



Modeling Wild Crab Responses to OA and Warming

Esther Kennedy



Esther Kennedy

- PhD student at UC Davis in Tessa Hill's Ocean Climate Lab.
- Currently research:
 - OA impacts on Bering Sea king crab
 - Coastal OA in California
- Previously spent 5 years as an environmental scientist for the Sitka Tribe of Alaska.

I currently live and work on Dena'ina and Patwin lands. I acknowledge and honor their stewardship.





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Additional Collaborators

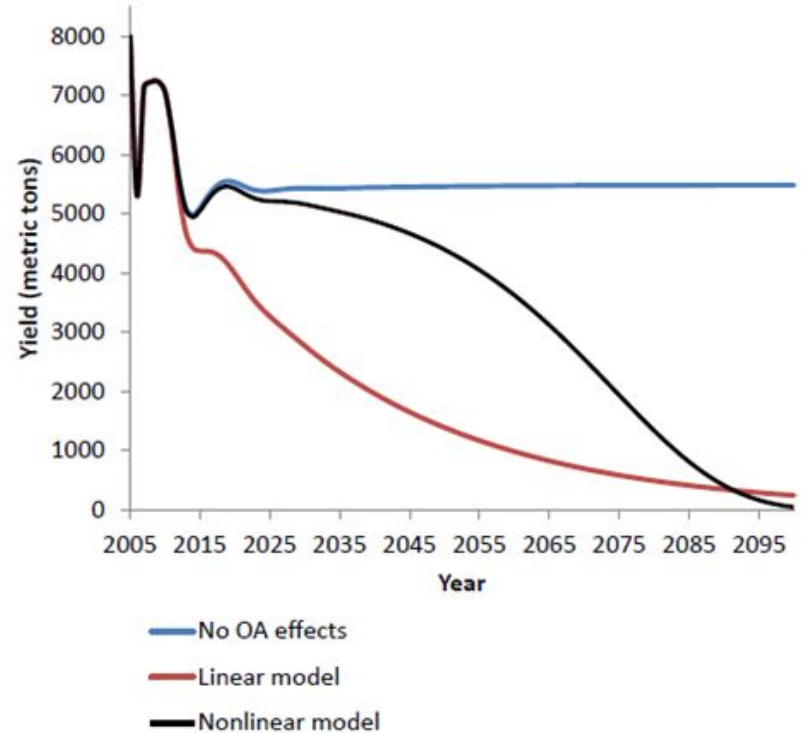
Also, many thanks to Jon Richar, Kalei Shotwell, Chris Long, Cole Monnahan, Al Hermann, Wei Cheng, and especially Jim Thorson for technical help, feedback, and data access.



Motivation

- Large mismatch between the information available from lab studies and the data available from the field.
 - In lab - studies show larval and juvenile crab directly at risk from OA.
 - In field - limited OA measurements and essentially no larval or juvenile crab data.
- Urgent need to understand risks for sustainable fisheries and subsistence harvests.
 - King crab fishery is most valuable fishery in the state.
 - Can't manage for what we can't monitor.

Projected Crab Fishery Yields Under Different OA Scenarios

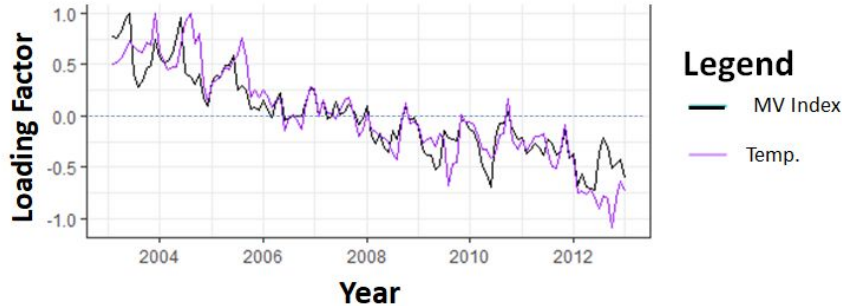


Goal: to develop
a fishery-relevant
indicator of OA
stress in king
crab.

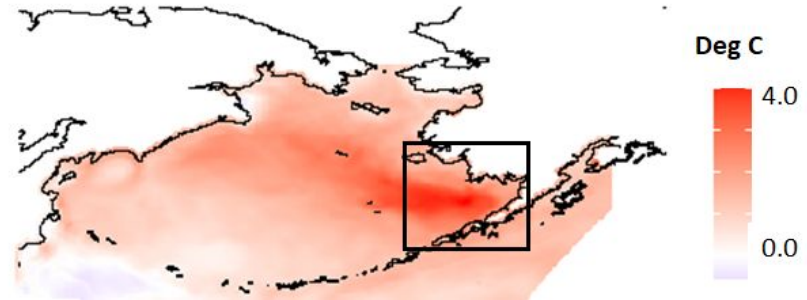


Pilot study results: broad environmental patterns

Temperature and Multivariate OA Environmental Time Series



Primary Surface Temperature Pattern

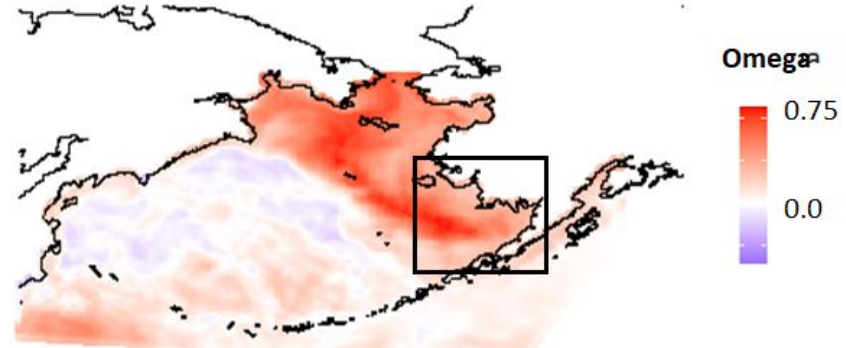


Pilot study period from 2003-2012.

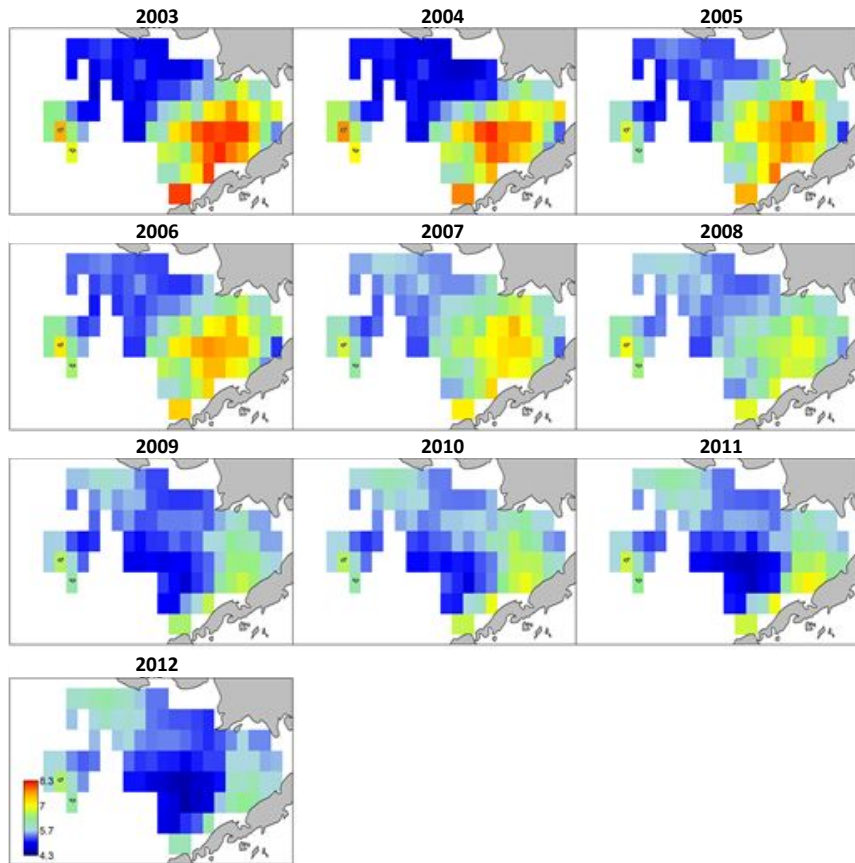
Transition from warm to cool conditions.

Warmer temperatures correspond with more favorable OA conditions on the shelf and in Bristol Bay.

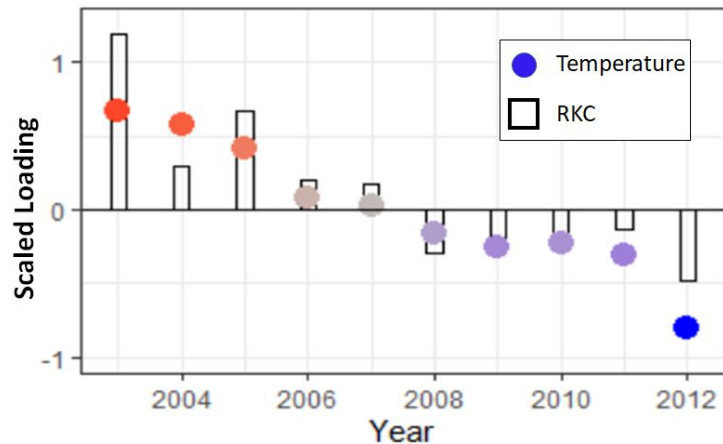
Primary Aragonite Saturation Pattern



Pilot study results: RKC distribution



RKC Index vs Temperature Index



Strong correlation between the RKC distribution and temperature.

- Warm temps → higher RKC densities in central Bristol Bay
- **No separable OA effects**

Future Research



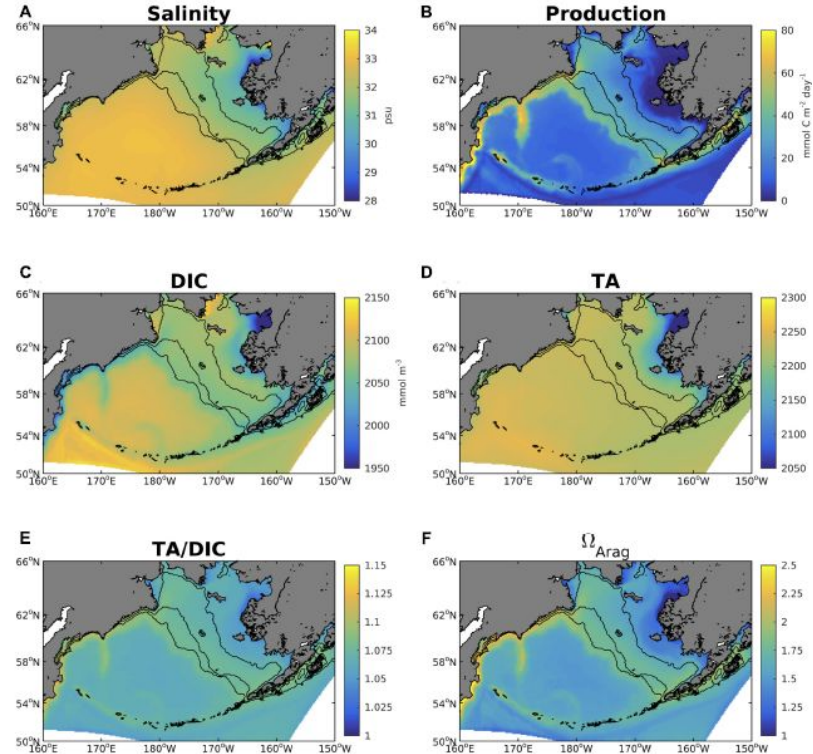
Incorporate more detailed environmental information into RKC models.

- Could include both measured and modeled environmental data.

Extend analysis to other king crab species, female crab, and/or different size classes.

Examine a longer time series.

- OA hindcast will extend from 1970 to 2020.



Pilcher et al., 2019

Conclusions

Large mismatch between lab-available OA information and field-available OA information

- Makes assessing OA impacts to the fishery challenging.

OA hindcast offers new possibilities for fishery indicators.

- King crab models of OA impacts could be improved with more spatial environmental or biological information (e.g. temperature, dissolved oxygen, crab obs.)

OA and climate change are happening together - the effects will be difficult to disentangle.