



# Early Life History of Crabs in Pribilof Islands Nearshore Habitat and Potential for Rebuilding of Alaskan Blue King Crab

Jared Weems<sup>1</sup>, Ginny Eckert<sup>1</sup>, Franz Mueter<sup>1</sup> and Chris Long<sup>2</sup>

<sup>1</sup> University of Alaska Fairbanks, Juneau Center, College of Fisheries and Ocean Sciences, Juneau, Alaska 99801, Email: jdweems@alaska.edu

<sup>2</sup> National Oceanic and Atmospheric Administration, Alaska Fisheries Science Center, Kodiak Laboratory, Kodiak, Alaska 99615



## Introduction

Pribilof Islands blue king crab (*Paralithodes platypus*) is the only federally-managed overfished commercial fishery stock in the North Pacific, and recruitment limitation could be a contributing factor to failed rebuilding efforts. Because crabs have a complex life cycle with dispersive larval stages and a sedentary adult, successful larval recruitment is required for recruitment. Cobble and shell hash substrates are a preferred benthic settlement habitat for blue king crab (Armstrong *et al.* 1987). Once settled, groundfish predation and inter, intra-cohort competition are hypothesized to be factors affecting survival (Long *et al.* 2015). Proposed studies will examine larval seasonal abundance and advection dynamics and juvenile recruitment to the benthos and mortality regionally in the U.S. Arctic Subarctic.

## Hypotheses

- Pelagic larval crab distribution and abundance is species and stage-specific across water masses.
- Benthic juvenile crab distribution and abundance is mediated by larval supply, habitat, and predation pressure.



## Methods

### Bering and Chukchi Sea Sampling

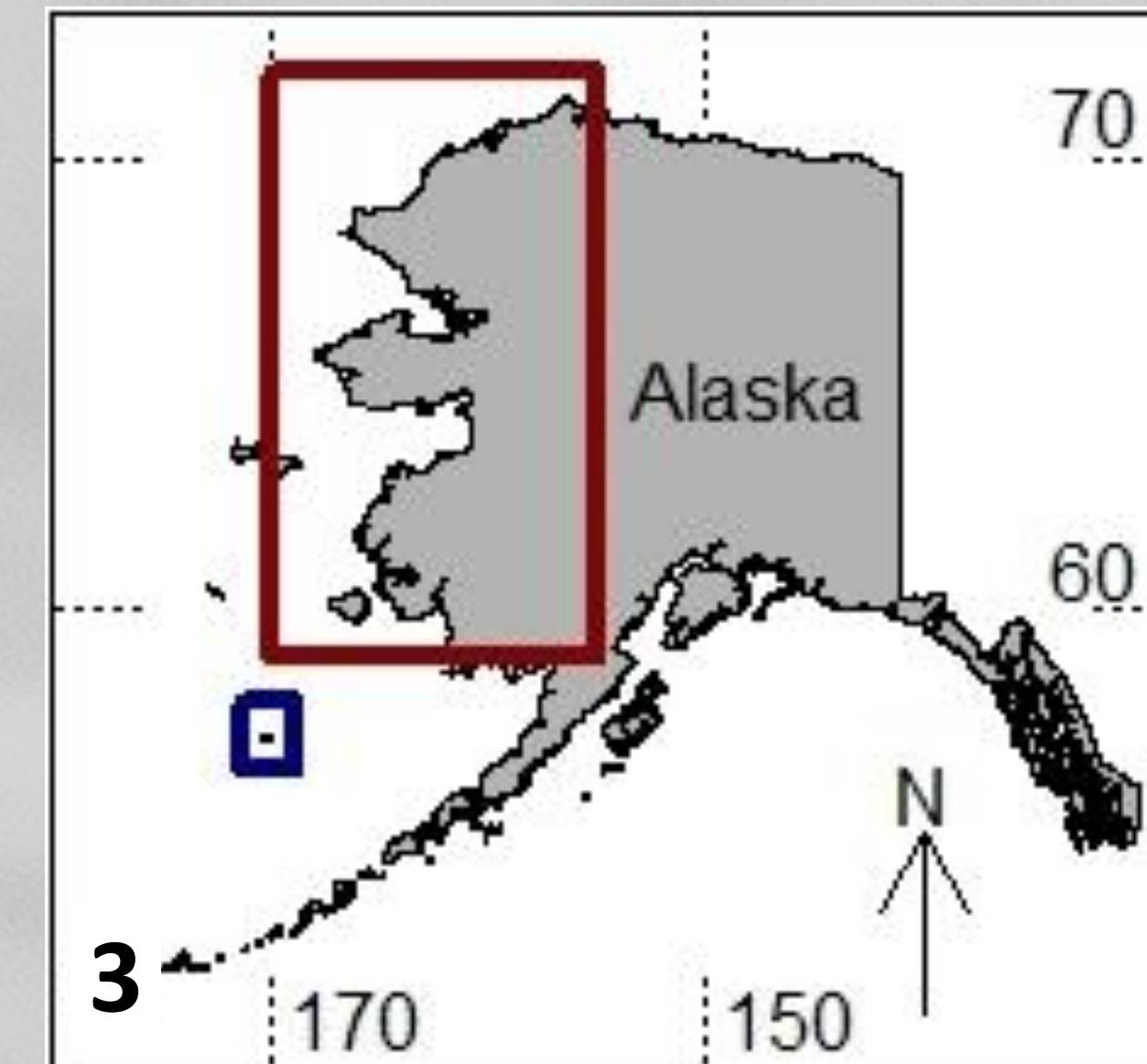
- 60cm diameter Bongo net (505µm mesh) samples during 2012, 2013, and 2017.

### Pribilof Islands Sampling

- Diver and camera surveys, megalopae collector bags, and tethering experiments

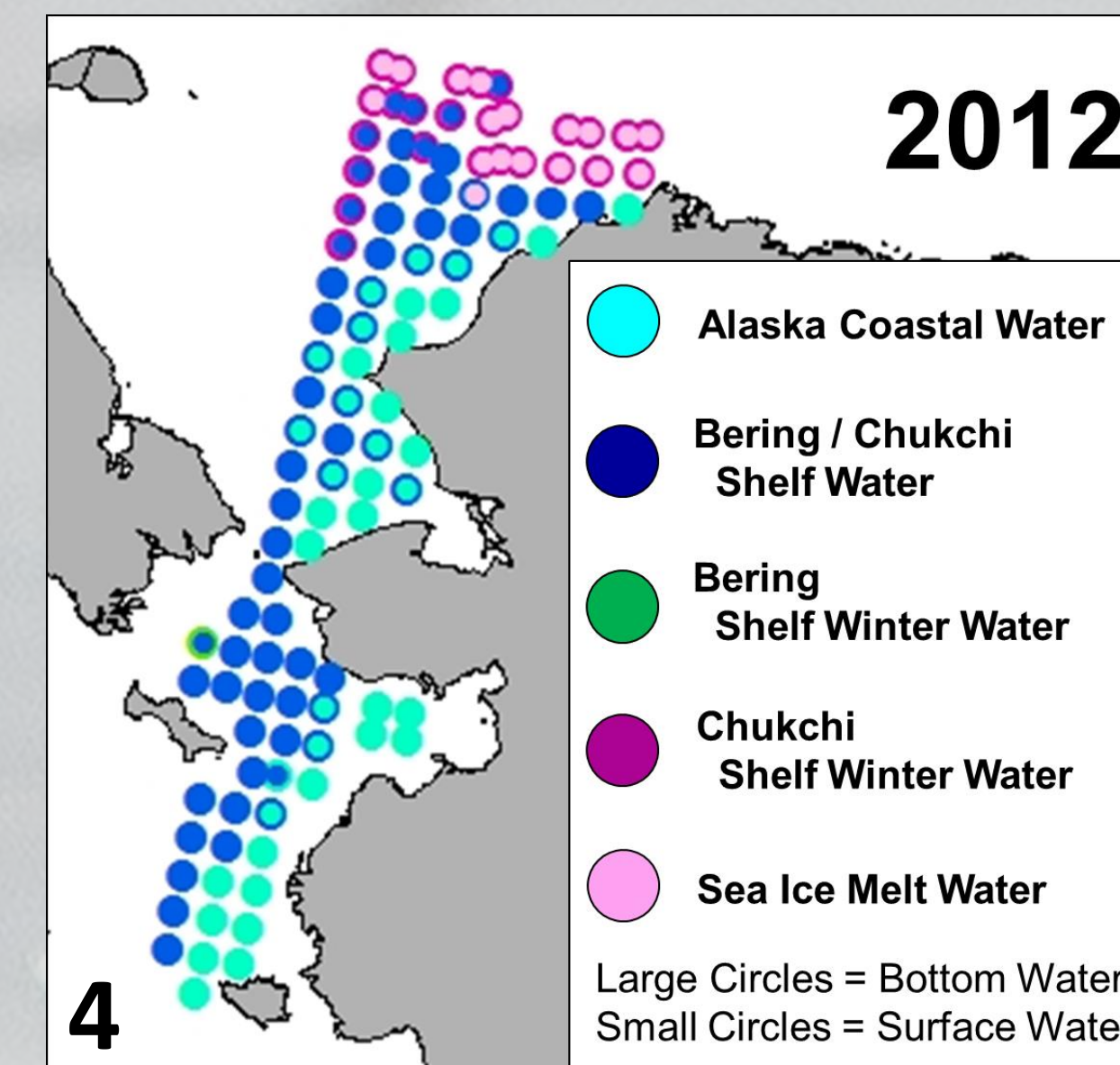
## Study Area

- U.S. Arctic and Subarctic Seas
- Pelagic larval crab studies in the northeastern Bering Sea and Chukchi Sea (NBCS).
- Benthic juvenile crab studies in the nearshore neritic zone of St. Paul Island, Alaska.

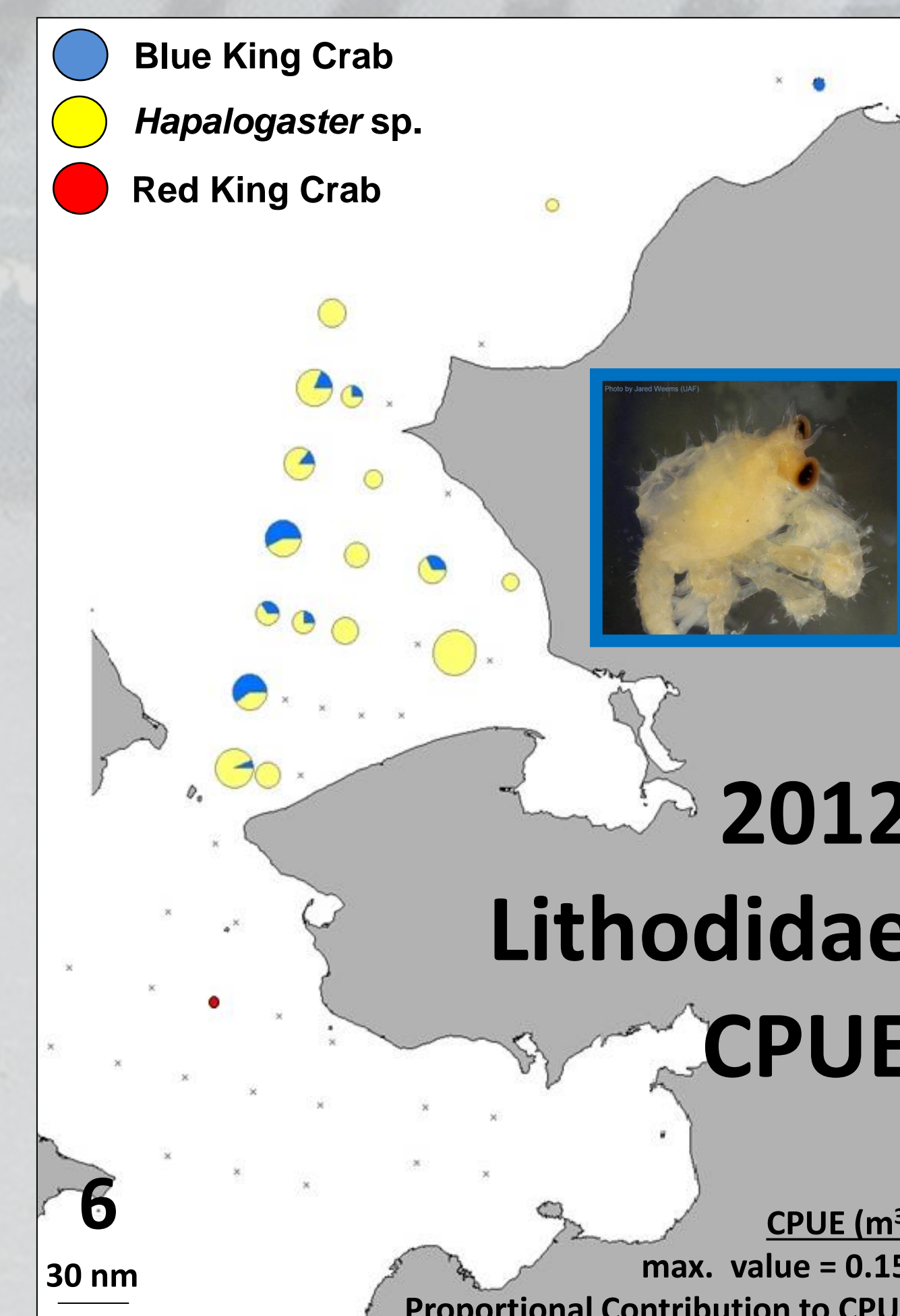
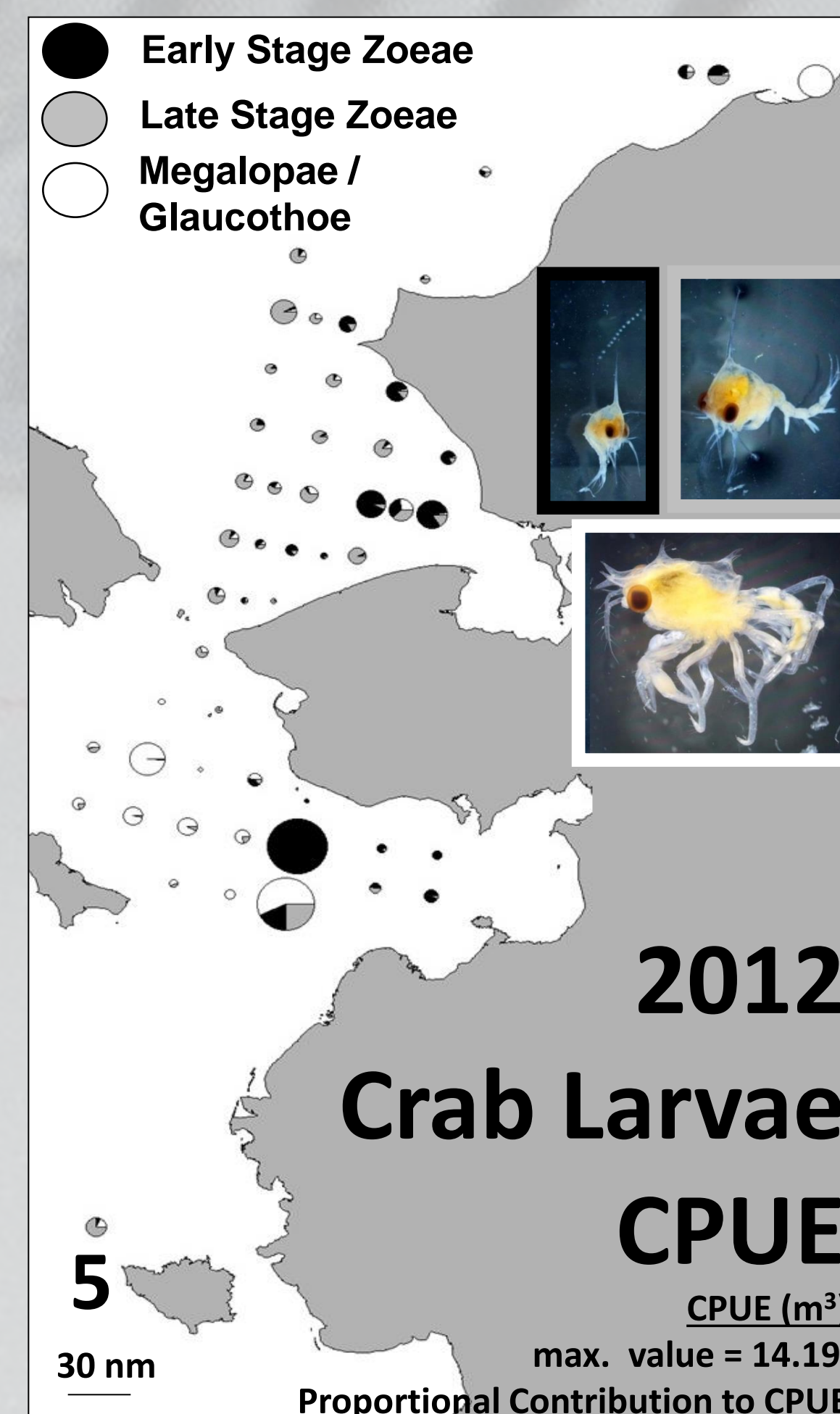


## Oceanography

- Five distinct water masses observed in the NBCS (Danielson *et al.* 2016).
- Surface water temperatures represent a 'cold' year.
- Atmospheric wind field maintained water mass fronts.



## Pelagic Larval Crab in the Arctic

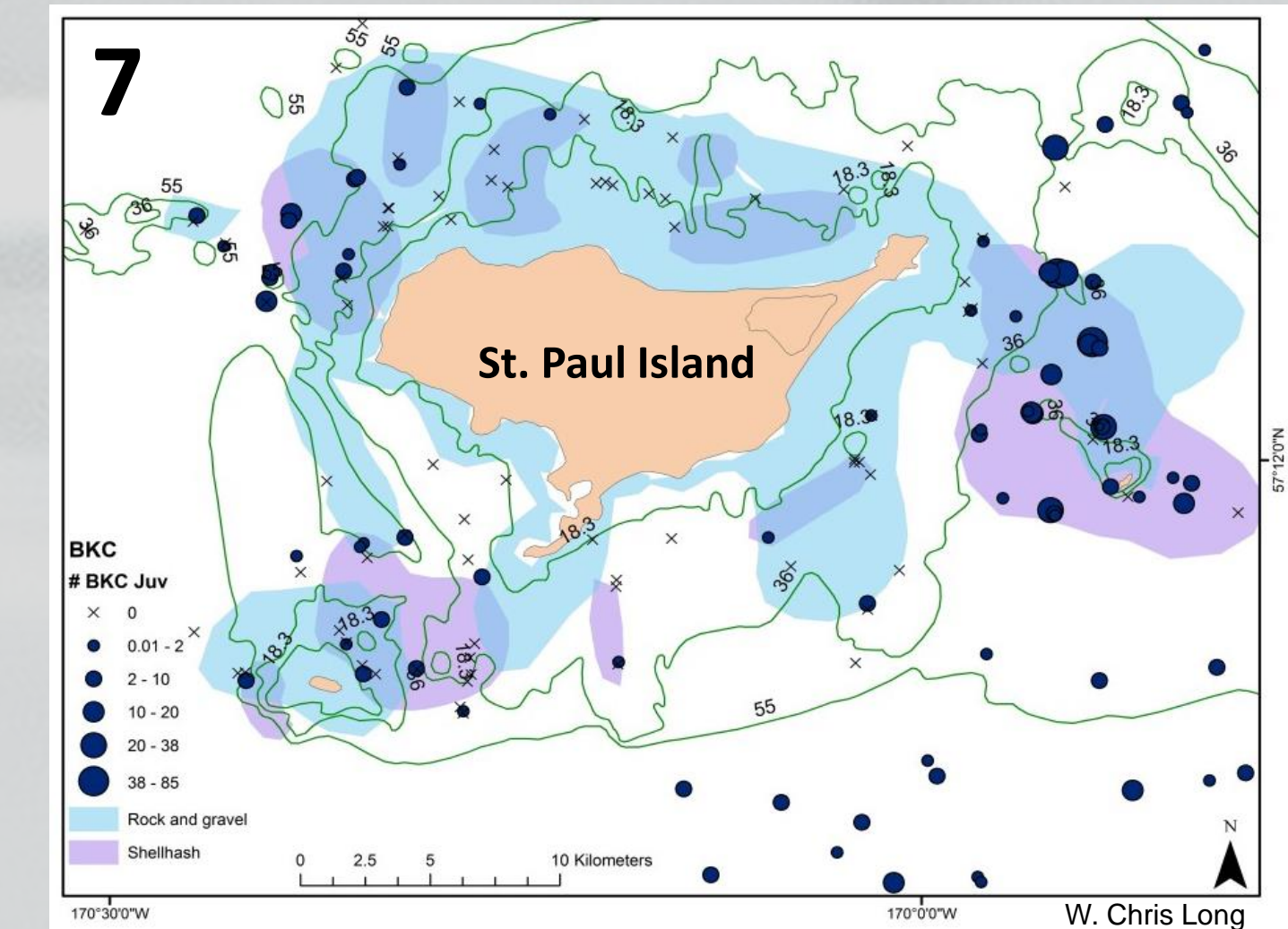


- Total crab larvae catch-per-unit-effort (CPUE, ind. m<sup>3</sup>) reveals high abundance of early stage zoeae in the Alaska Coastal Current.
- Late stage zoeae and glaucothoe blue king crab are seemingly restricted to bottom or off-shore Bering/Chukchi Shelf Waters.

## Benthic Juvenile Crab in the Pribilof Islands

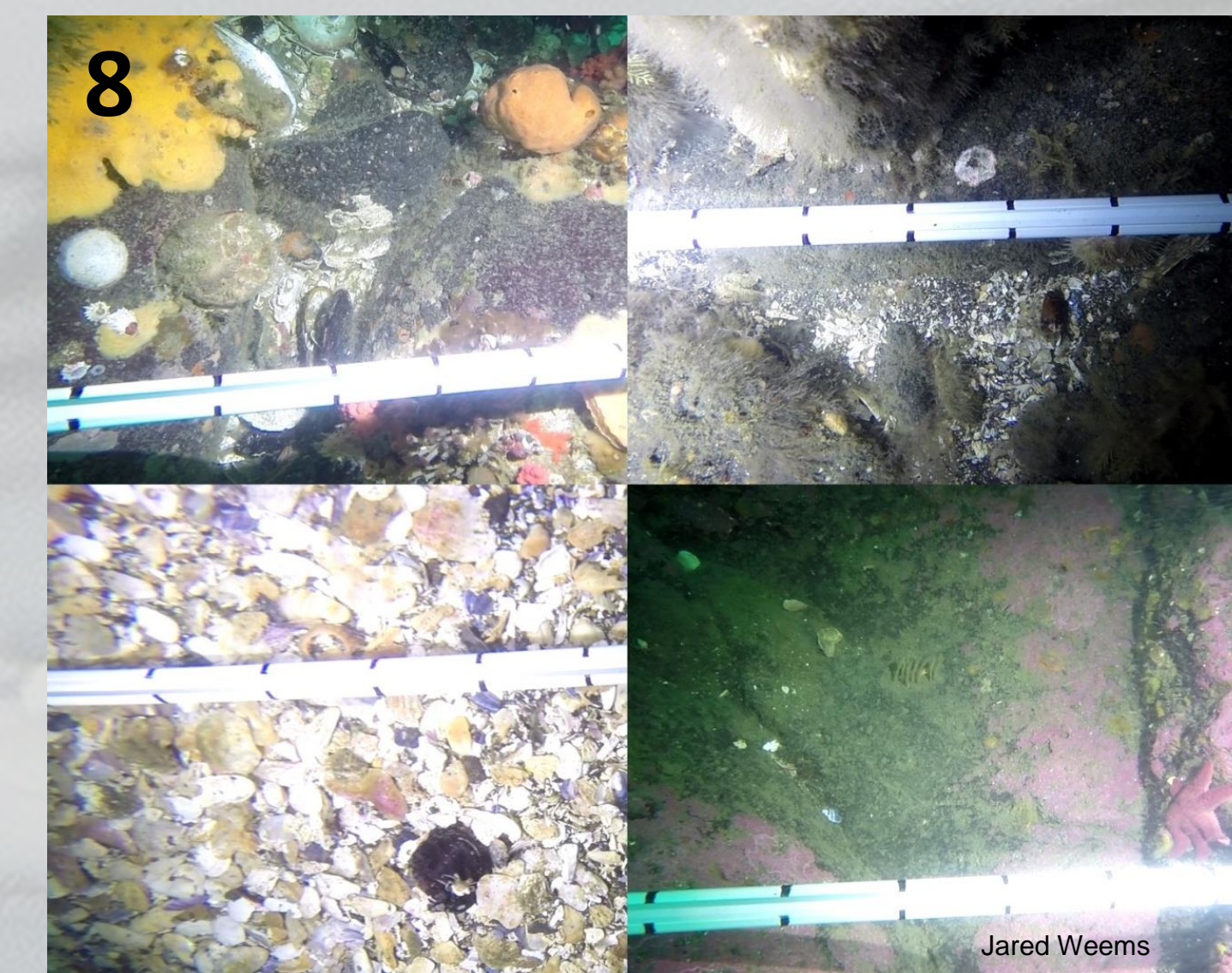
### 1983-84 Sampling

- Historically, high abundances of juvenile blue king crab were found in shell hash and rock/gravel habitats.



### Future 2017-2018 Proposed Field Studies

- SCUBA diver and collection bag surveys (1) will be used to enumerate recent blue king crab recruits.
- Diver and drop camera surveys (8) will assess current habitat structure and bottom community composition.
- Diver fish surveys and fish stomach content analysis will expose species preying upon blue king crab.
- Video recorded blue king crab tethering experiments will estimate depredation by predators and survival.



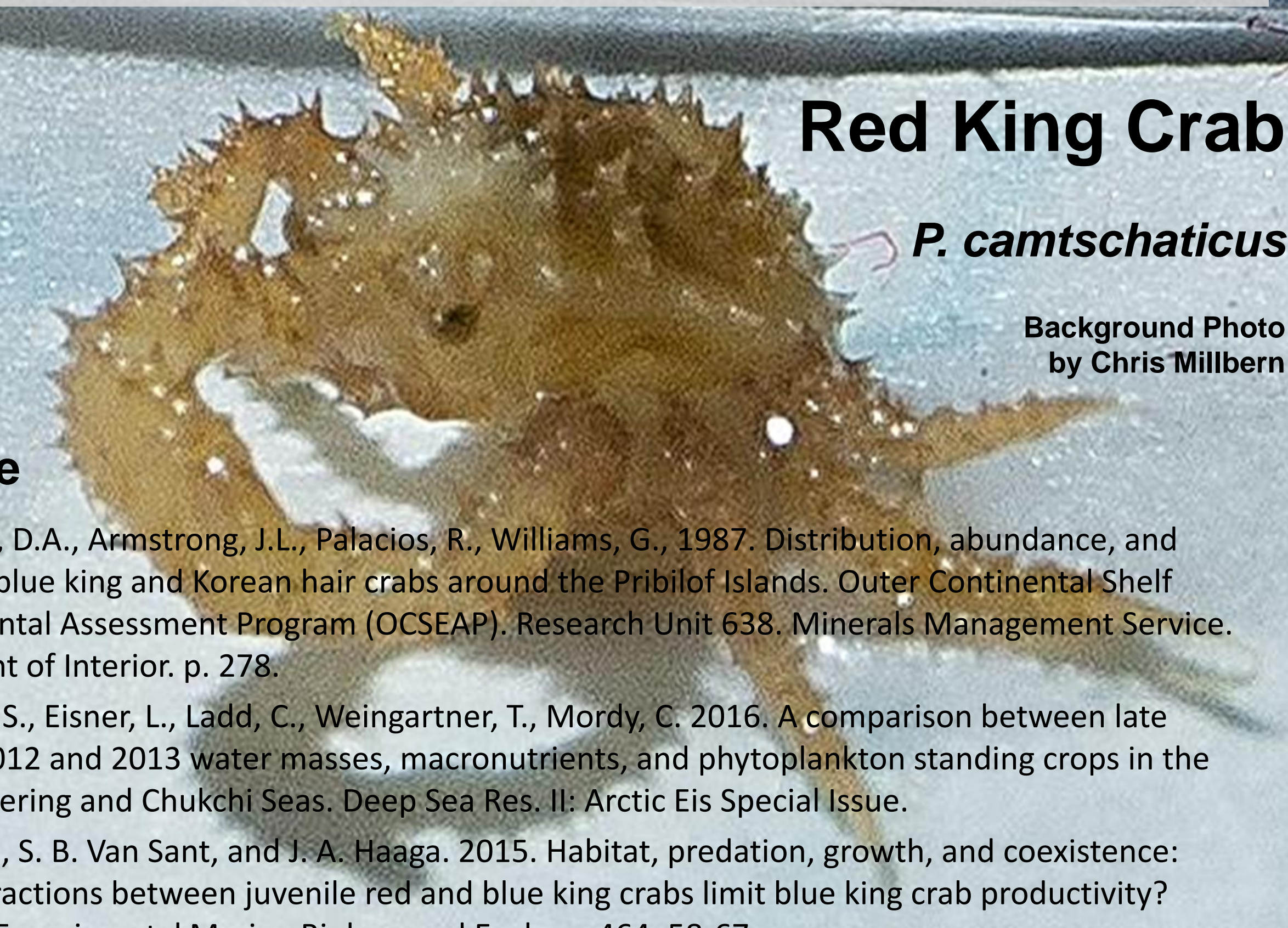
## Acknowledgements

Pribilof Island juvenile studies supported by the 2016 North Pacific Research Board Annual Research Award and the Central Bering Sea Fisherman's Association small grant funds. Bering Sea and Chukchi Sea larval studies supported through the Arctic Ecosystem Integrated Survey (Arctic Eis). Funds provided by qualified outer continental shelf oil and gas revenues by the Coastal Impact Assistance Program, US Fish and Wildlife Service (USFWS), Number F12AF00188 and by the U.S. Department of Interior, Bureau of Ocean Energy Management (BOEM), Environmental Studies Program, Numbers M12AC00009, M12PG00018, and M10PG00050.



Blue King Crab  
*P. platypus*

Photo by W. Chris Long



Red King Crab  
*P. camtschaticus*

Background Photo by Chris Millbern

## Literature

- (1) Armstrong, D.A., Armstrong, J.L., Palacios, R., Williams, G., 1987. Distribution, abundance, and biology of blue king and Korean hair crabs around the Pribilof Islands. Outer Continental Shelf Environmental Assessment Program (OCSEAP). Research Unit 638. Minerals Management Service. Department of Interior. p. 278.
- (2) Danielson, S., Eisner, L., Ladd, C., Weingartner, T., Mordy, C. 2016. A comparison between late summer 2012 and 2013 water masses, macronutrients, and phytoplankton standing crops in the northern Bering and Chukchi Seas. Deep Sea Res. II: Arctic Eis Special Issue.
- (3) Long, W. C., S. B. Van Sant, and J. A. Haaga. 2015. Habitat, predation, growth, and coexistence: Could interactions between juvenile red and blue king crabs limit blue king crab productivity? Journal of Experimental Marine Biology and Ecology. 464: 58-67.



## **WSN Meeting – Monterey, CA - November 10-13, 2016**

### **Title:**

EARLY LIFE HISTORY OF CRABS IN PRIBILOF ISLANDS NEARSHORE HABITAT AND POTENTIAL FOR REBUILDING OF ALASKAN BLUE KING CRAB

### **Authors:**

Jared Weems, UAF-CFOS  
Ginny L. Eckert, UAF-CFOS  
Franz J. Mueter, UAF-CFOS  
Chris Long, NOAA-AFSC

### **Abstract:**

Pribilof Islands blue king crab (*Paralithodes platypus*) is the only federally-managed overfished commercial fishery stock in the North Pacific, and recruitment limitation could be a contributing factor to failed rebuilding efforts. This project will explore blue king crab early life history and assess potential bottlenecks in pelagic larval and early benthic phases. We will investigate the nearshore environment near the Pribilof Islands in the Bering Sea to quantify settlement and survival through early benthic stages. We will quantify availability of crab habitat and predation pressure from local groundfish. Preliminary 2016 results from habitat and bottom community assessments and settlement collectors will inform future methodology and site selection in 2017 and 2018. Additionally, pelagic larval crab distribution and abundance from the Pribilof Islands to the Chukchi Sea shelf break (57°-73°N latitude) will be quantified with plankton tows over the period from 2012-2019. Larval *P. platypus* CPUE abundance will be combined with corresponding oceanographic data and ROMS models to infer retention of larvae around the Pribilof Islands and northward flowing advection processes. This multifaceted approach will address the mechanisms controlling the abundance and survival of young-of-year blue king crabs and evaluate whether lack of juvenile recruitment is occurring and limiting recovery of the Pribilof Islands stock.