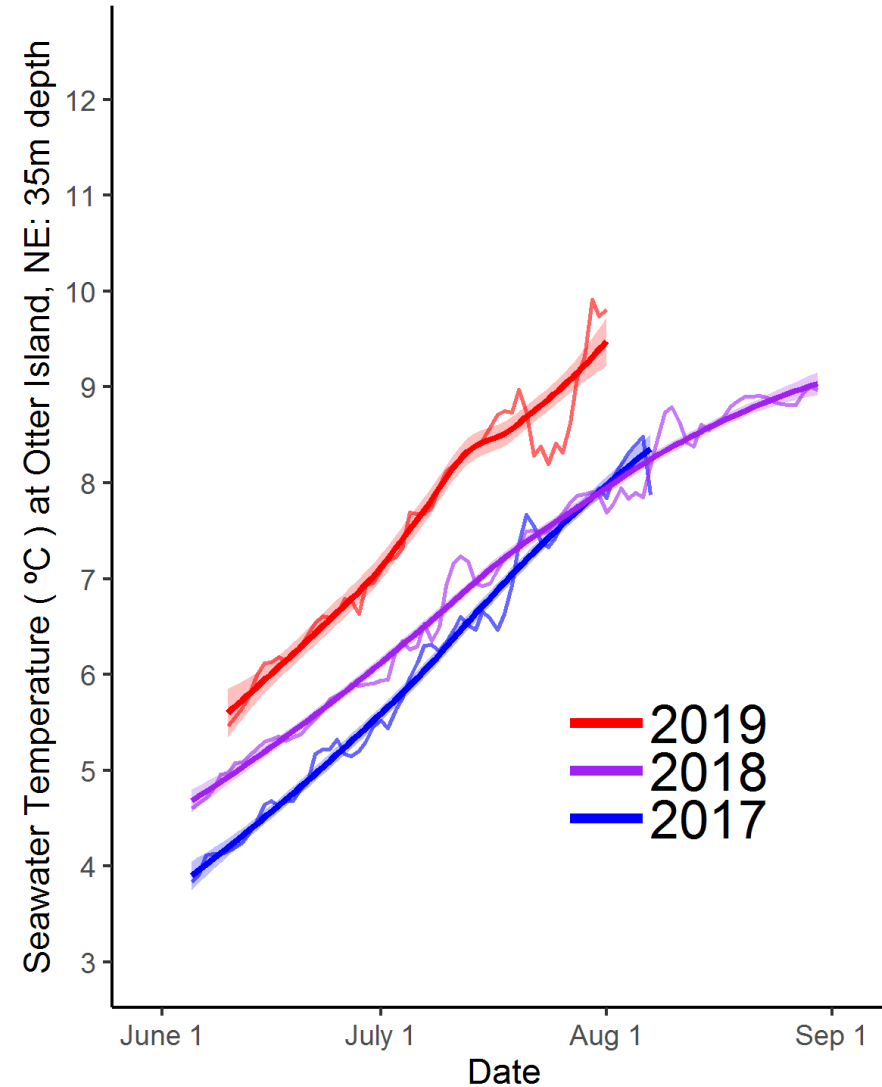
Intact Shell Hash Type I





2(a). Pelagic Habitat

- Oceanography
 - Tidbit / CTD SSTs from nearshore areas
- Air Temps from St. Paul Airport NWS
- Weather
 - 2018 Storms





2. Habitat

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



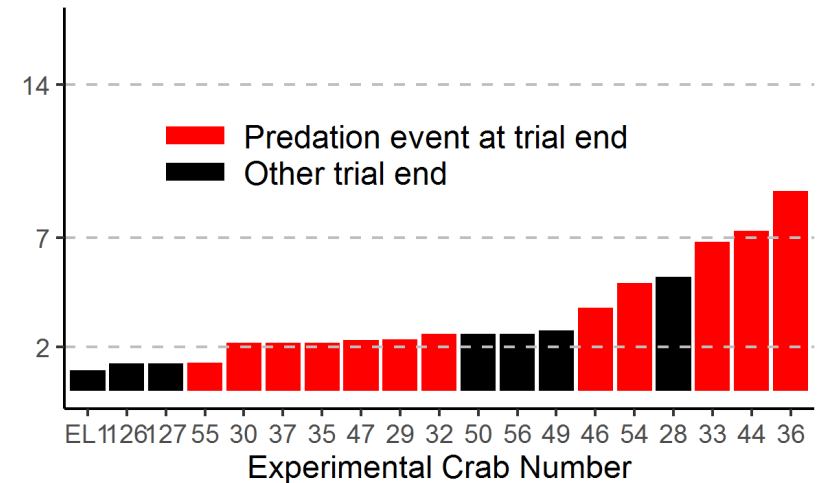
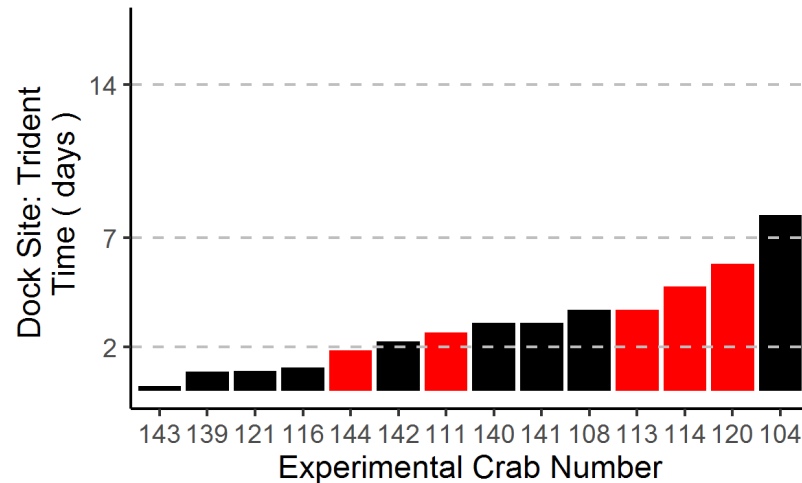
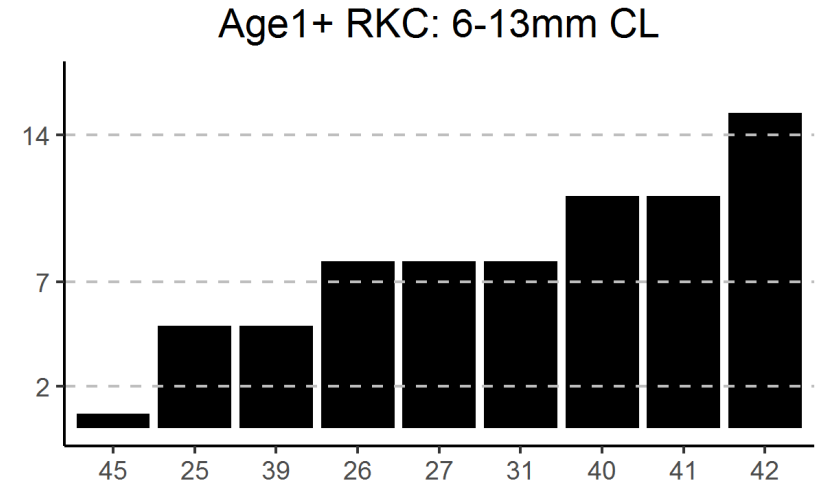
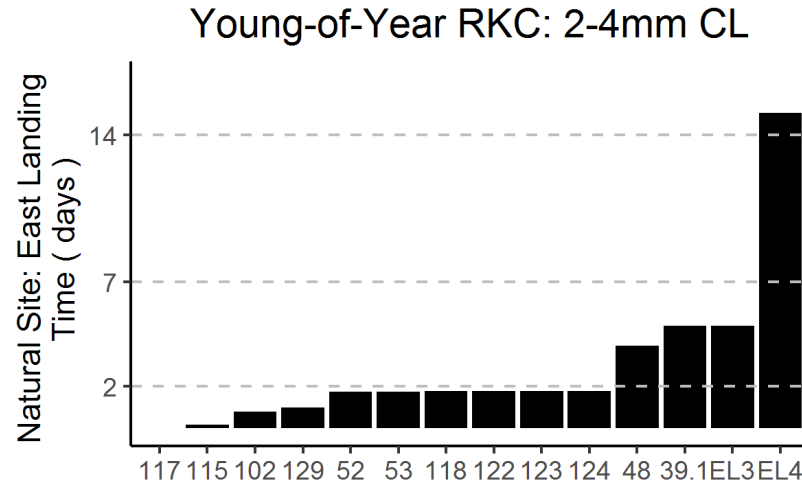


Awesome videos at <https://www.instagram.com/pribsbluesmuse/>

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



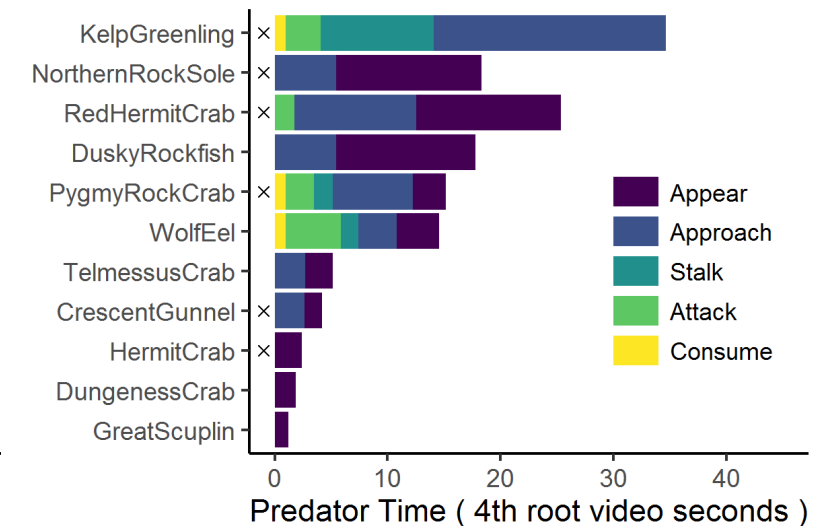
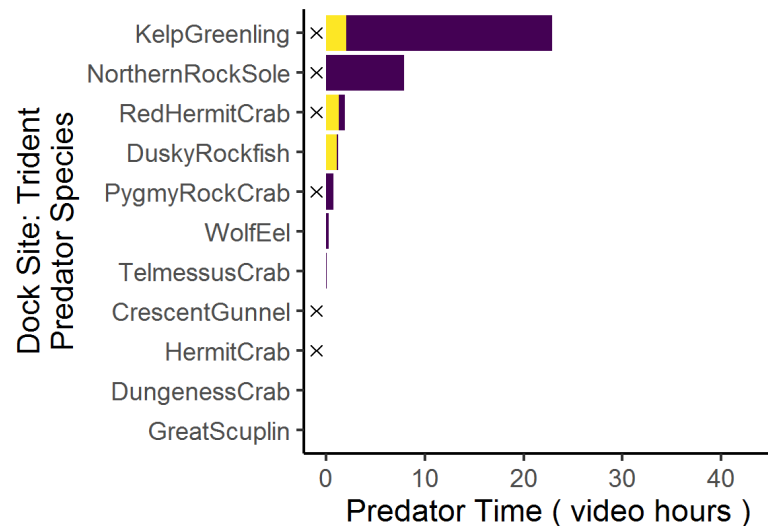
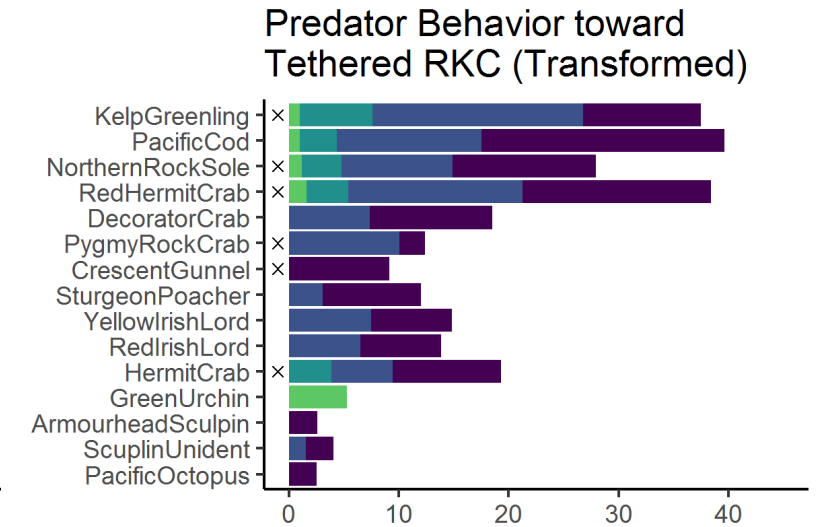
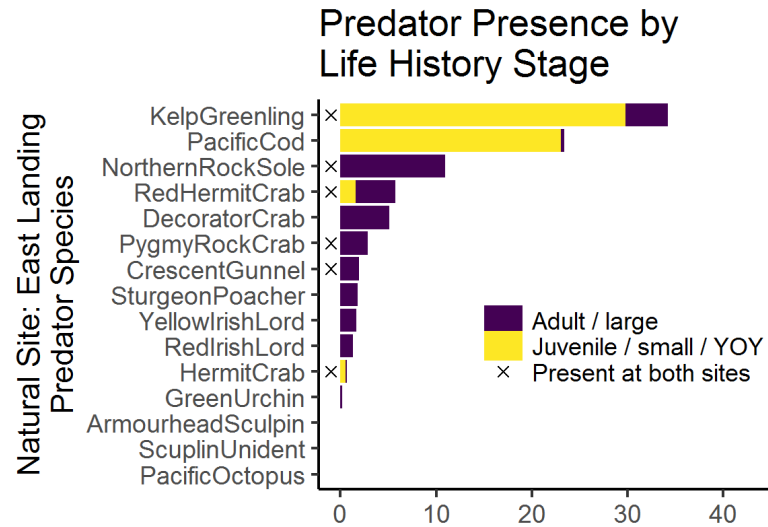


4. Predation

BKC... RKC Tethering Experiments

Awesome videos at <https://www.instagram.com/pribsbluesmuse/>

- 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

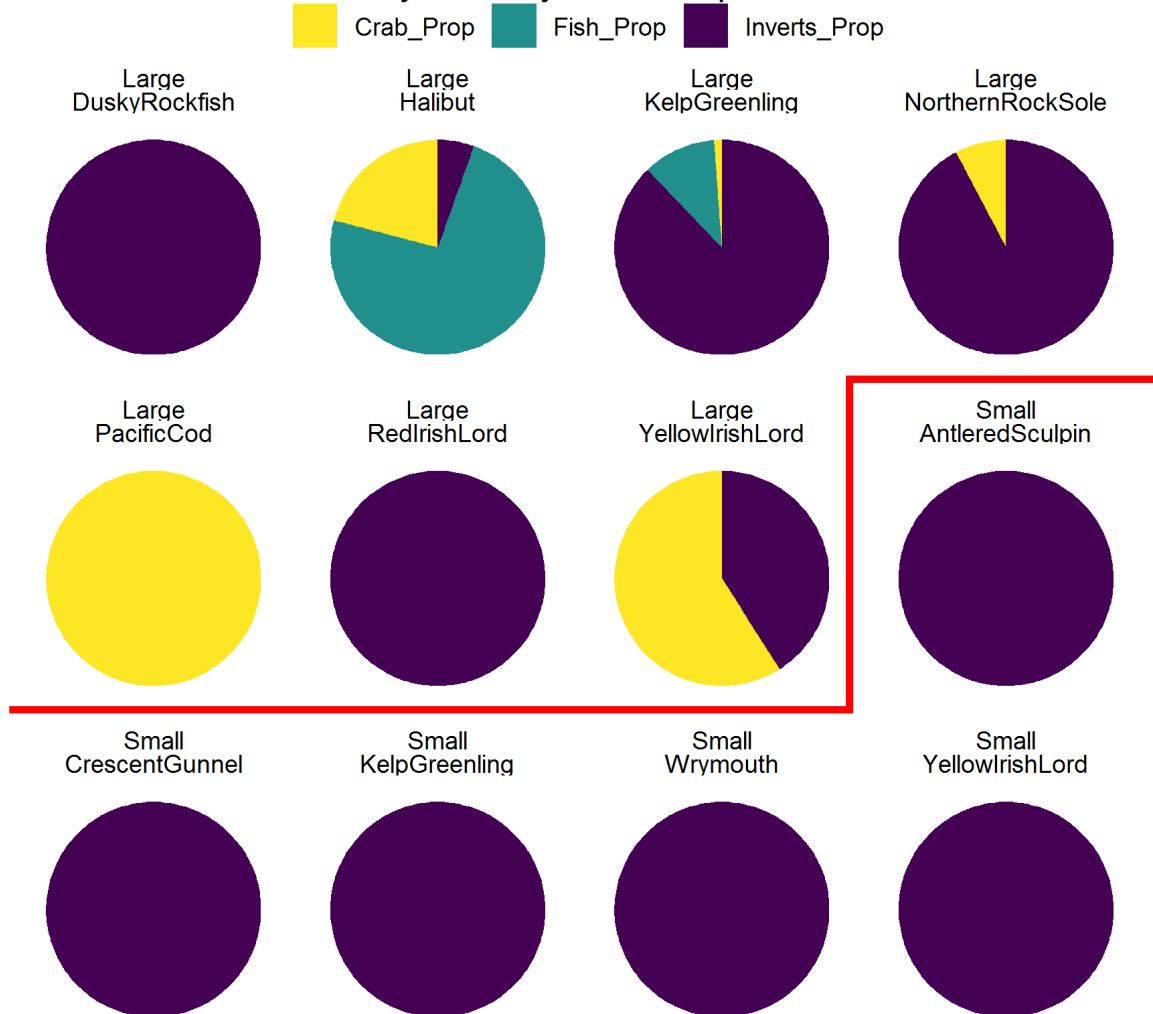
- Fish Stomach Samples

- 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

Fish Predator Diet Analysis: Prey Taxa Proportional Contribution





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

Armstrong, D. A., J. L. Armstrong, R. Palacios, and G. Williams. 1987. Distribution, abundance, and biology of blue king and Korean hair crabs around the Pribilof Islands. Final Report. Outer Continental Shelf Environmental Assessment Program (OCSEAP). Research Unit 638. Minerals Management Service. Department of Interior.

Armstrong, D.A., W.C. Long, J. Armstrong, and P. S. McDonald, J. Kvistad, A. Doty, M. 78 Logsdon, and G. Fraser. 2015. Blue king crab, habitat, and the ecosystem: Data rescue from the 79 1980s. NPRB Project 1321 Final Report. 27pp. NPFMC (North Pacific Fisheries Management Council). 2015. "Stock assessment and fishery evaluation report for the king and Tanner fisheries of the Bering Sea and Aleutian Islands Regions: 2015 Final Crab SAFE." North Pacific Fisheries Management Council. 605 W. 4th Ave., #306, Anchorage, Alaska 99501.

Palof, K., Zheng, J., Ianelli, J. 2019. St. Matthew Island Blue King Crab Stock Assessment. In: Stock Assessment and Fishery Evaluation Report for the King and Tanner crab fisheries of the Bering Sea and Aleutian Islands Regions 2019 Final Crab SAFE. North Pacific Fishery Management Council, 605 W. 4th Avenue, #306, Anchorage, AK 99501.

Stockhausen, W. 2019. 2019 stock assessment for the Pribilof Islands blue king crab fisheries of the Bering Sea and Aleutian Islands Regions. In: Stock Assessment and Fishery Evaluation Report for the King and Tanner crab fisheries of the Bering Sea and Aleutian Islands Regions 2019 Final Crab SAFE. North Pacific Fishery Management Council, 605 W. 4th Avenue, #306, Anchorage, AK 99501.



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

