NPRB #23-08
Bristol Bay Settlement Project

Crab Plan Team, Seattle WA

September 12, 2024

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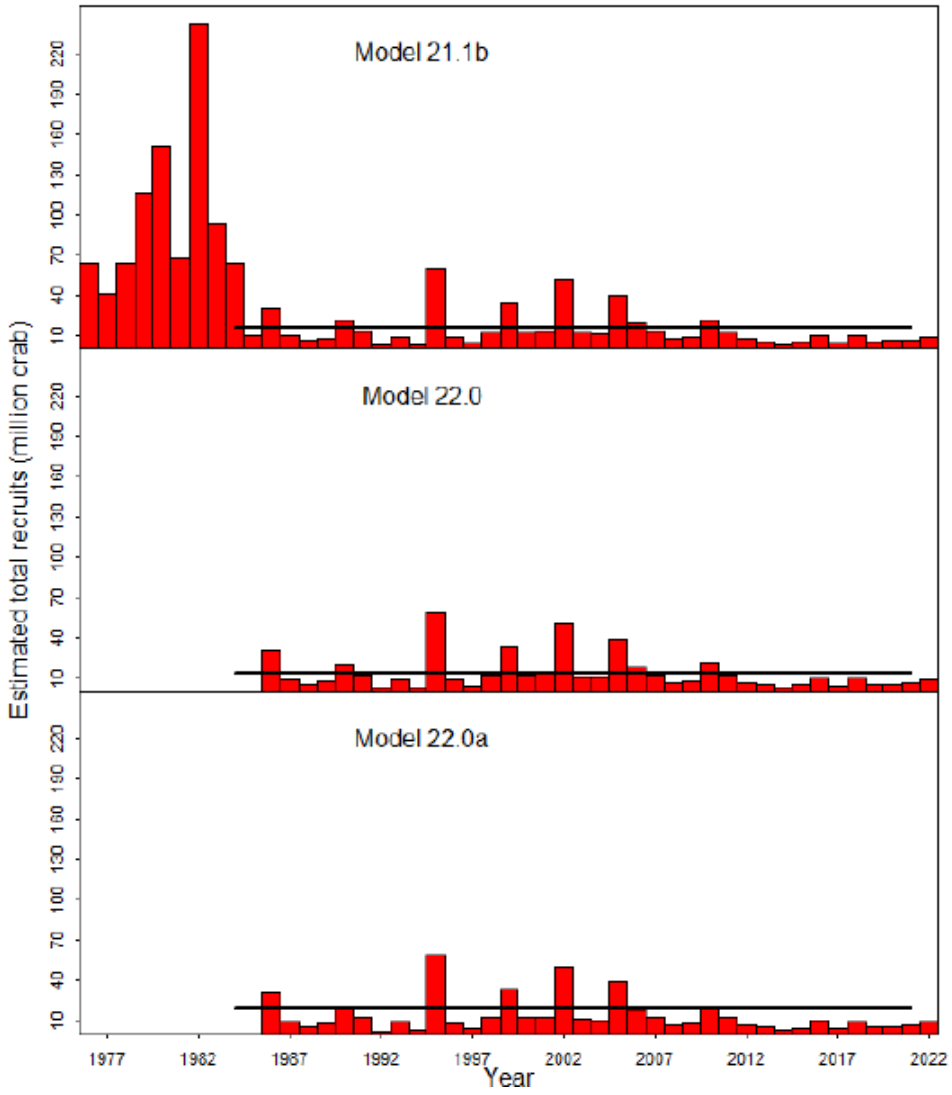
Participating Scientists: Liza Hasan, Erin Stand, Marina Thomas, Ric Shepard

Assessment of Bristol Bay Red King Crab Recruitment Bottlenecks

- Framing the issue
  - Decade-plus long, continuous decline in BBRKC abundances
  - Low, intermittent recruitment pulses for last three decades and historically low over the last 12 years
  - Apparent contraction of the population to central Bristol Bay (northward)
    - Loss of biomass on the Slime Bank
    - Increases in northern district crab?
- Can early life assessments help inform recruitment?
- What are the appropriate methods?

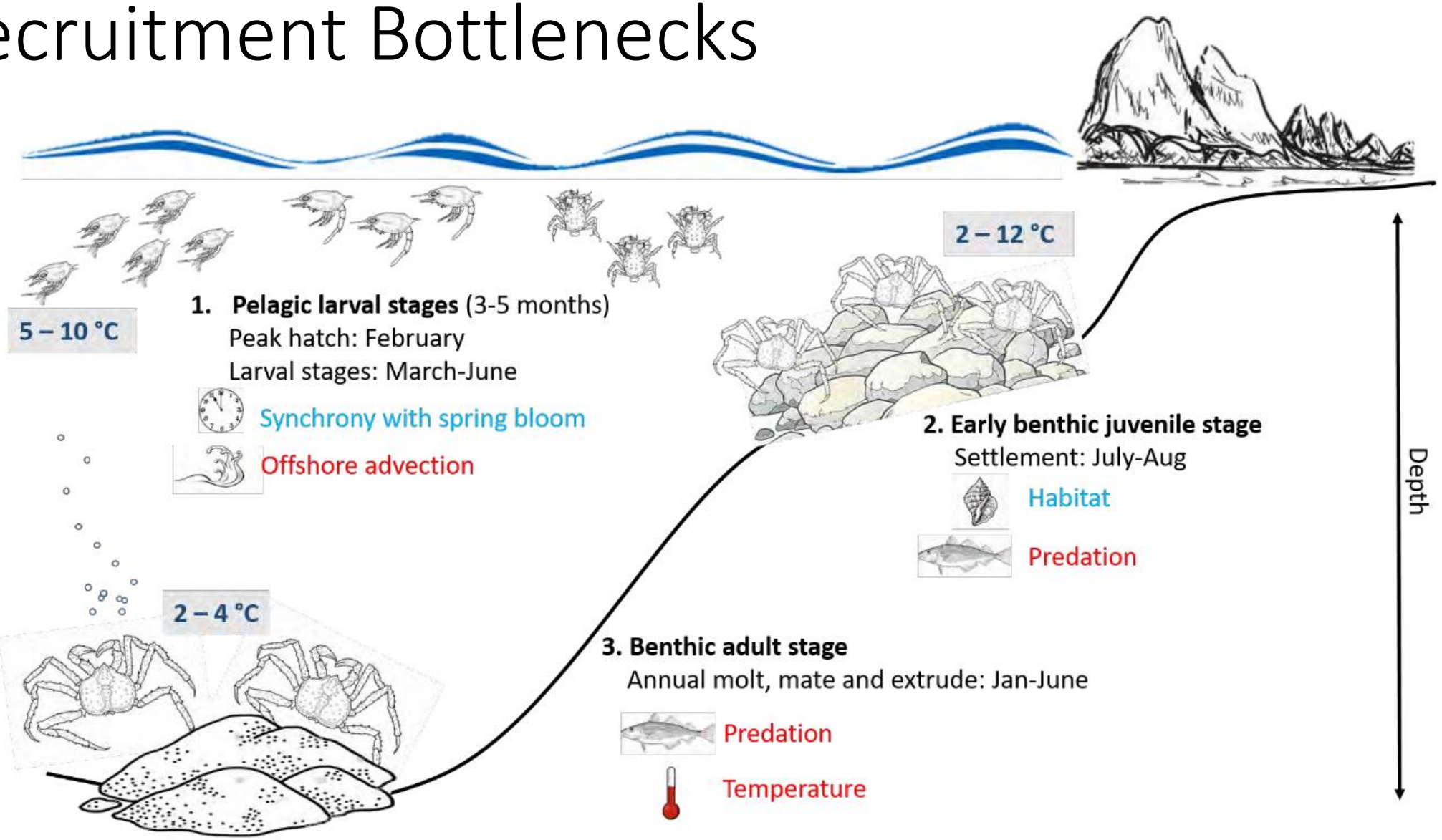


SAFE 2022

Assessment of Bristol Bay Red King Crab Recruitment Bottlenecks

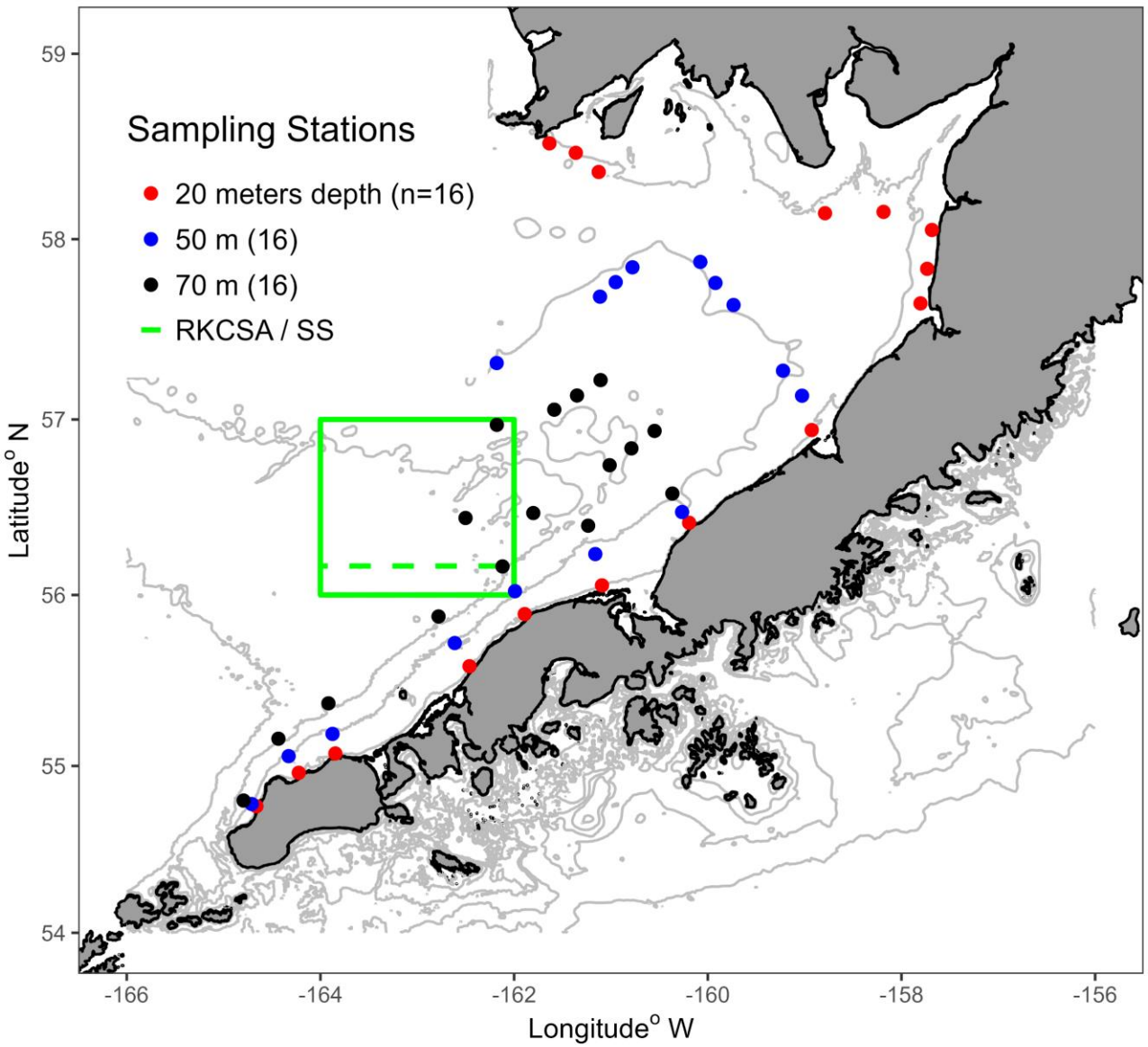
- Possible limiting factors, and things to think about
  - Supply of juveniles
    - Supply and development of development of larvae and settlers
    - Female spawners abundance and distribution at time a larval release
  - Habitat
    - Availability / change over time
    - Disturbance effects on RKC recruits
  - Predation
    - Pelagic (e.g., BB sockeye salmon)
    - Benthic (e.g., Pollock, Pcod, flatfishes, and reef fishes)
  - Climate
    - Retrospective analyses or modeling with data in hand
    - Field assessment and laboratory research relative to crab condition
  - Management and Policy
    - Area closures, fisheries restrictions / closures, biological thresholds, enhancement

Assessment of Bristol Bay Red King Crab Recruitment Bottlenecks



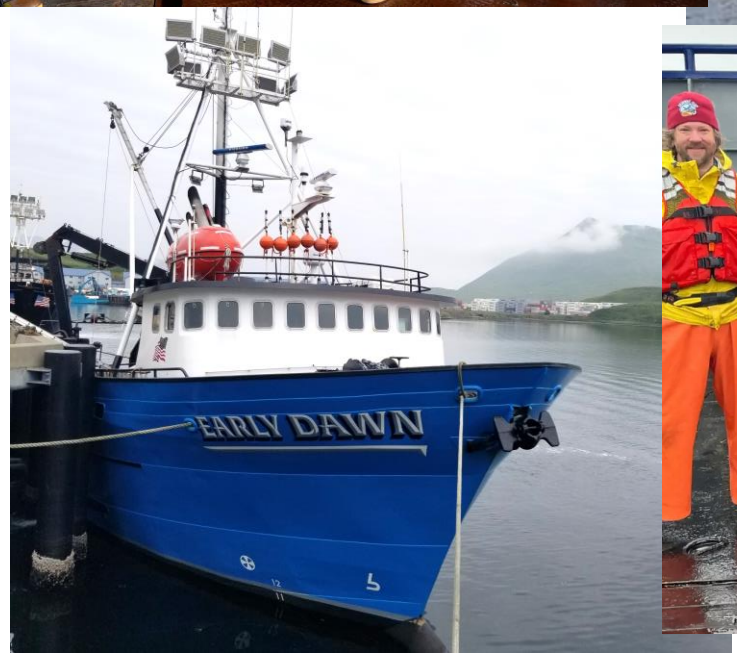
Objectives

- Collect quantitative data on
  - Settlement habitat
    - CamSled benthic image analysis
  - Post-larval red king crab supply
    - Artificial collectors catch
- Collect supporting crab and ecosystem-level data
  - Oceanography
  - Ocean acidification
  - Pelagic larval crab community
  - Sediment grain size
  - Benthic infaunal communities
  - Crab movement (tagging)



Sampling Plan

- Charter 1 (35 days)
  - BSFRF charter of FV Early Dawn
    - DFG coop-agreement
  - Extensive pre-cruise fabrication period
  - 17 sampling days
    - May 3-22
- Charter 2 (14 days)
  - DFG charter of PV Stimson
    - Simple, cost effective SOA-RSA process
  - 8 sampling days
    - August 17-24



ADF&G CamSled

- Scallop program developed by Gregg Rosenkranz in early 2000s
  - Network developed by Ric Shepard
  - WHOI / Habcam partnerships
- 2008 Bering Sea tests in Norton Sound, St. Mats, and St. Paul
- 2015-2022 no deployments
- 2023 re-boot

Alaska CamSled
High Resolution Benthic Imaging

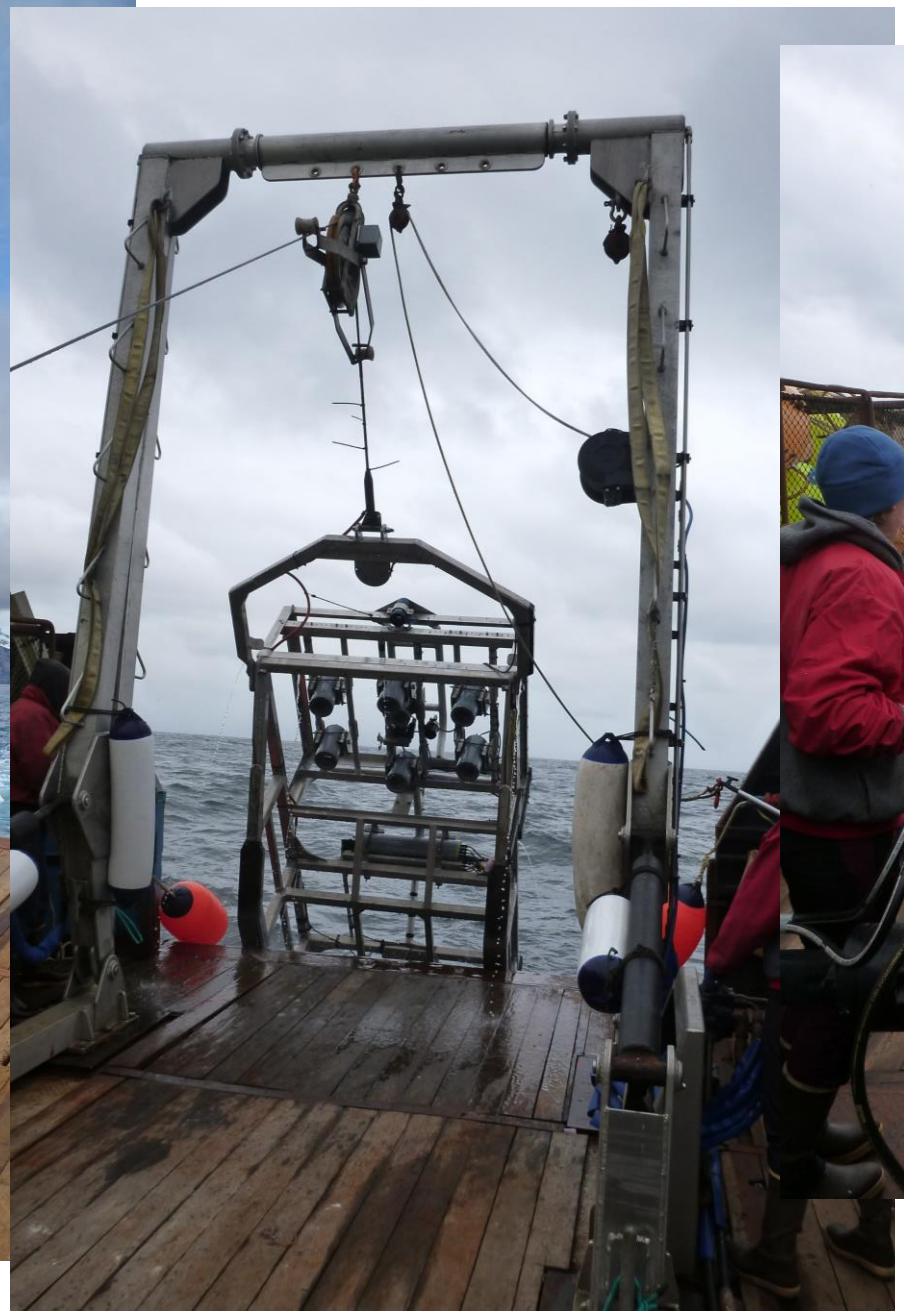
System Features

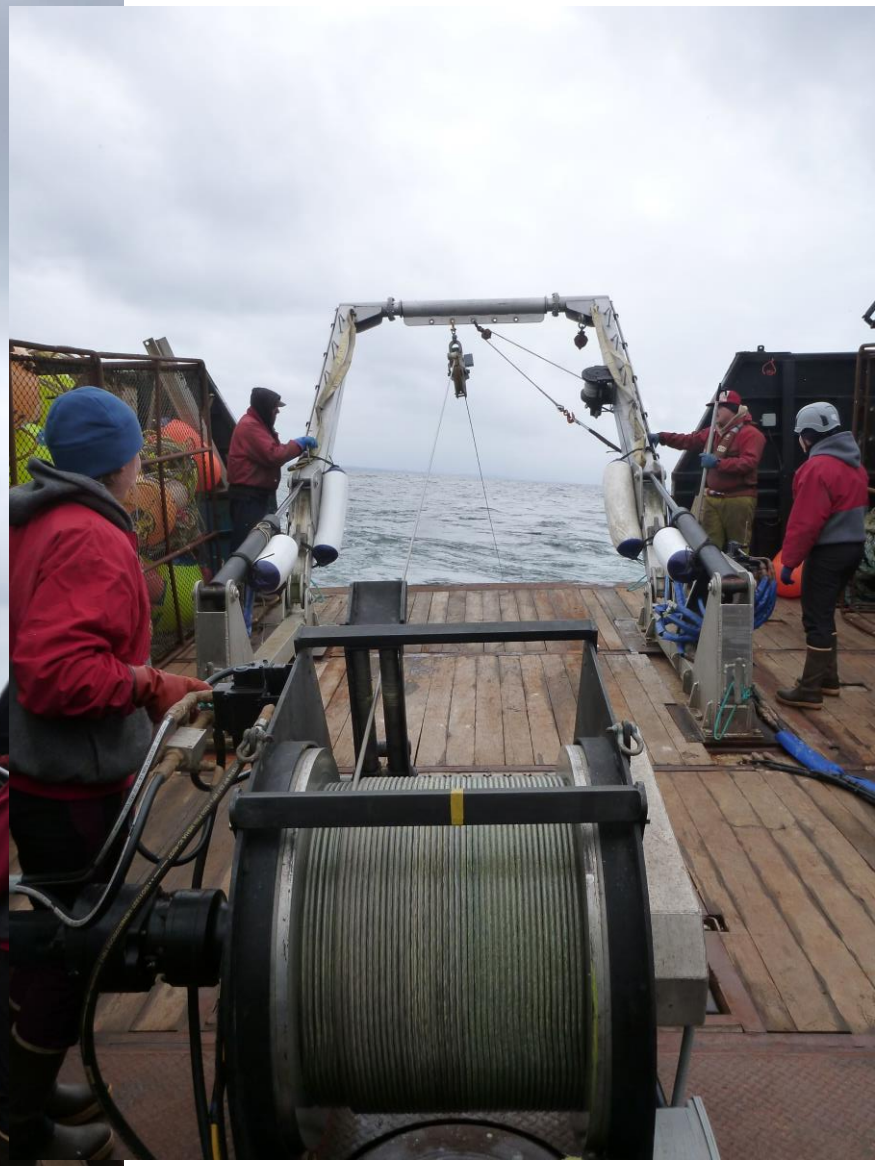
- 1600 x 1200 pixel GigE Vision™ camera
- 6 xenon flashlamp strobes
- Gigabit Ethernet data telemetry
- armored fiber optic tow cable
- real-time onboard image and sensor display
- 1 m-wide seafloor FOV
- 5 images/sec, 40+ gigabytes/hr
- towing speeds 4+ knots

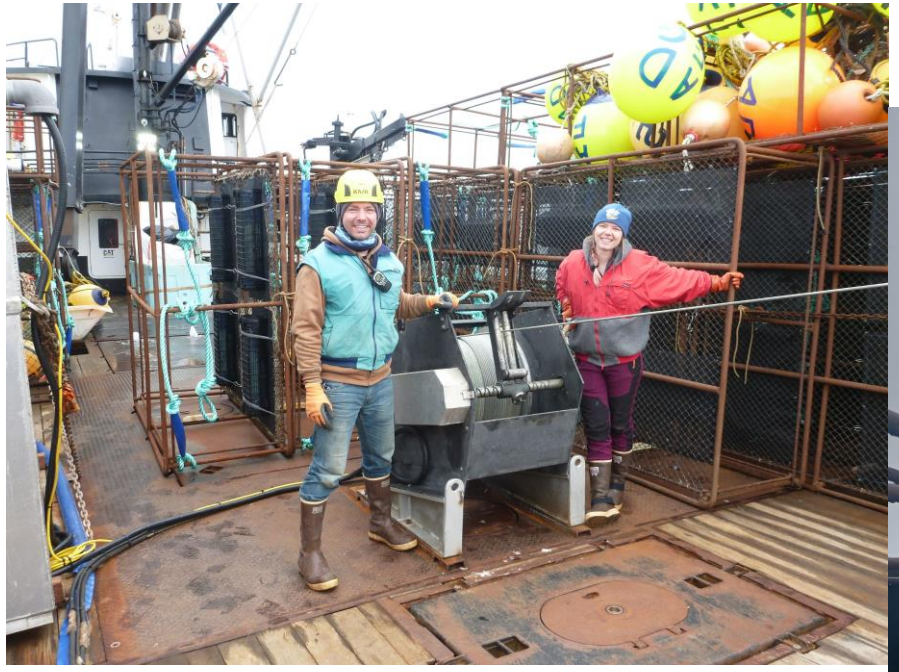
Over 2,800 km imaging transects towed in the Gulf of Alaska and Bering Sea

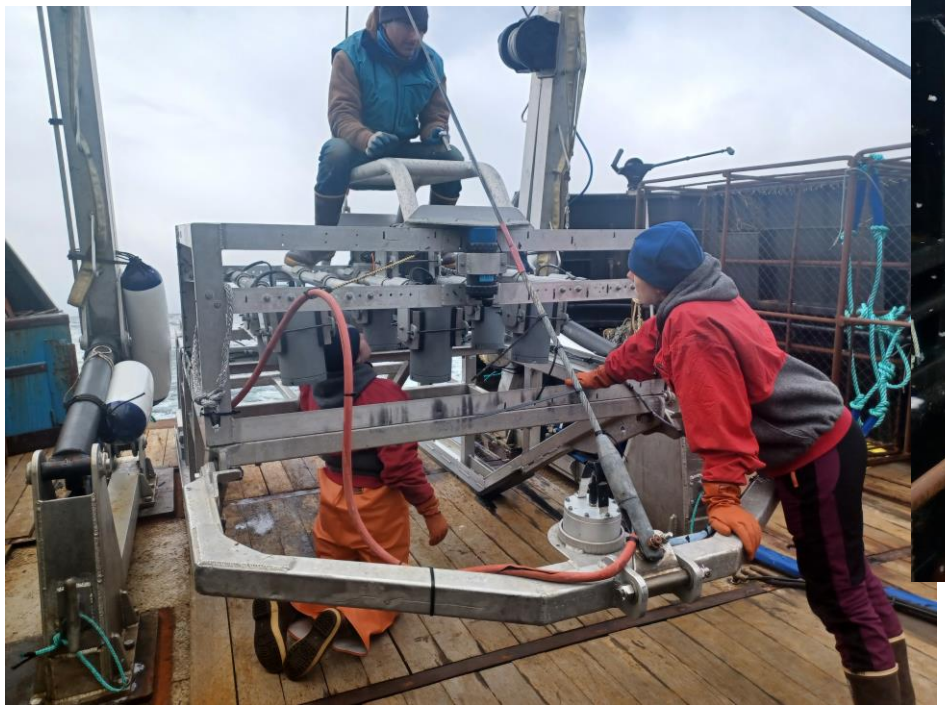
Over 7 million images collected and archived at ADF&G-Kodiak

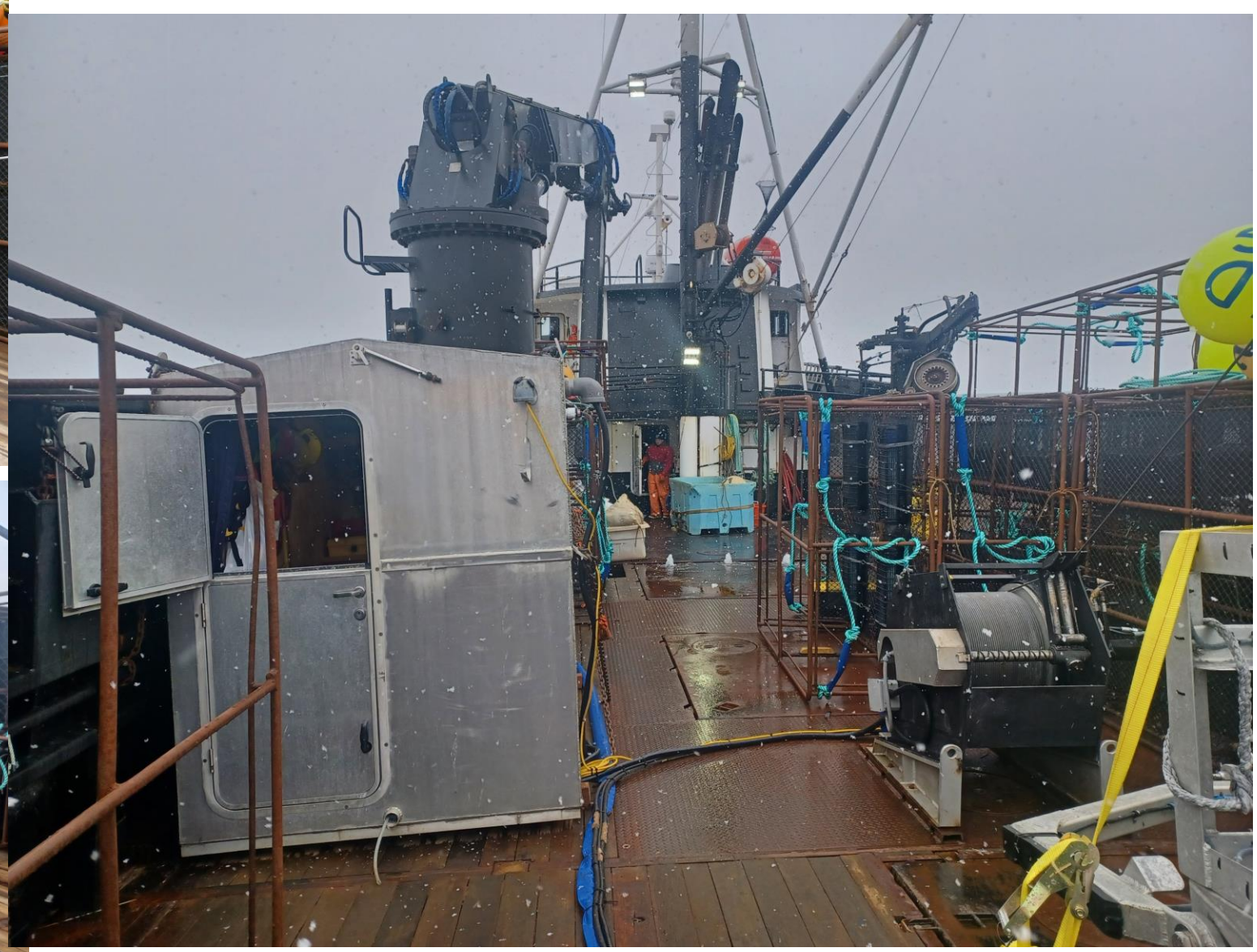
Benthos off Narrow Cape, Kodiak Island, Alaska

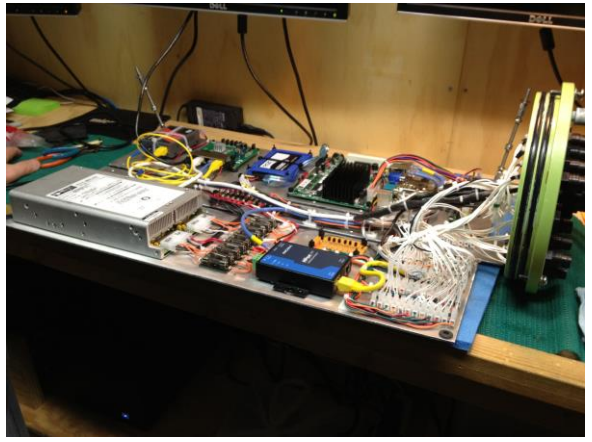


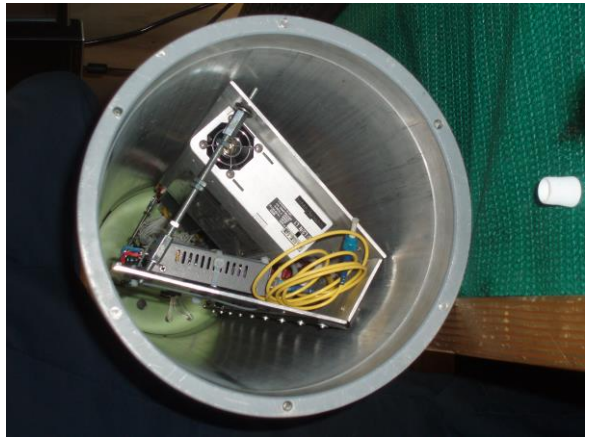








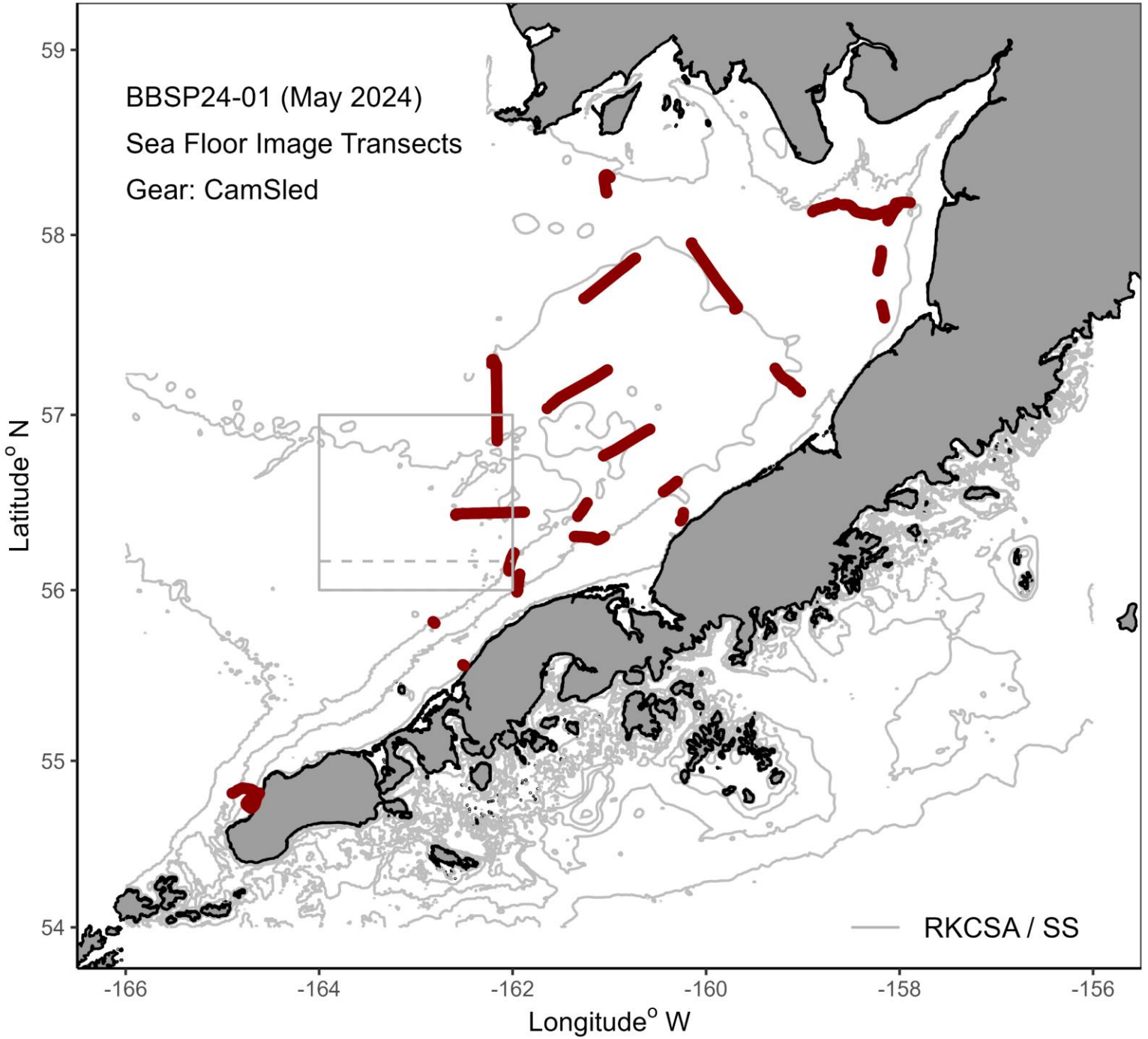




IMPERIAL
Clarke
ANKER

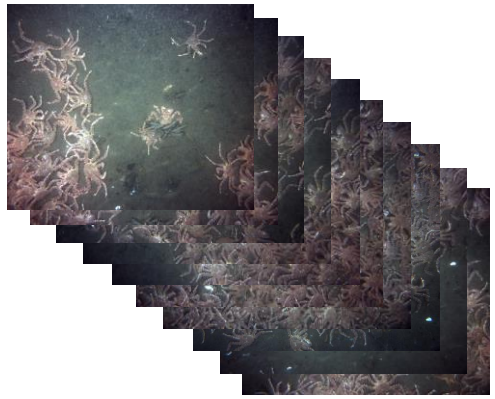
CamSled 2024

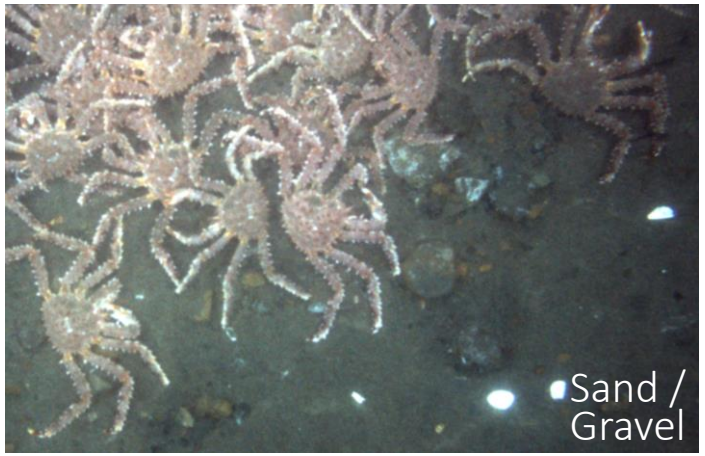
- Over 500 km towed
- 34 of 48 planned stations
- Optimal sled performance, some human error
- Water clarity can be an issue
  - 30-80 m depth relatively clear water
  - < 30 m weather and turbidity issues
- Image annotation starting soon!



First direct scientific evidence of juvenile podding behavior in Bristol Bay red king crab!

4-5 m^2 = 200+ crab





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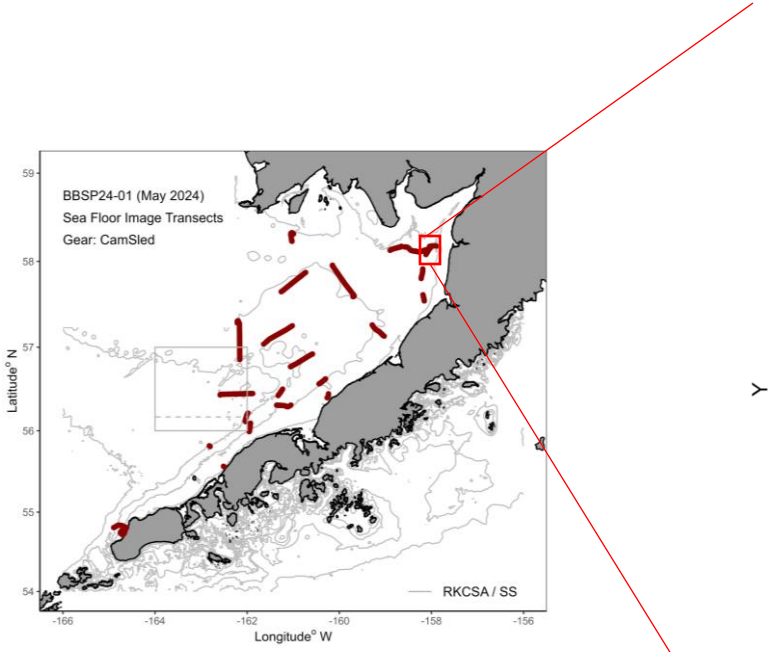
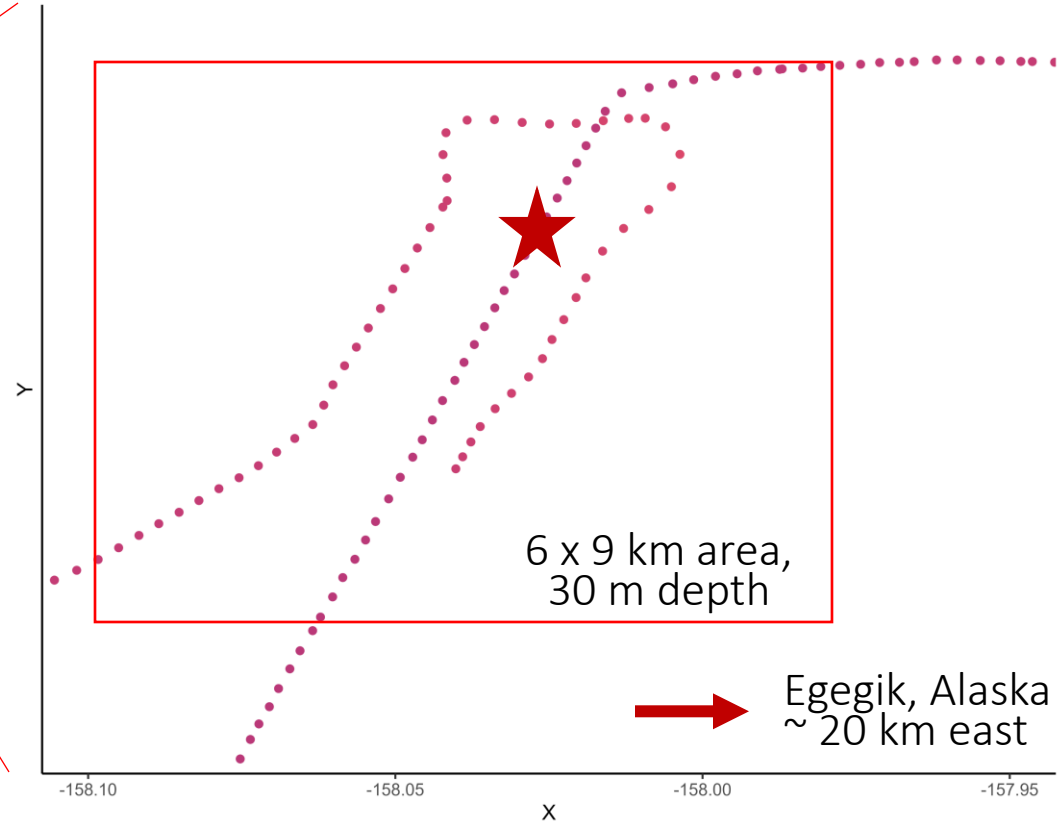
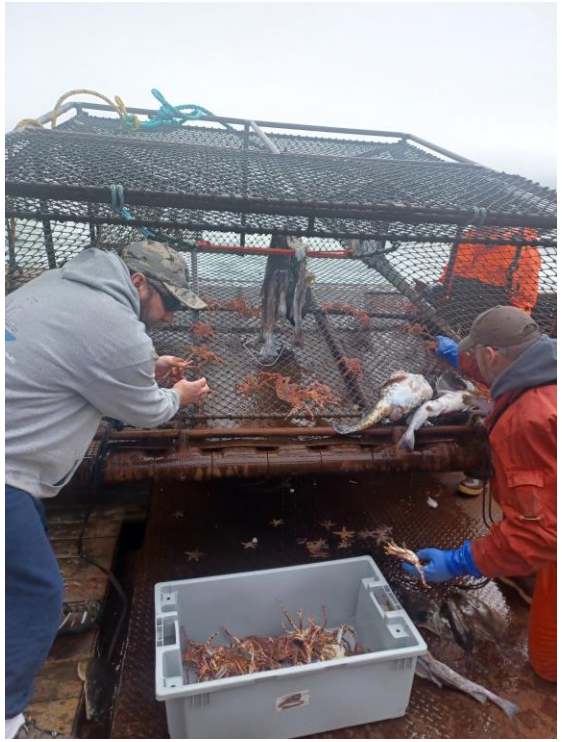
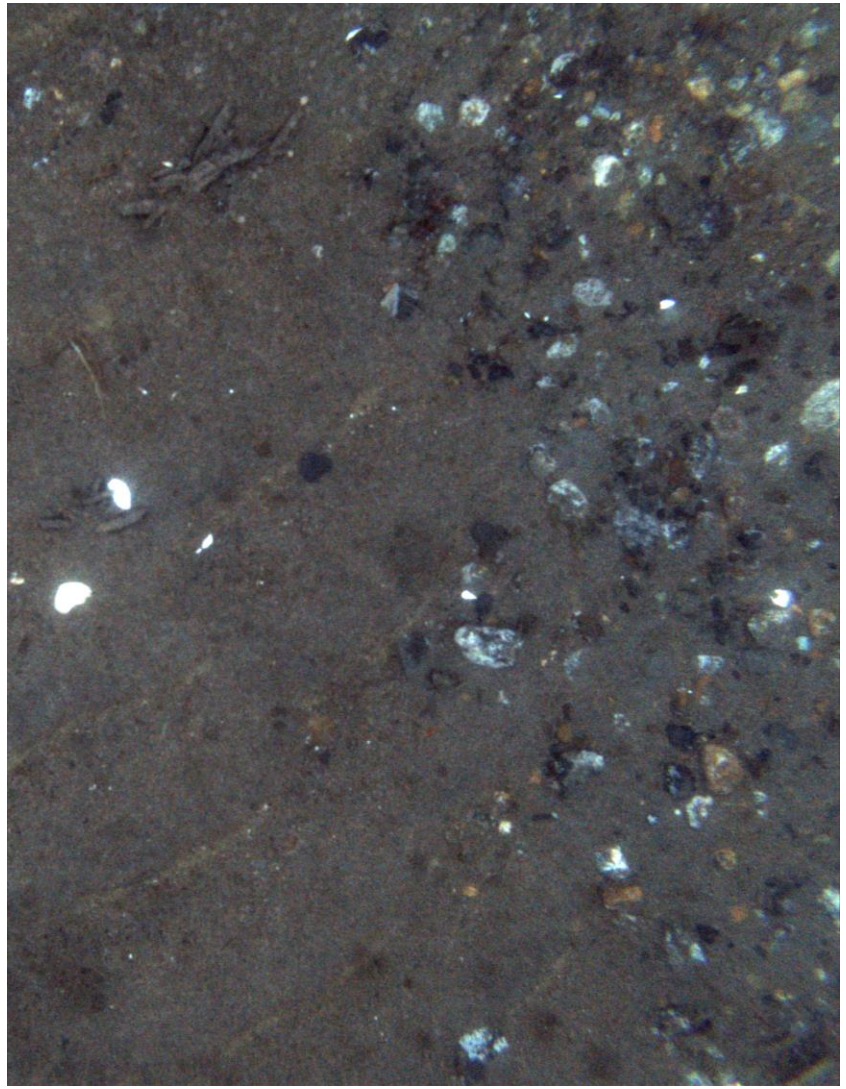
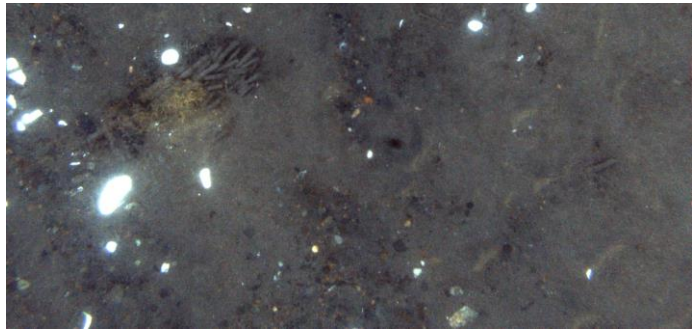


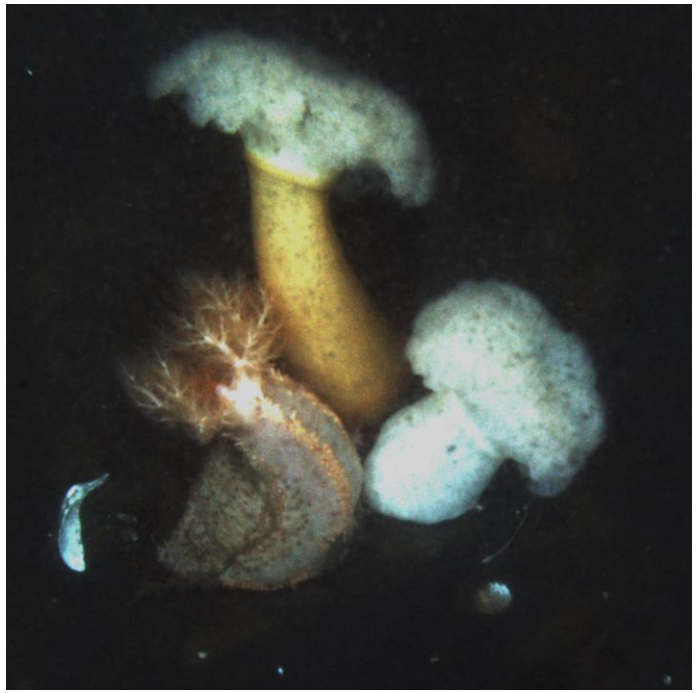


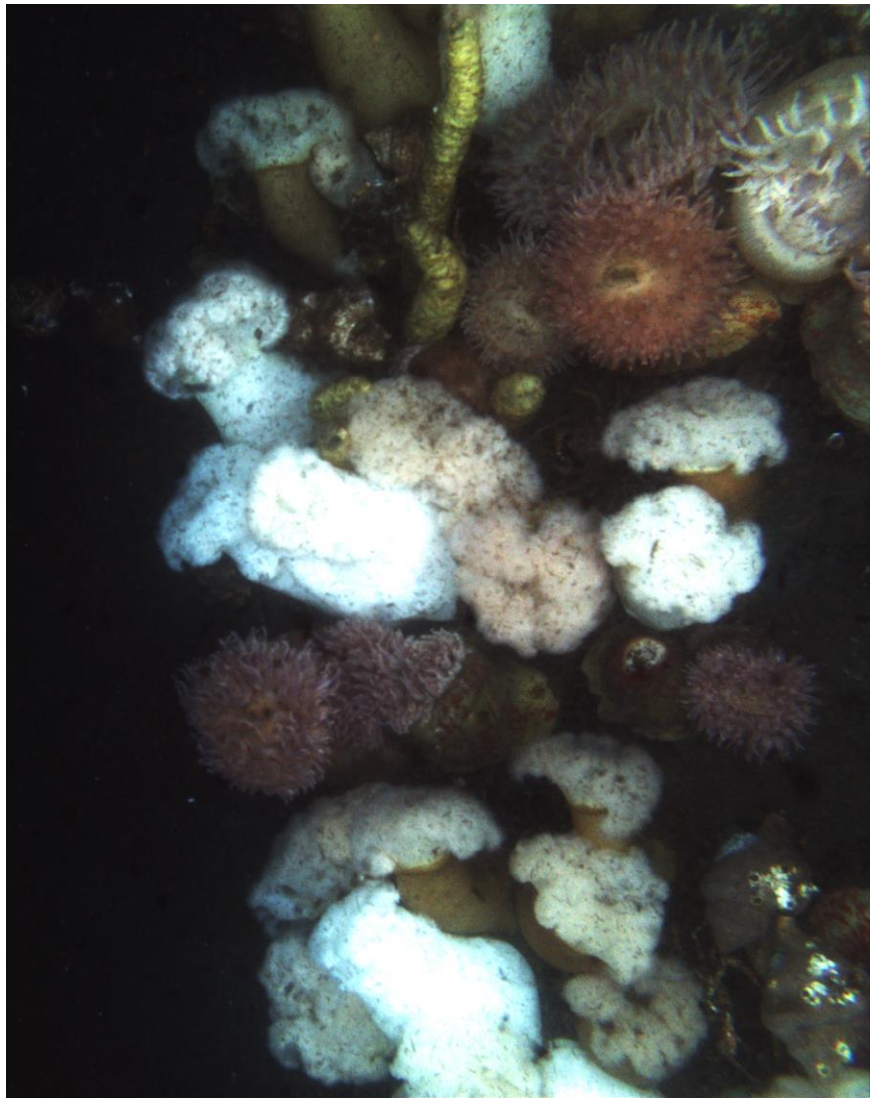


Shallow gravel, deep vertical epifauna

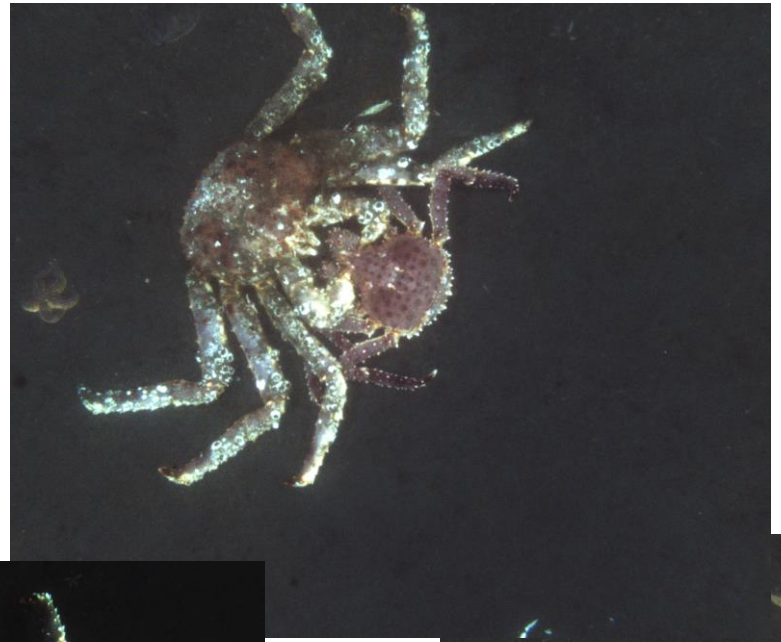




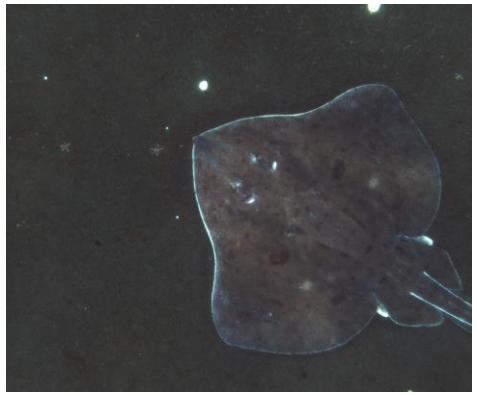


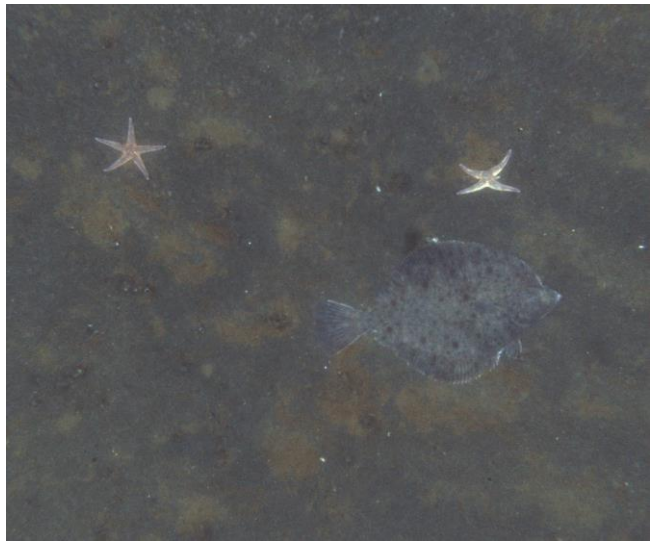


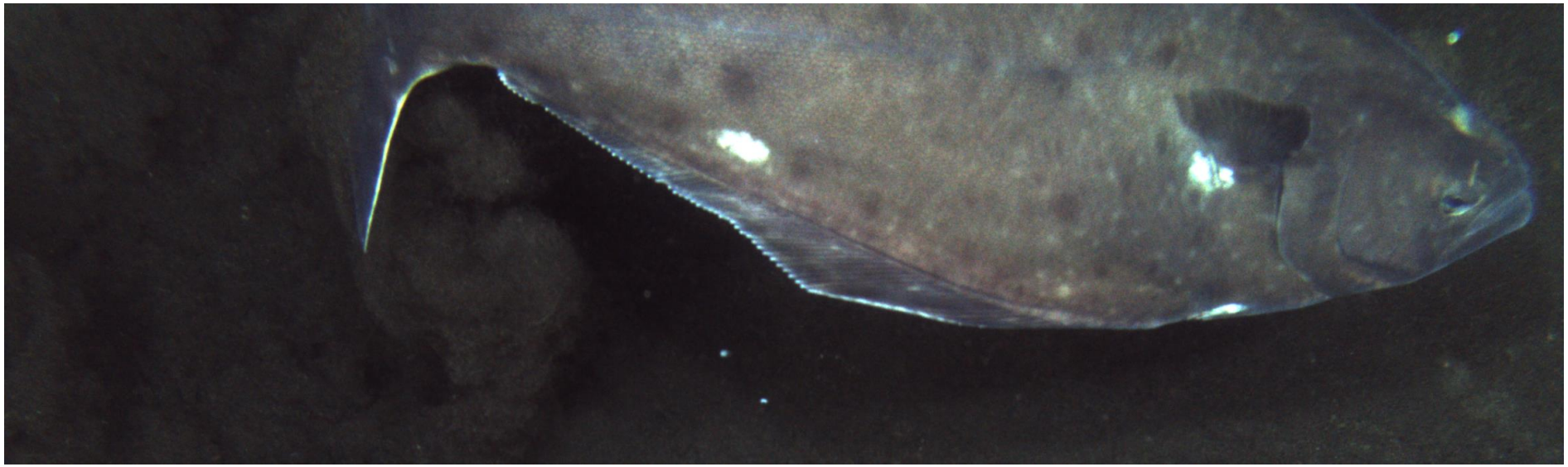
Central BB Mating Pairs

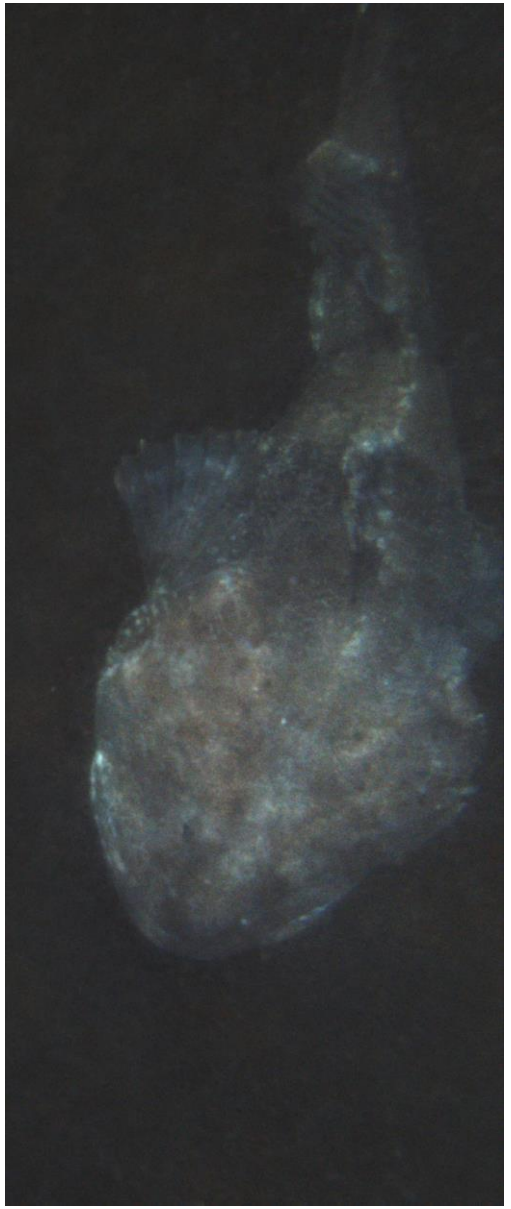


Lots of pollock and flatfish



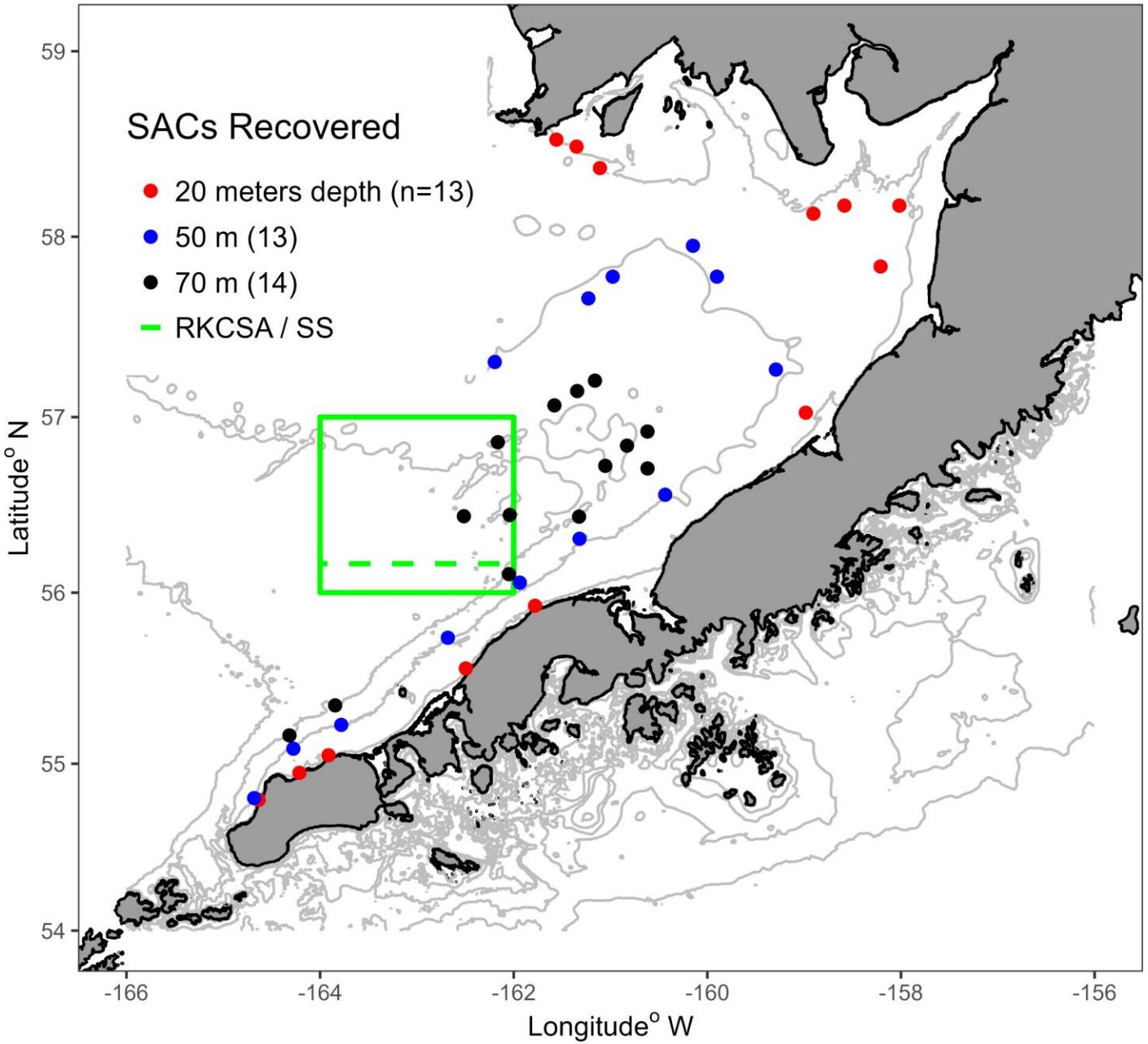






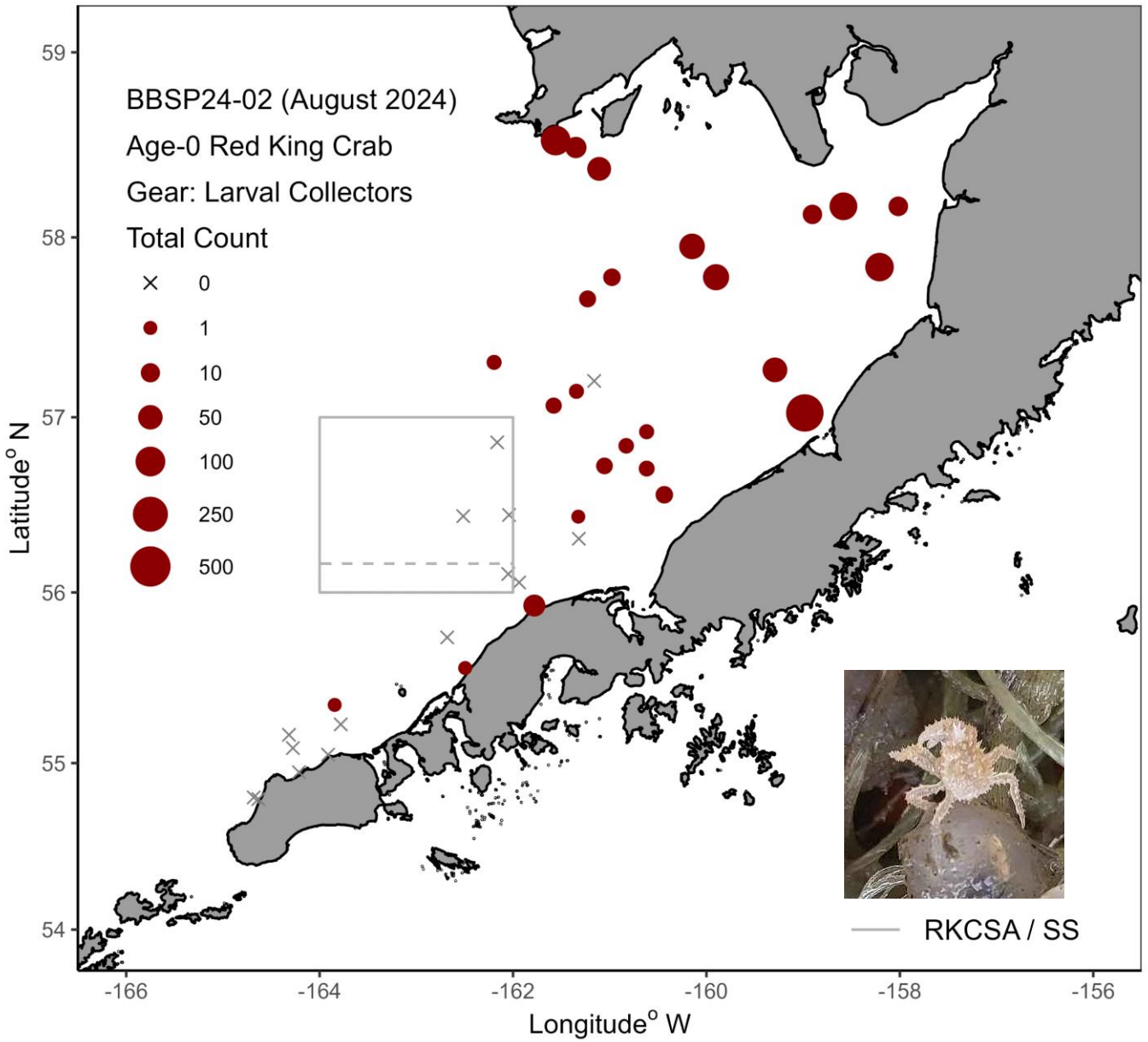
Artificial Collectors

- Crab pot moorings
  - 48 deployed
  - 40 recovered
- Artificial collectors
  - 4 per station
    - 10 mm mesh (3)
    - 5 mm mesh (1)
  - 160 recovered
- Fishery conflict avoidance and satellite monitoring with ‘smart’ buoys
- Image annotation starting soon!

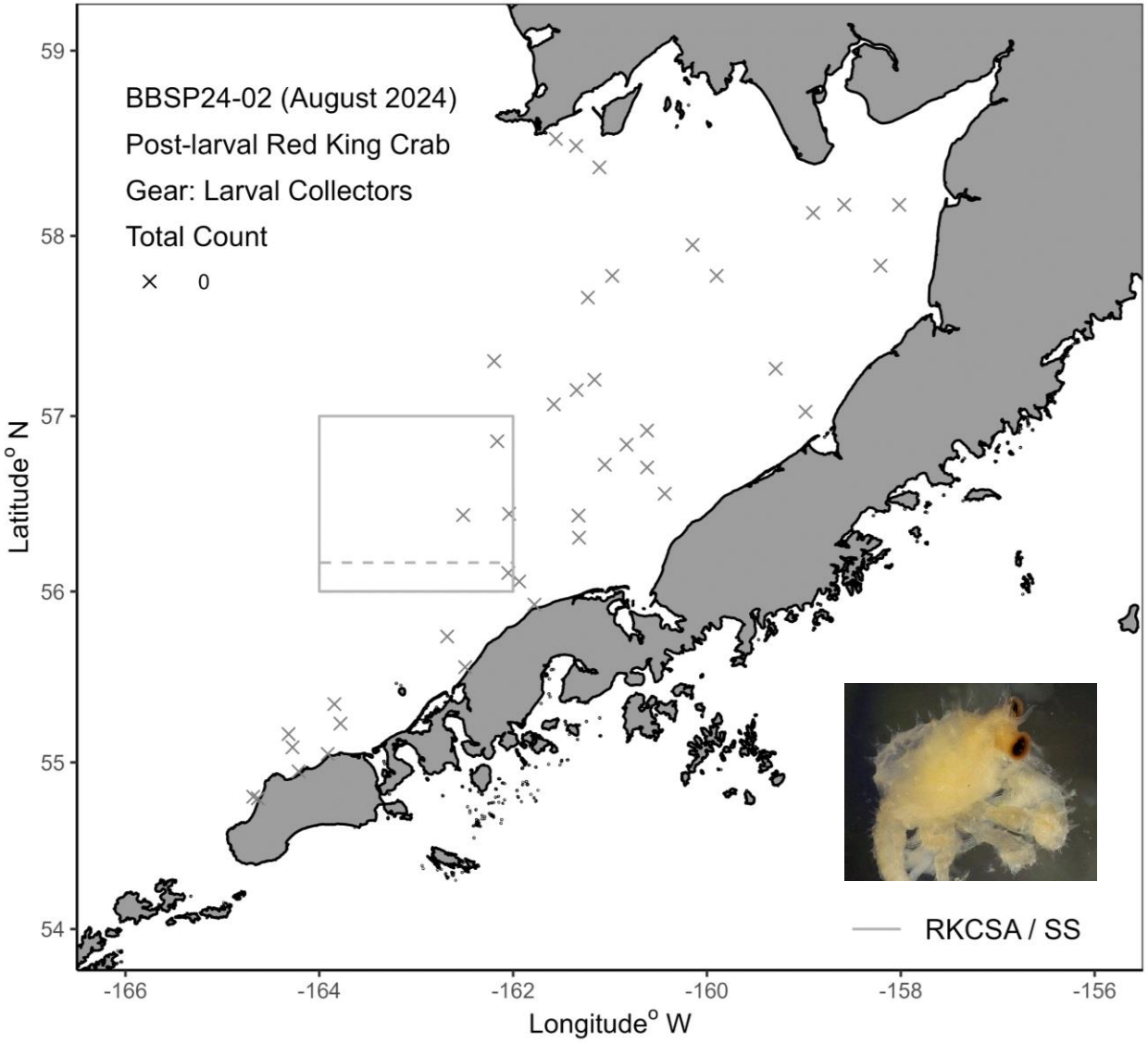


Age-0 RKC Catch

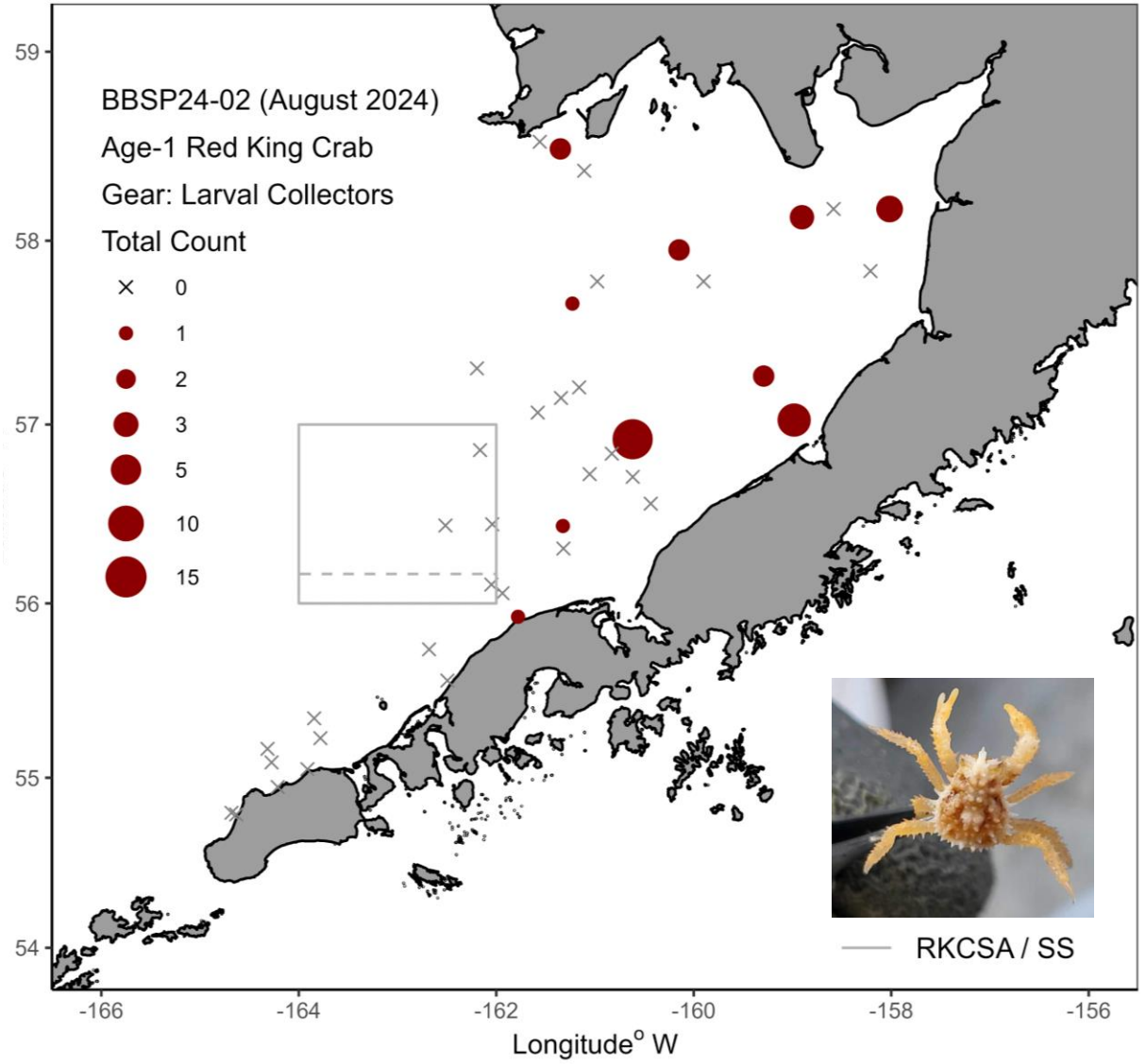
- 1,558 individuals
  - 94 % of total catch found in the upper Bristol Bay region
    - 20-50 m stations
  - Port Heiden hot spot
    - > 100 ind. per collector
  - Could have had more?..
    - lost 3 nearshore samples
  - None observed in RKCSA
  - Only two observed south of the Black Hills
    - Other lithodids were observed



Glaucothoe Catch (0)

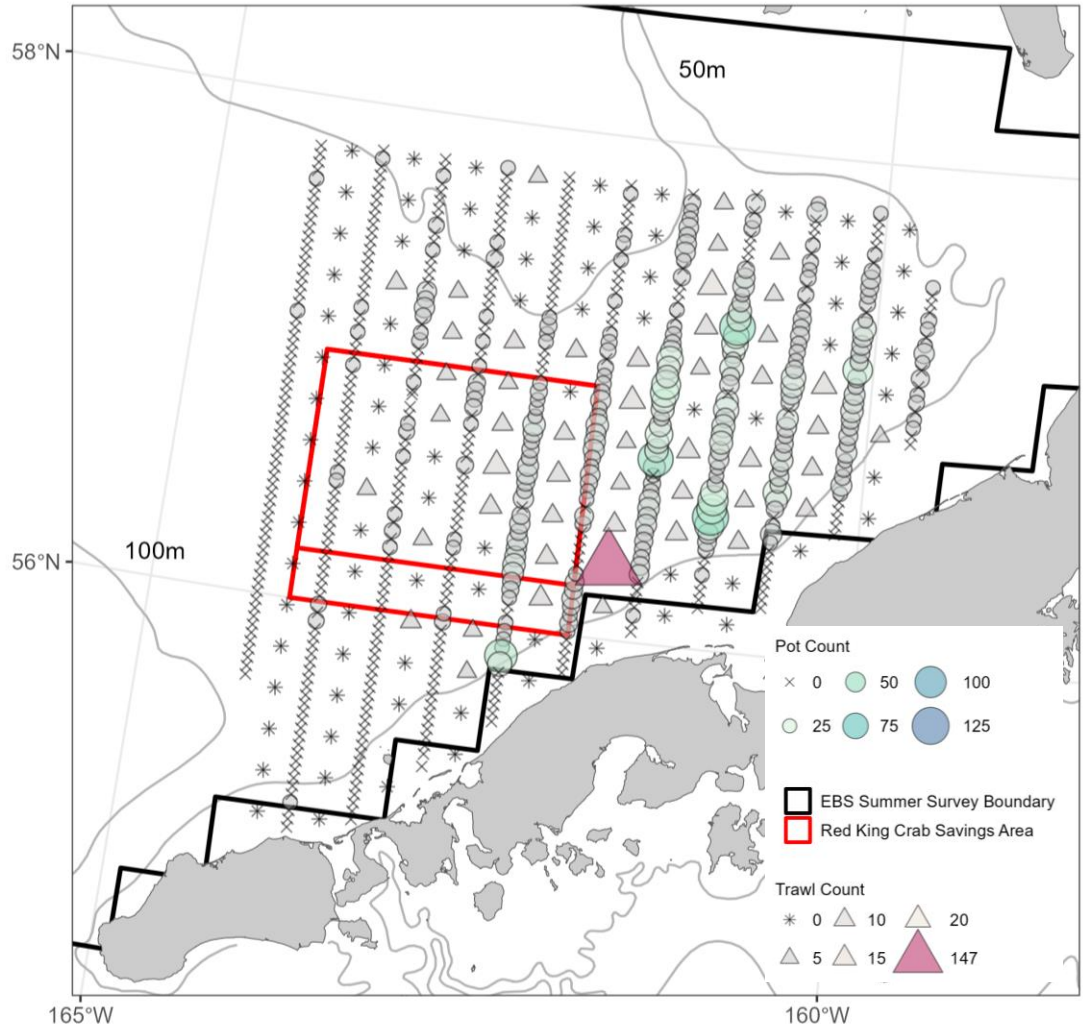


Age-1 Catch (38)

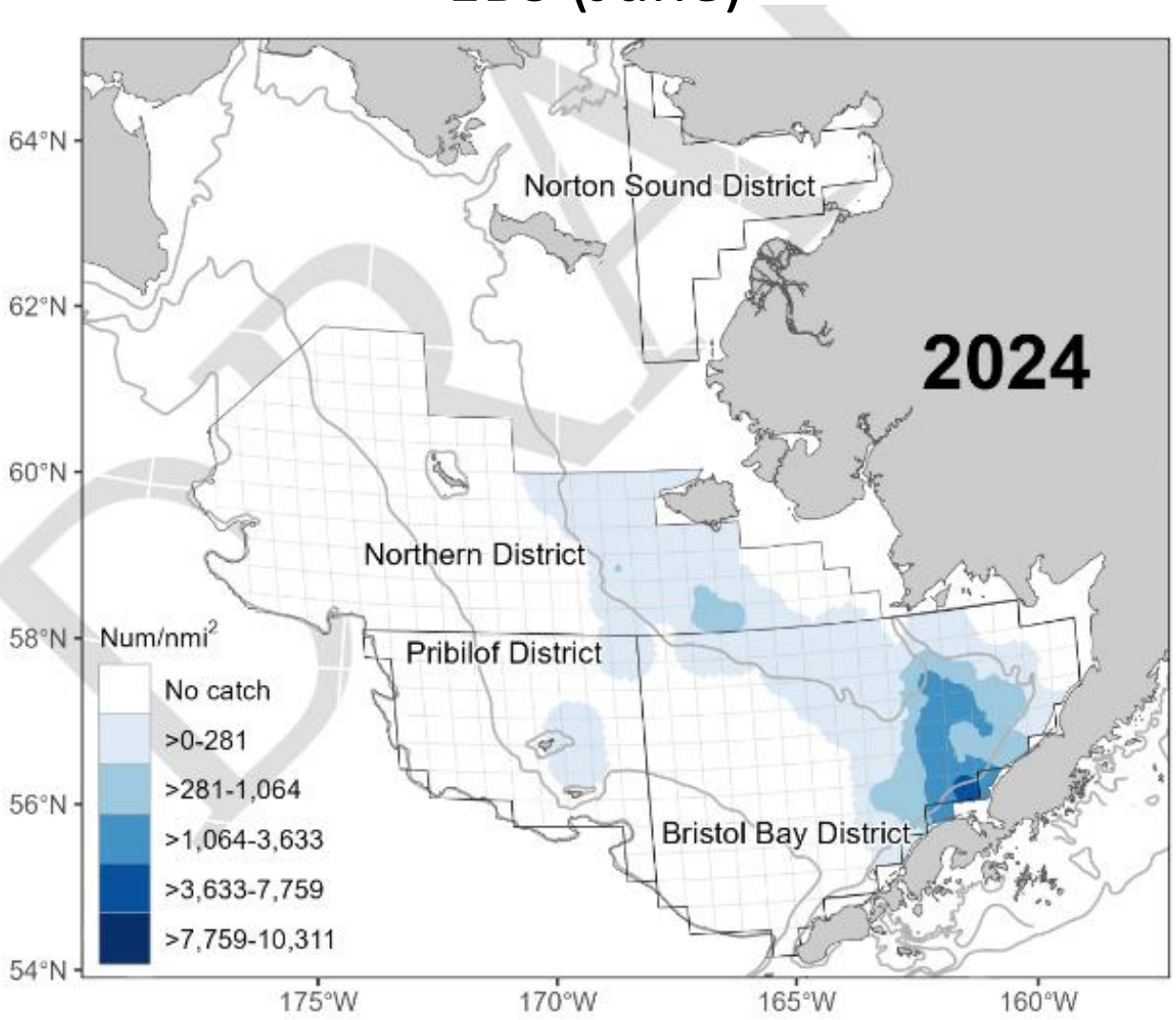


Mature Female Comparisons

- CPS2 (March)

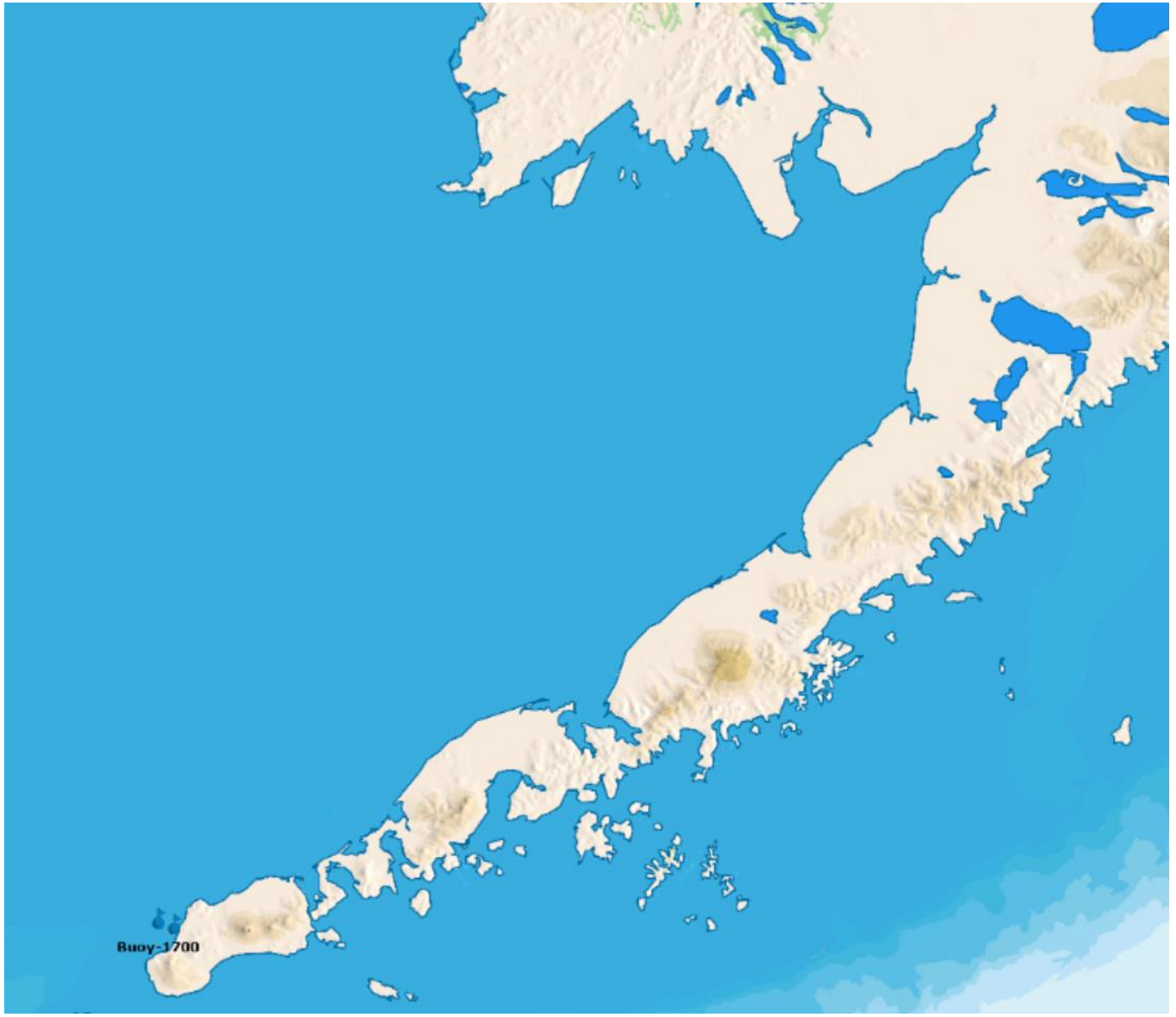


- EBS (June)



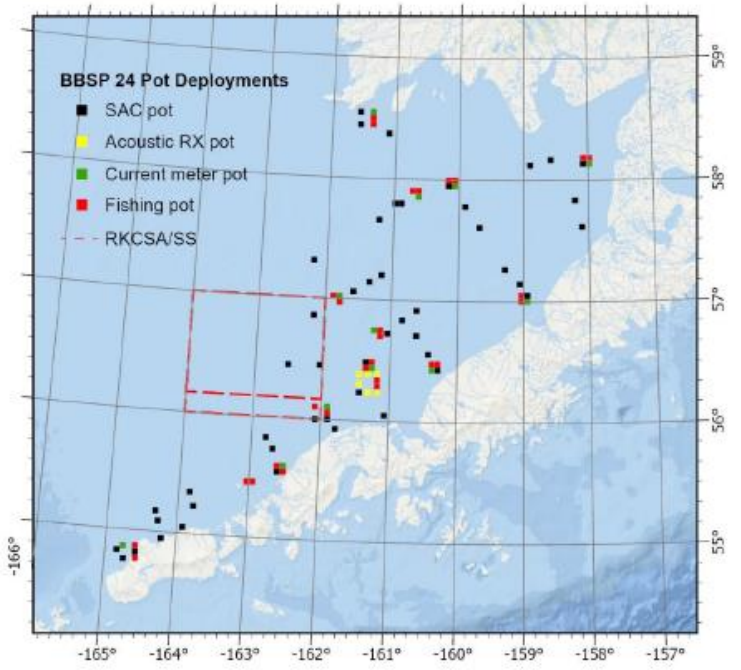
Surface Currents

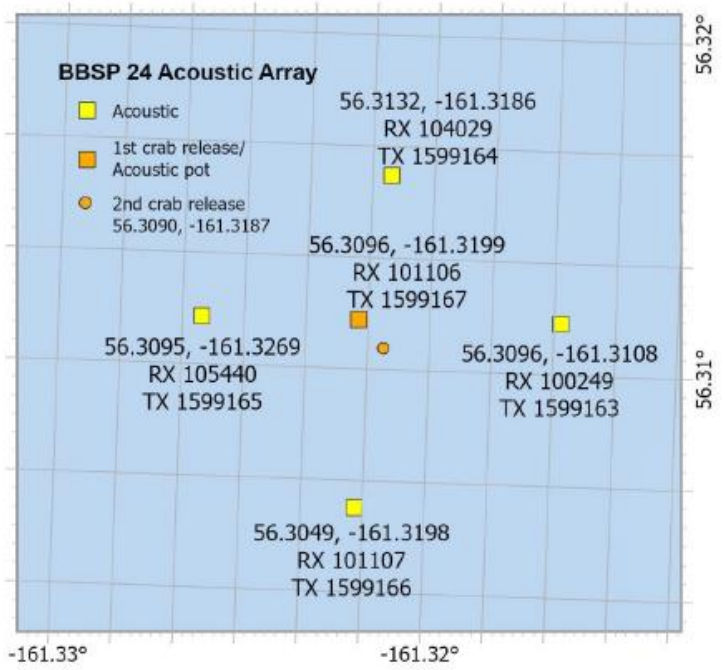
- ‘Unfortunately’ smart buoys periodically broke off crab pot lines.
  - Very stressful, but interesting
  - Soliciting help in beached buoy recovery!
    - https://bluevue.boggroup.net/#/login
    - Username: bbsp_rkc
    - Password: redkingcrab1
- Possible re-analysis of Daly et al. 2020 ROMS-IBM w/ 2024 data?..

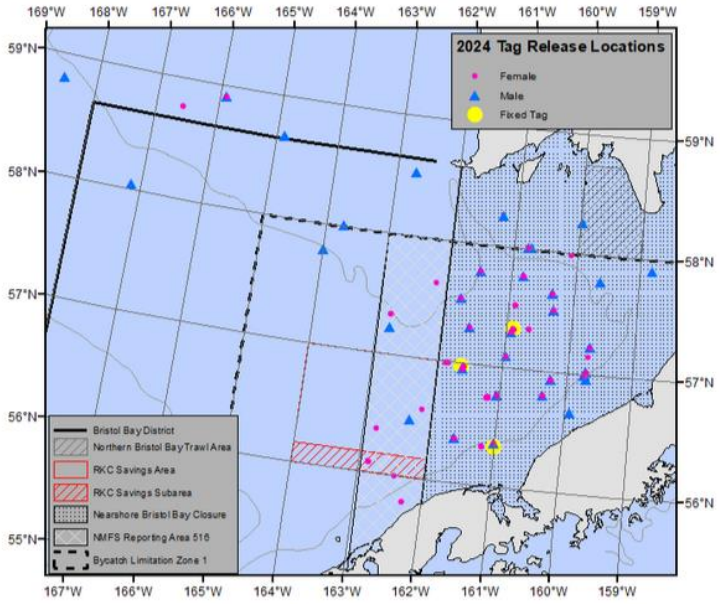


Crab Movement

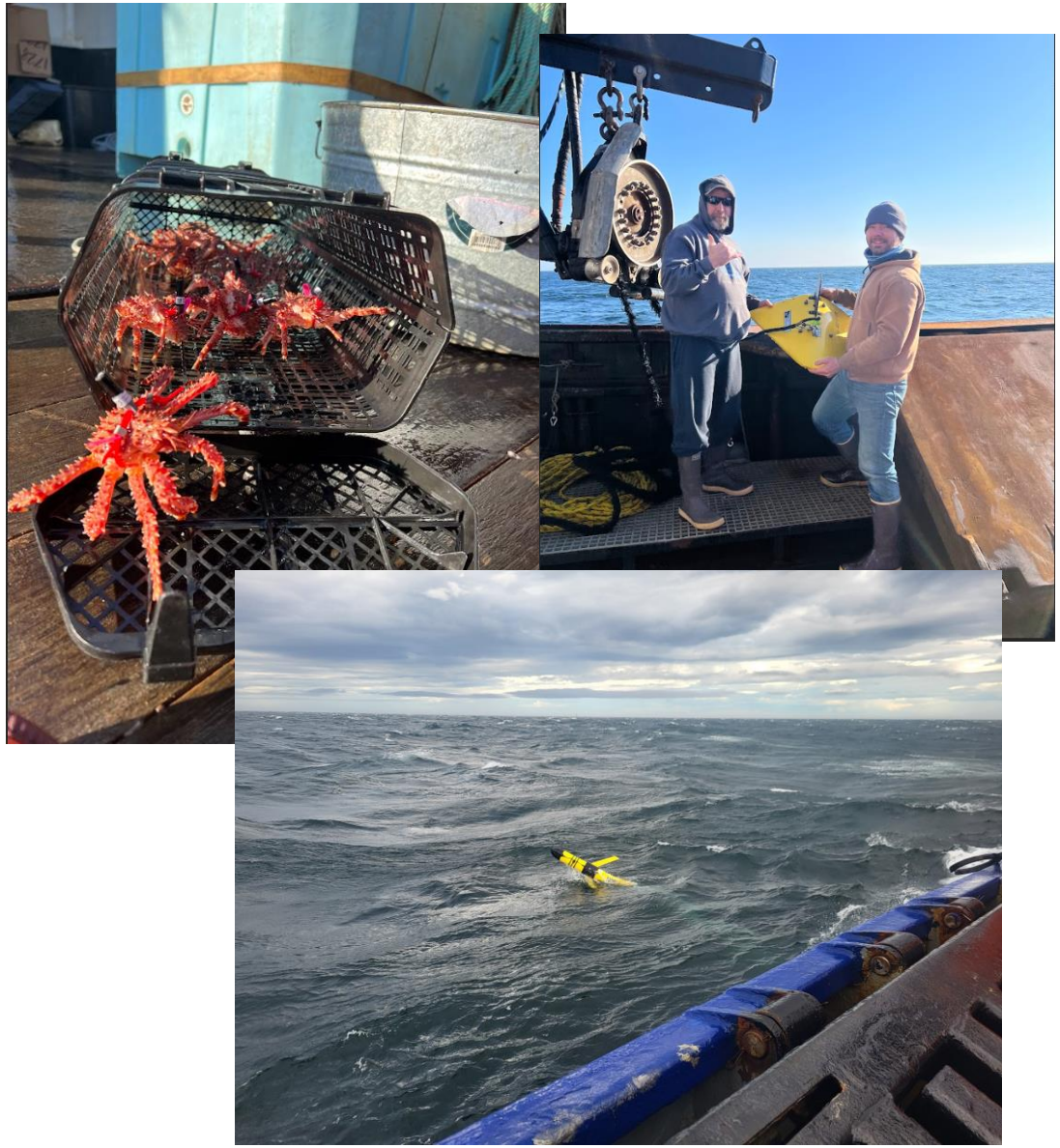
- Two studies
  - Limited use of small-mesh pots
  - Leah's NPRB#24-09
    - Satellite popup tags deployed on mature females (n = 47)
  - DFG internal funds for acoustic tracking of juvenile red king crab
    - 'Predator Tags' deployed on
    - UAF Glider and fixed receivers

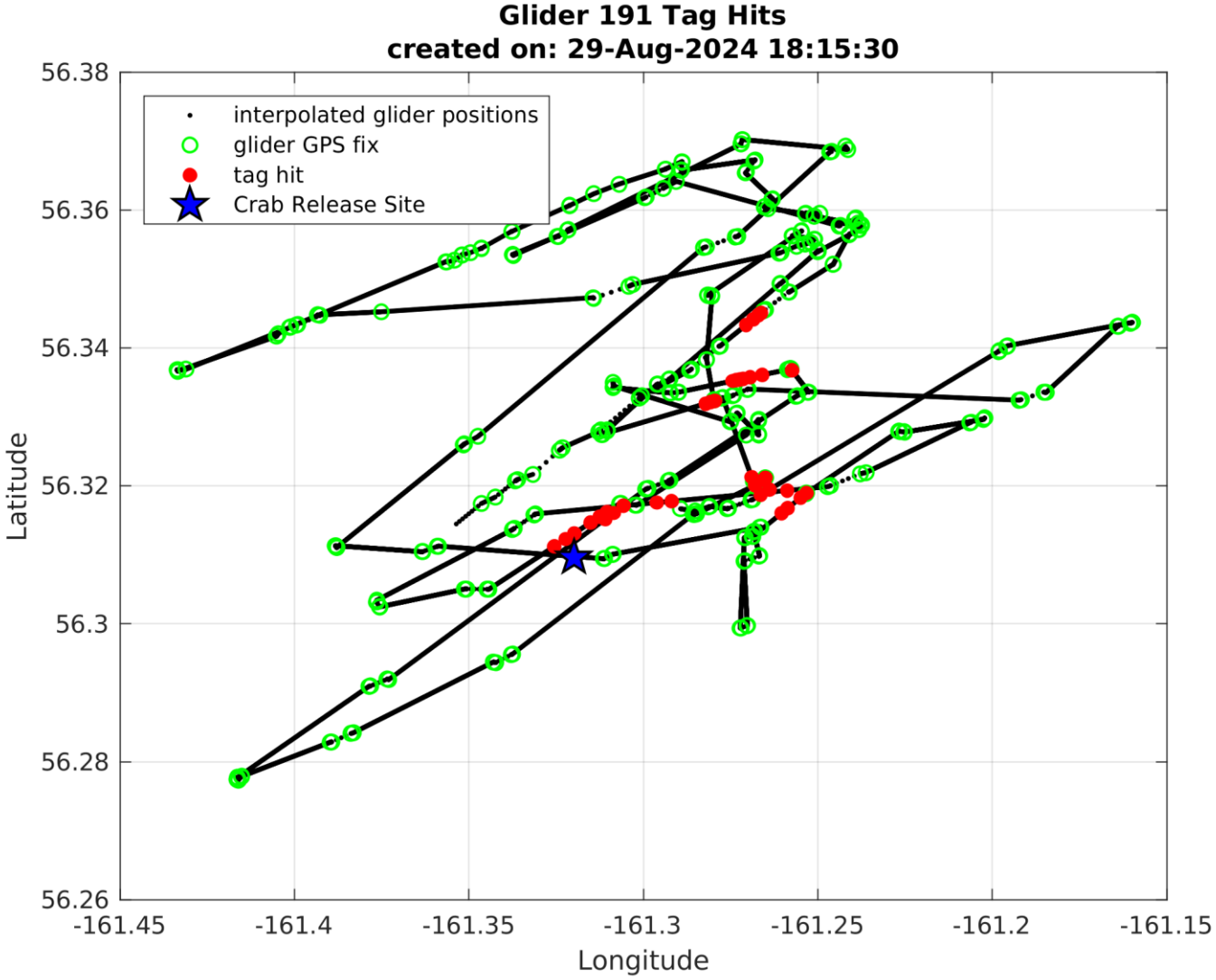






Acoustic Tagging, V-Fin, and Shackelton Glider



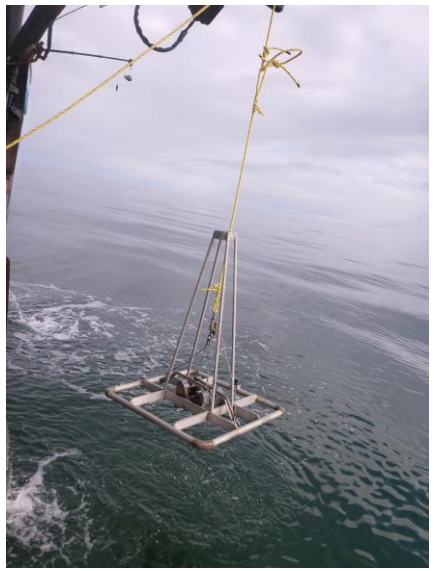


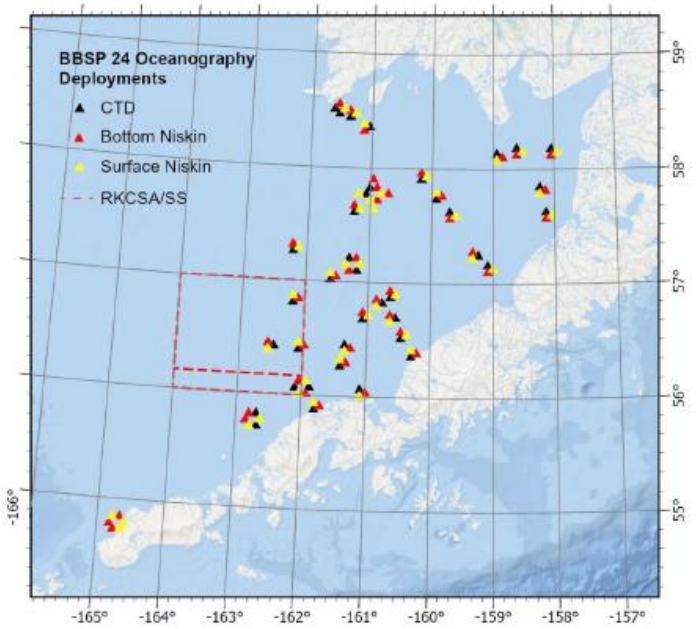
Preliminary conclusions

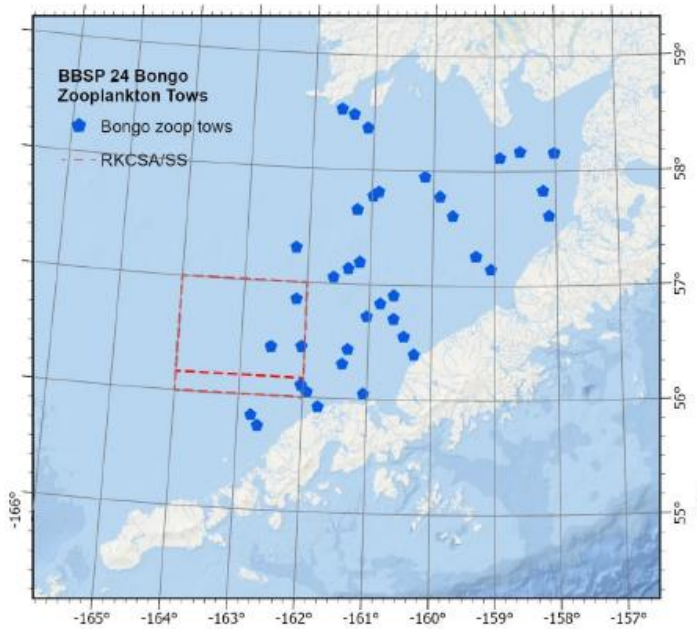
- First dedicated assessment of Bristol Bay red king crab recruitment at early life stages since the 1980s
  - Exceeded age-0 catch expectations in larval collectors
    - Appears to be spatial (and temporal) pattern to larval delivery
  - Development of recruitment index is possible
- First quantitative habitat assessment in Bristol Bay
  - Met nearly all CamSled field sampling objectives
    - Complex habitats nearshore (more abiotic) and offshore (large inverts)
    - Need more shallow, nearshore survey work… with favorable weather
- Ecosystem sampling was complimentary and effective

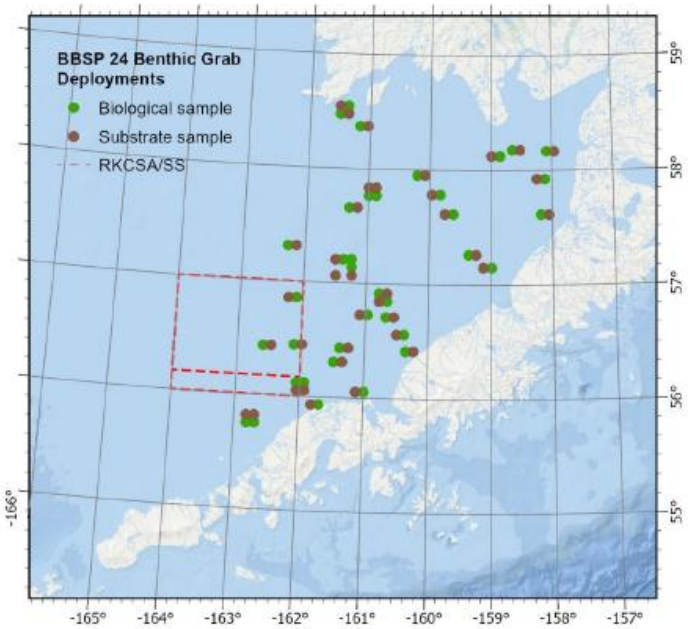
Ecosystem Sampling

- Oceanography (T/S)
- Ocean Acidification
- Larval crab community
- Sediment grain size
- Benthos communities
- Crab movement (tagging)



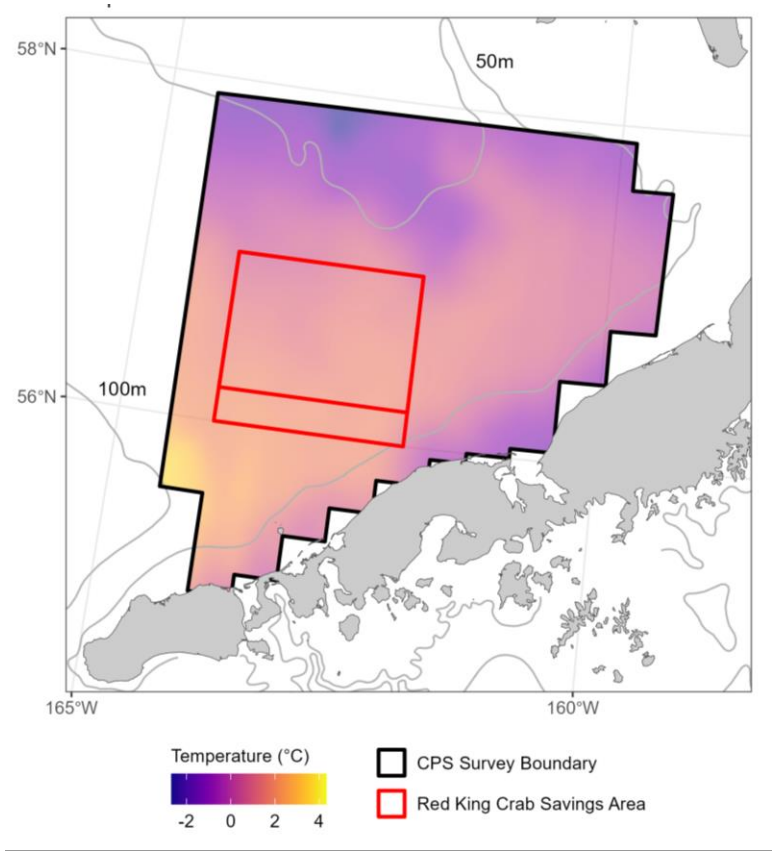




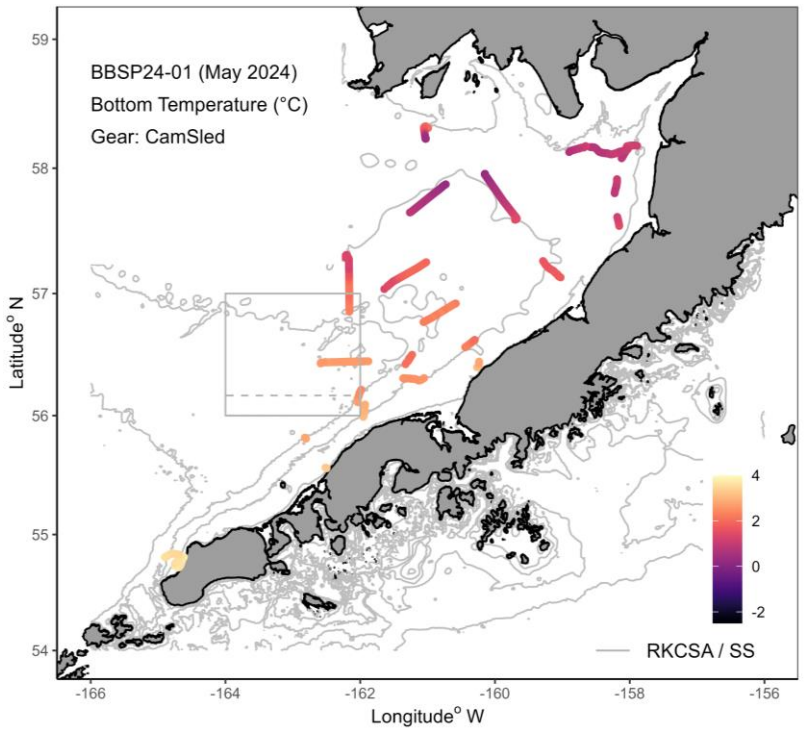


Ocean Temperature

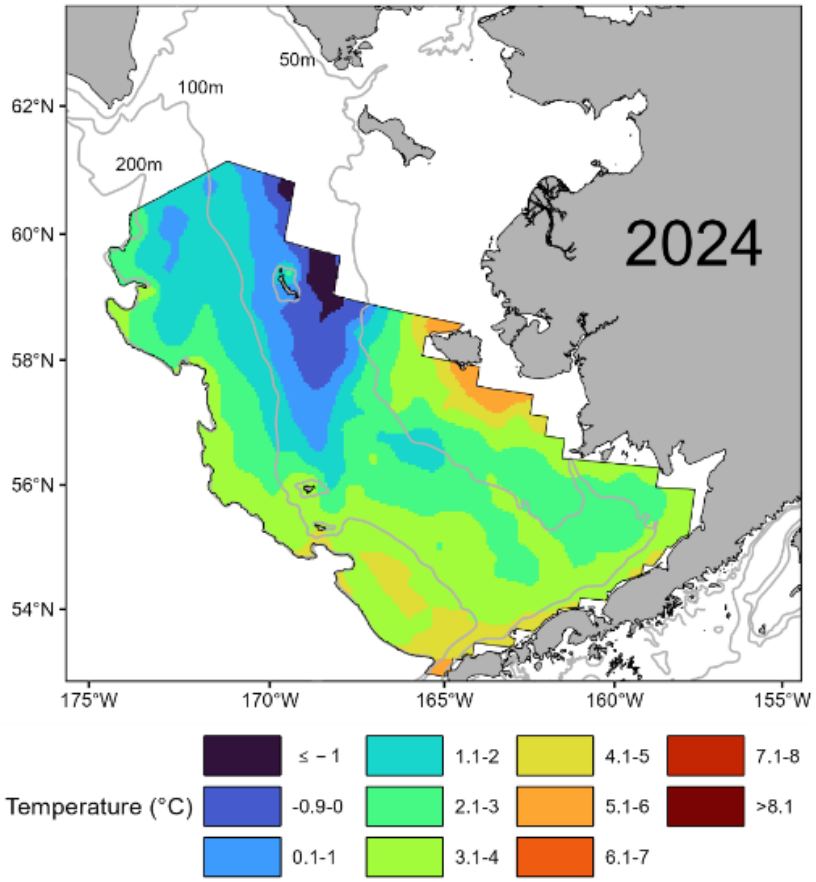
- CPS2 (March)

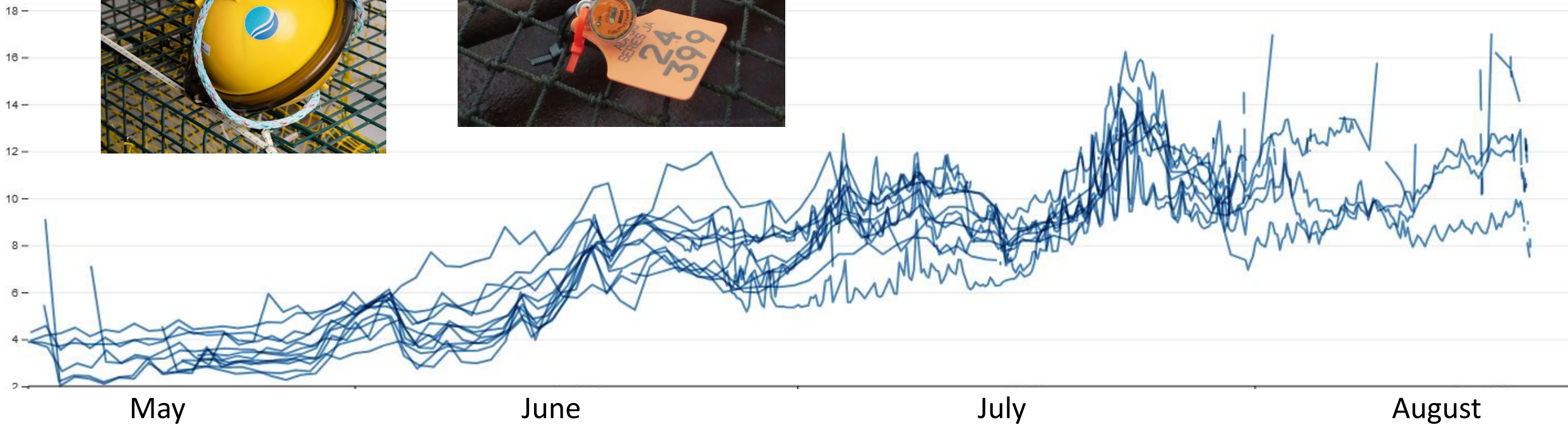


- BBSP (May)



- EBS (June)



Seasonal Temperature

- May – August continuous monitoring
  - Surface water – Satellite communicating ‘smart’ buoys
  - Bottom water – Tidbit loggers