

The background of the slide is a close-up photograph of several snow crabs (Chionoecetes opilio) resting on a bed of crushed ice. The crabs are brownish-orange, and the ice is white and translucent. The image is slightly faded to allow the text to be clearly visible.

Forecasting the effects of climate change on Alaskan snow crab (*Chionoecetes opilio*)

Christine C. Stawitz^{1,2}, William T. Stockhausen¹, Cody S. Szuwalski¹,
Robert J. Foy¹, Andre E. Punt²

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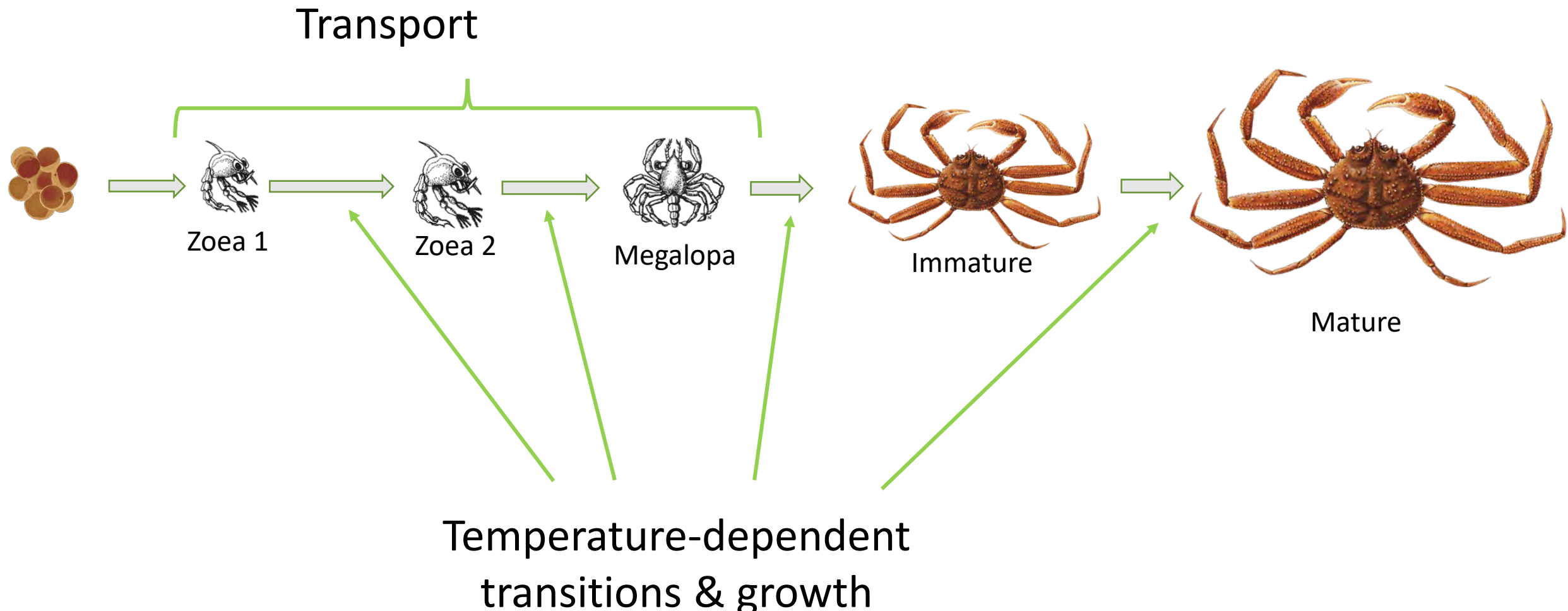
**The importance of integrating spatial
variability & physiology**



Snow crab are valuable
and threatened



How does climate change affect snow crab?



Crab life stages have unique thermal preference

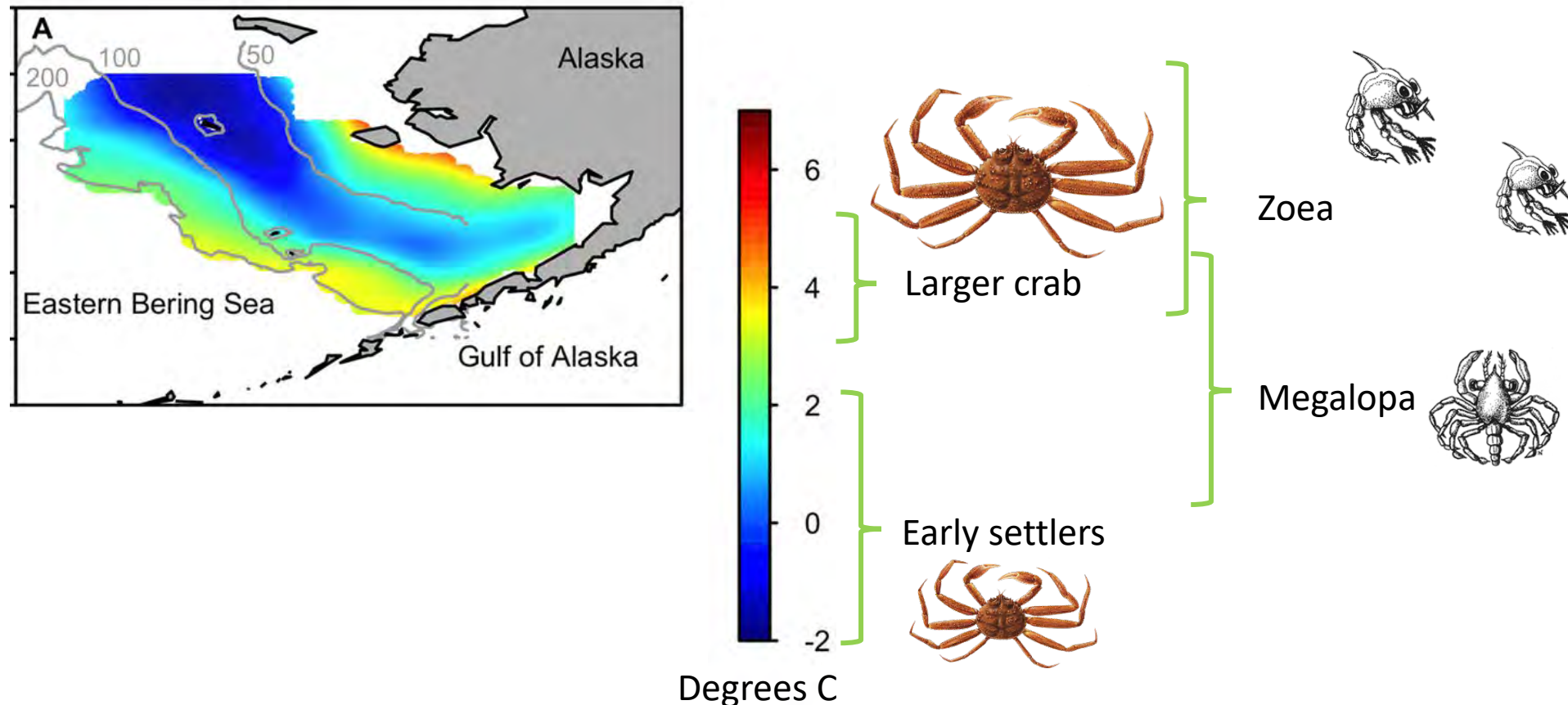
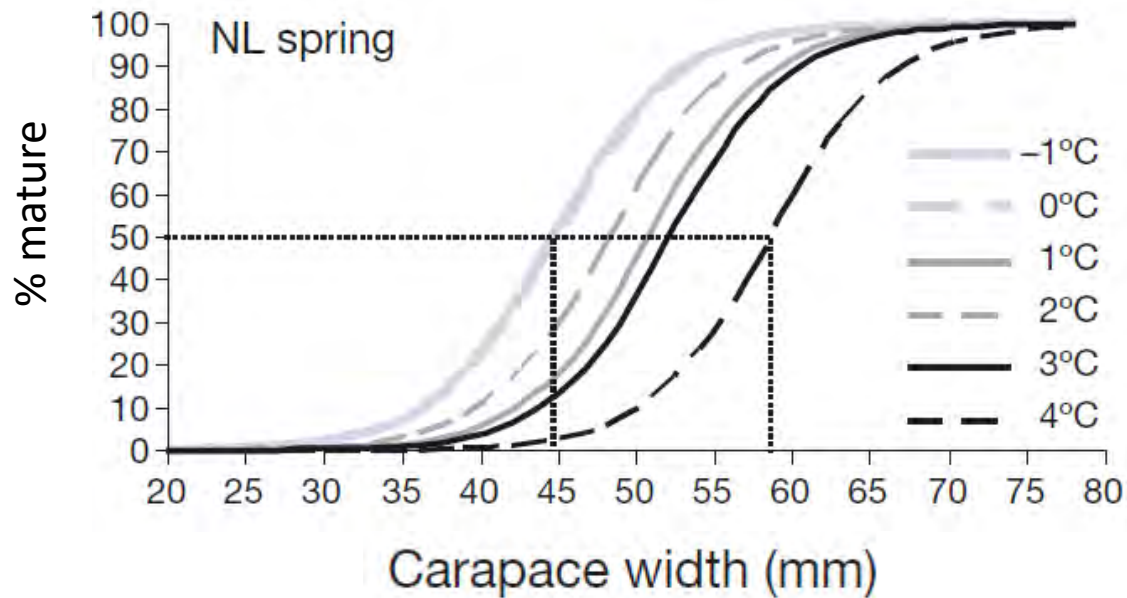


Figure: Hunsicker et al. 2013
Allard et al. (2018), Dionne et al. (2003)

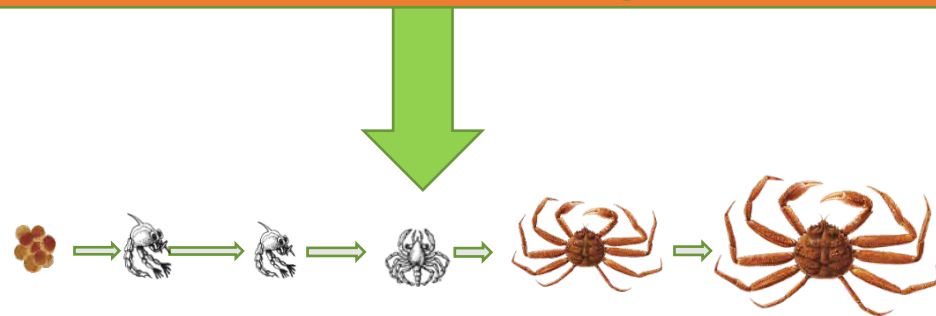
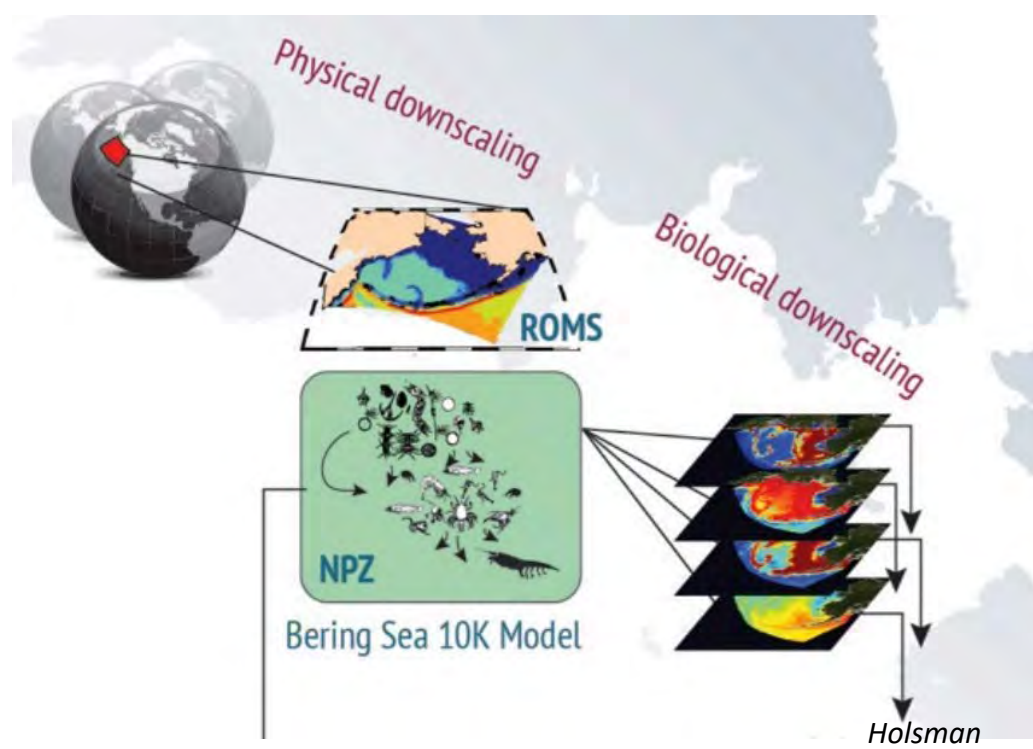
Molt timing is temperature dependent

- Juvenile molt timing speeds up with warming (Yamamoto et al. 2015)
- Crab in warmer water are bigger at maturity (Burmeister & Sainte-Marie 2010, Ernst et al. 2005)



Dawe et al 2012



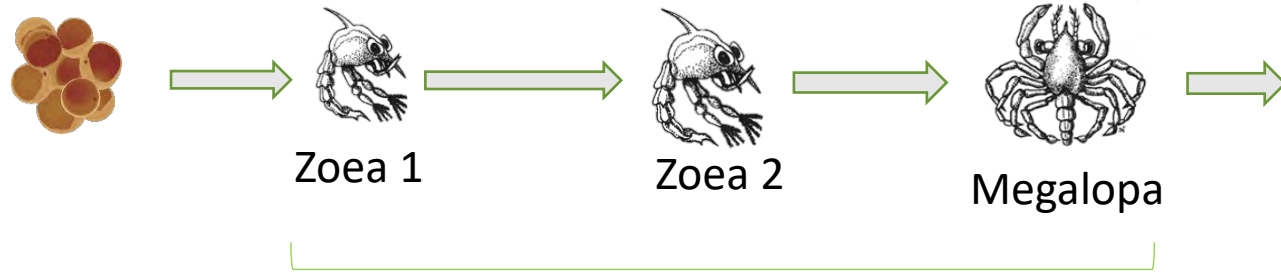


Life history model

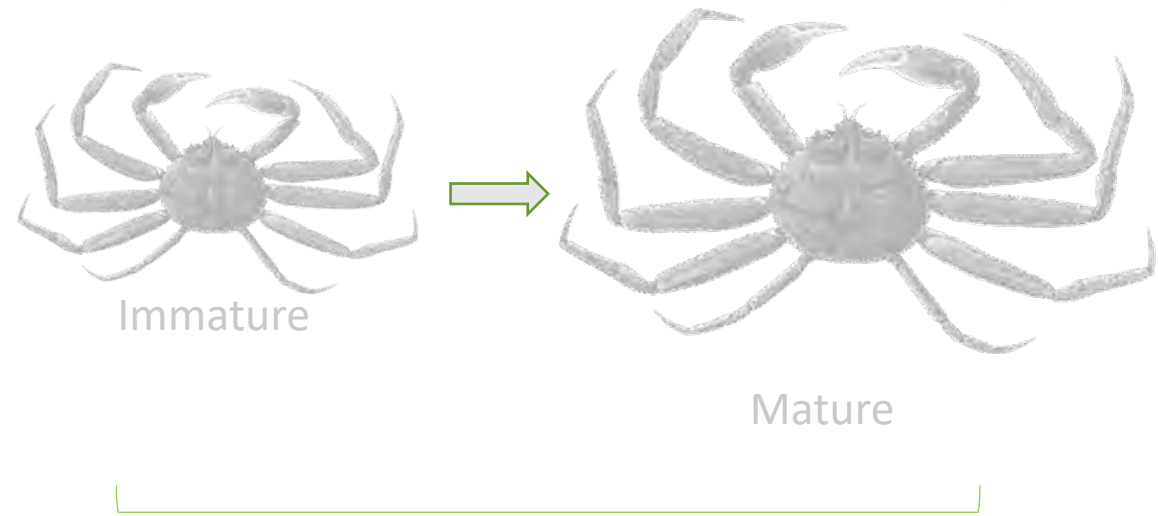


Temperature
effects

Larval stage

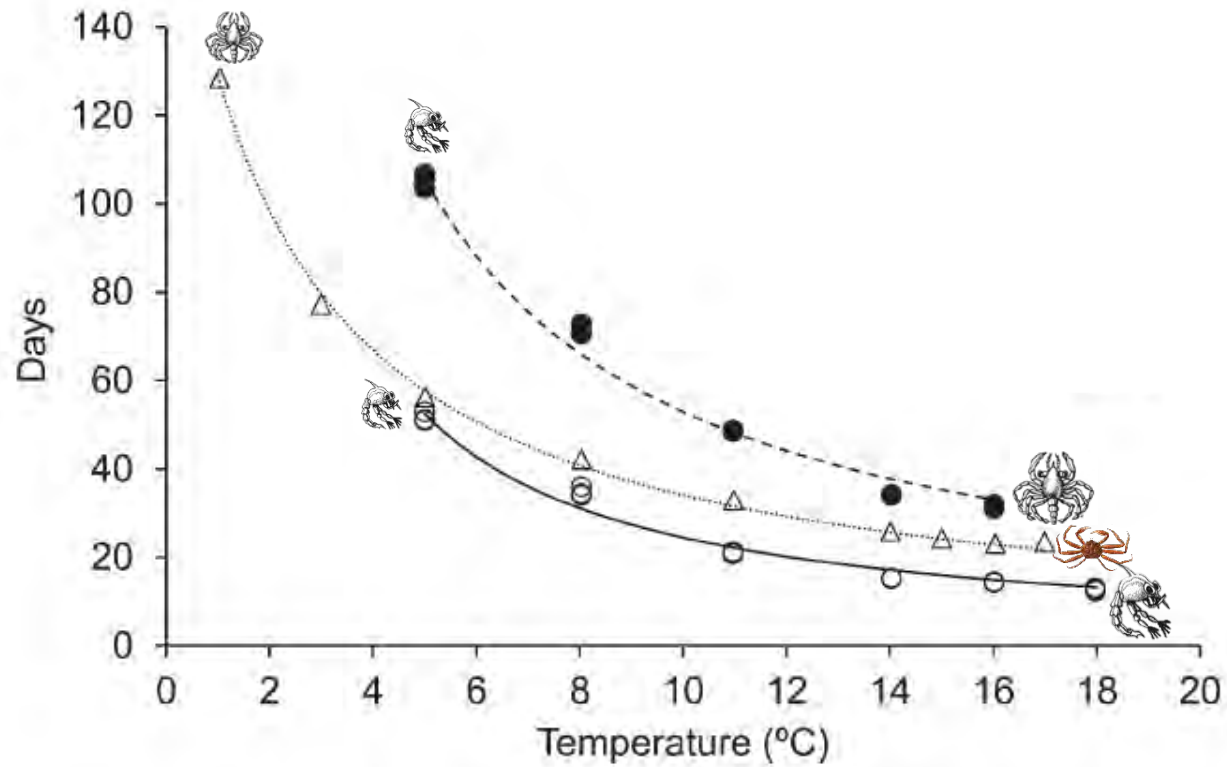


Transitions are
temperature
dependent



Bioenergetics

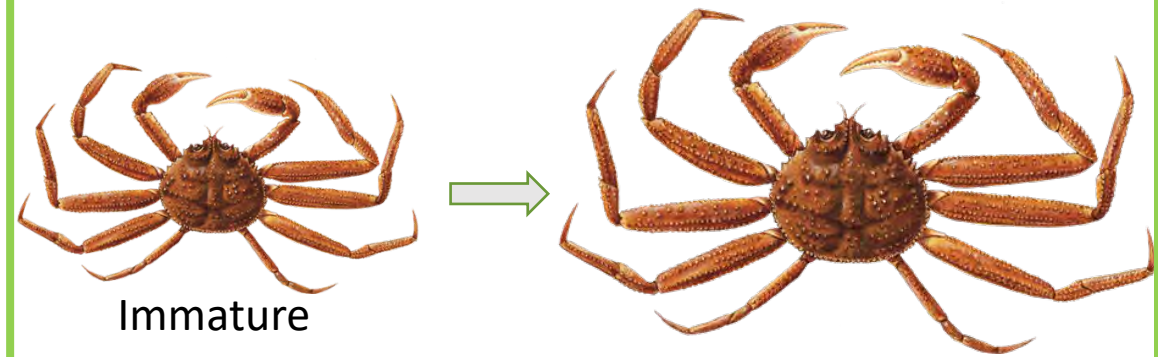
Faster molts as temperature increases



Yamamoto et al. 2014



Transitions are
temperature
dependent



Mature

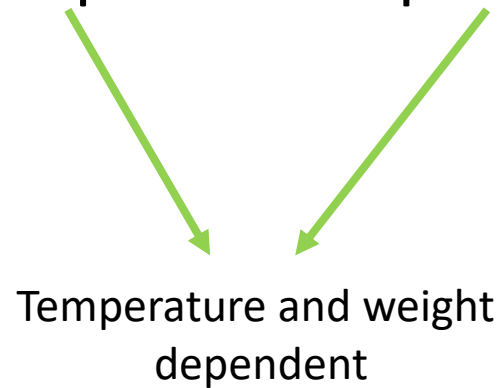
Bioenergetics

Growth

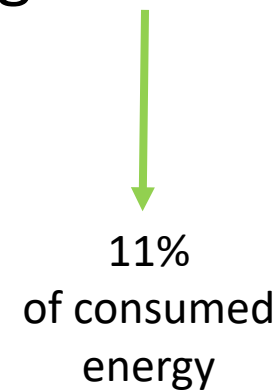
Bioenergetics model

growth = consumed energy – energy costs

= consumption – respiration – egestion – exuviae – excretion



Temperature and weight dependent

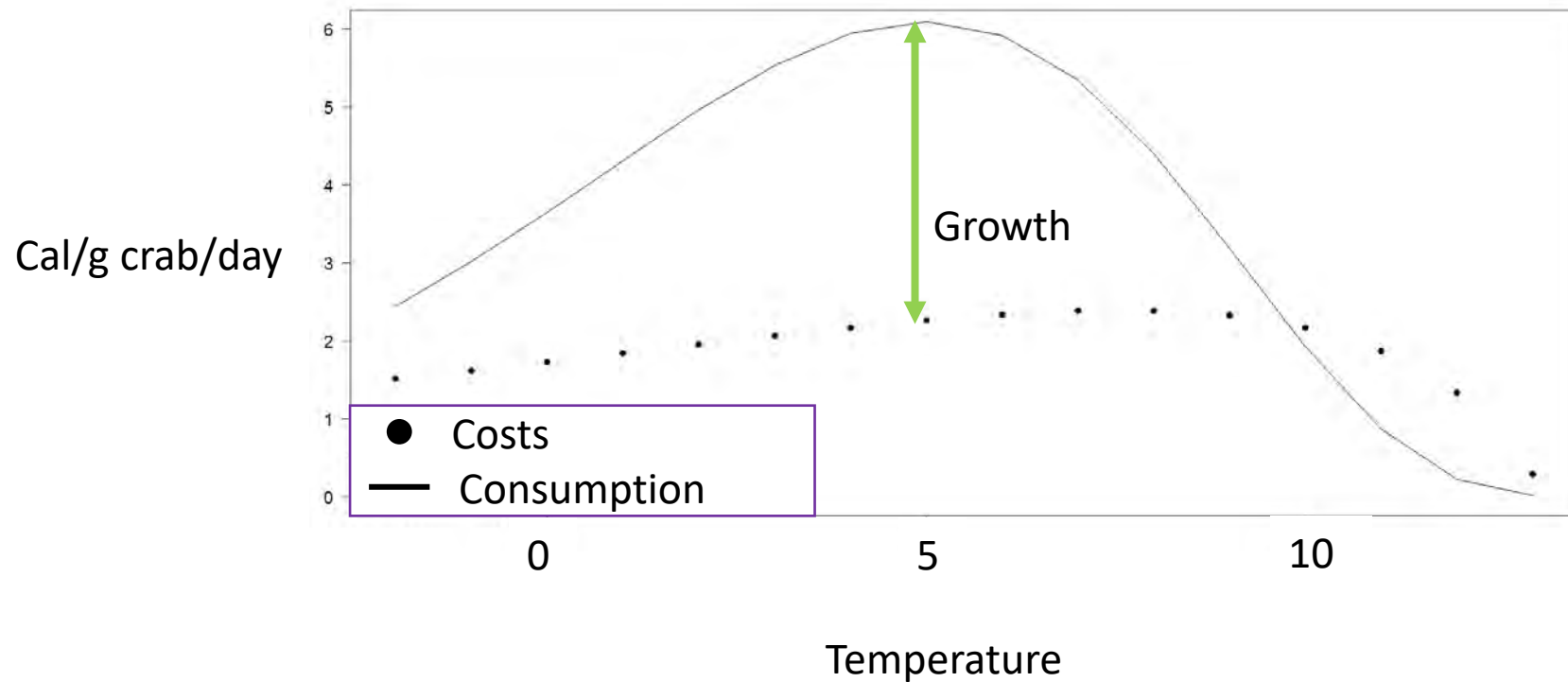


11%
of consumed
energy



Weight dependent

Thermal scope for growth is limited



Consumption maximized 5 degrees, while respiration maximized ~8 degrees

Preliminary results

Settlement timing

Growth

Time of settlement



Previous studies



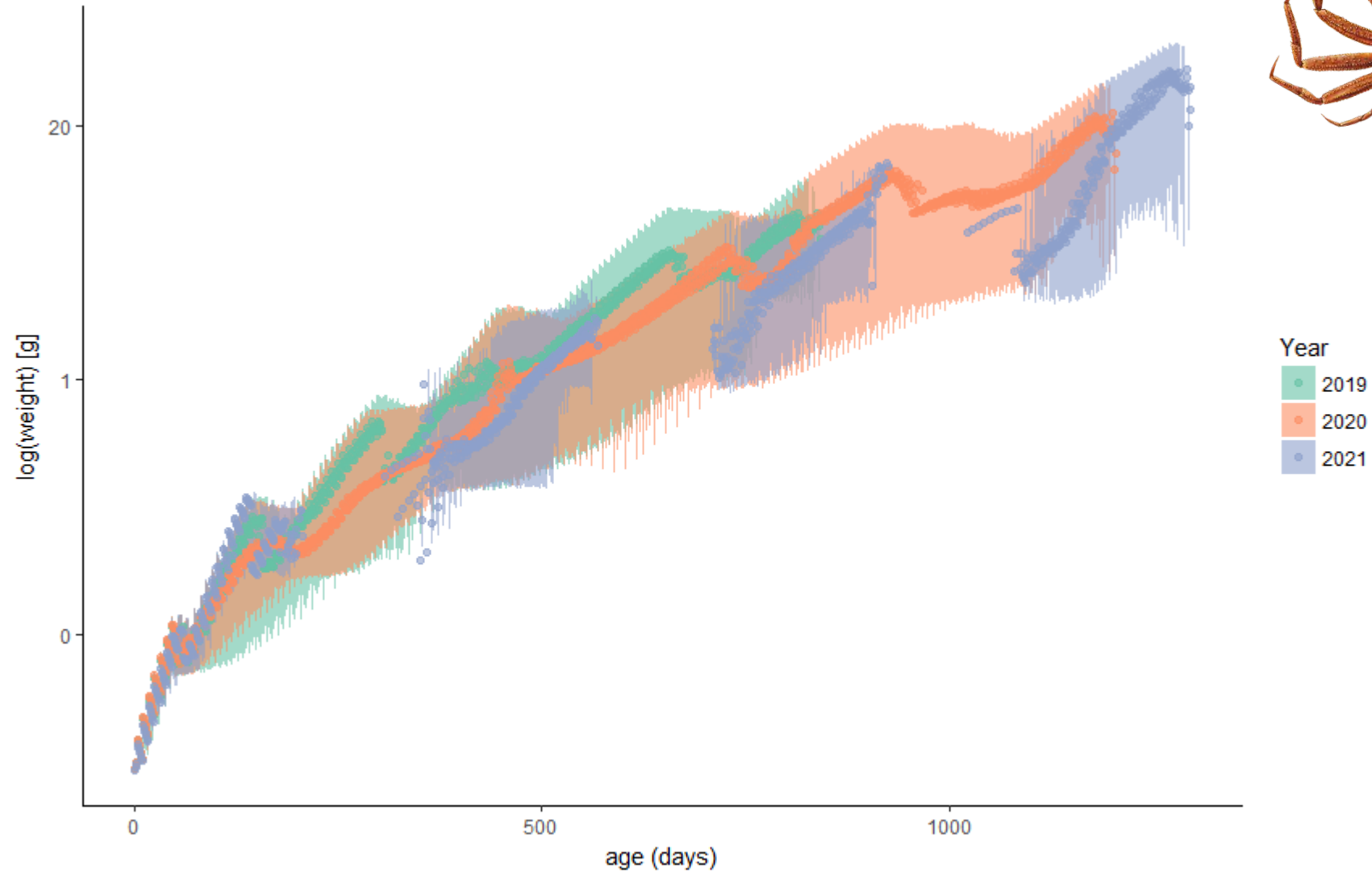
Oct

March

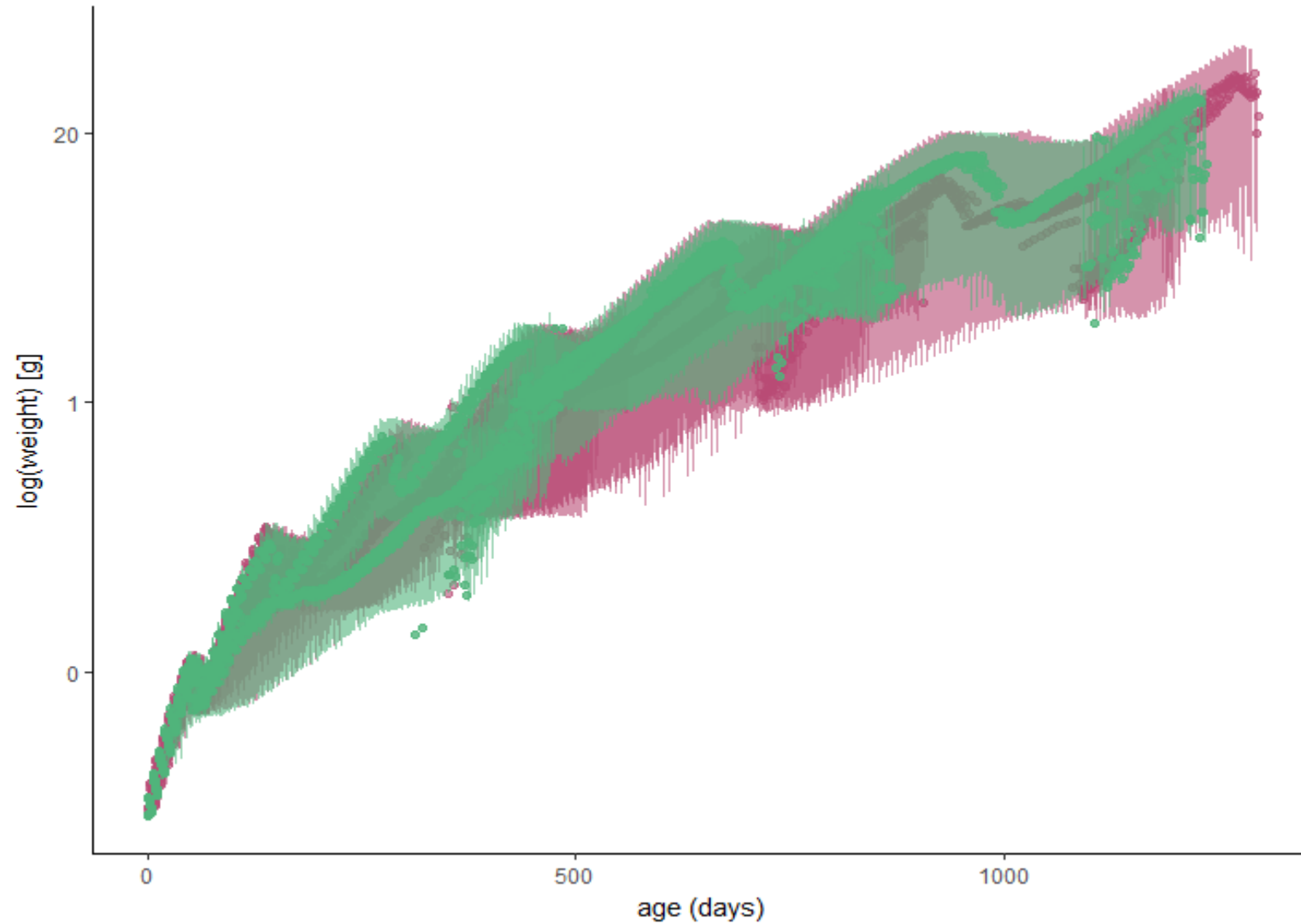
Aug

Settlement month

Growth under RCP 8.5



Growth between climate scenarios



Climate scenario

- RCP4.5
- RCP8.5

Challenges

- When to stop?
- Disentangling effects of different processes

Takeaways

- Movement could mediate temperature effects
- IBMs complement statistical approaches

Future work

- Incorporating pH
- Overlap of males and females

Questions?

Thanks to:

National Marine Fisheries Service Magnuson-Stevens Act

Kirstin Holsman

Anne Hollowed



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the Atmosphere and Ocean



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