



# **Ocean Acidification in Alaska: Ecosystems and Economies**

Jessica N. Cross, Ph.D.

National Oceanic and Atmospheric Administration

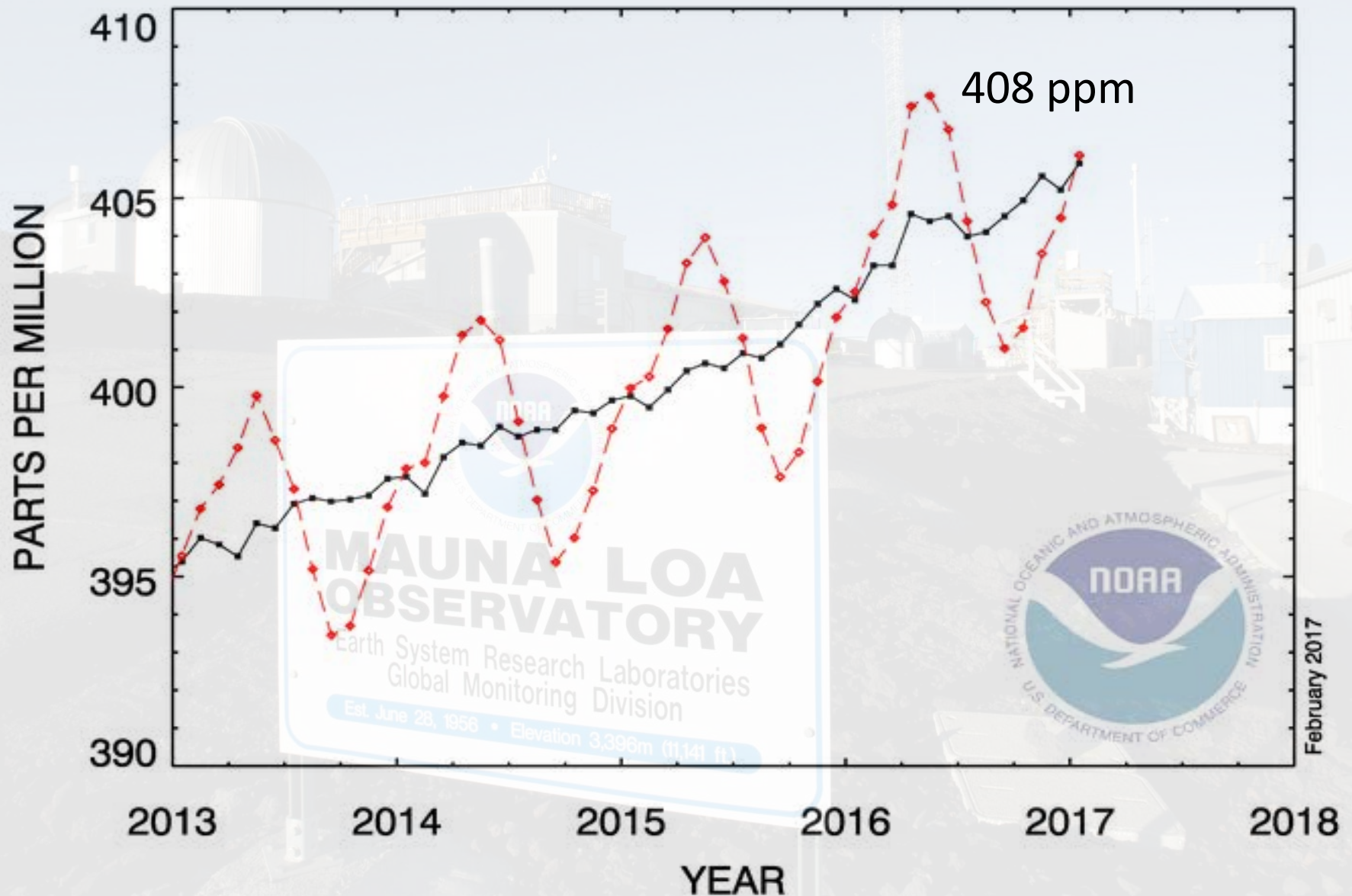
Pacific Marine Environmental Laboratory

[Jessica.Cross@noaa.gov](mailto:Jessica.Cross@noaa.gov)

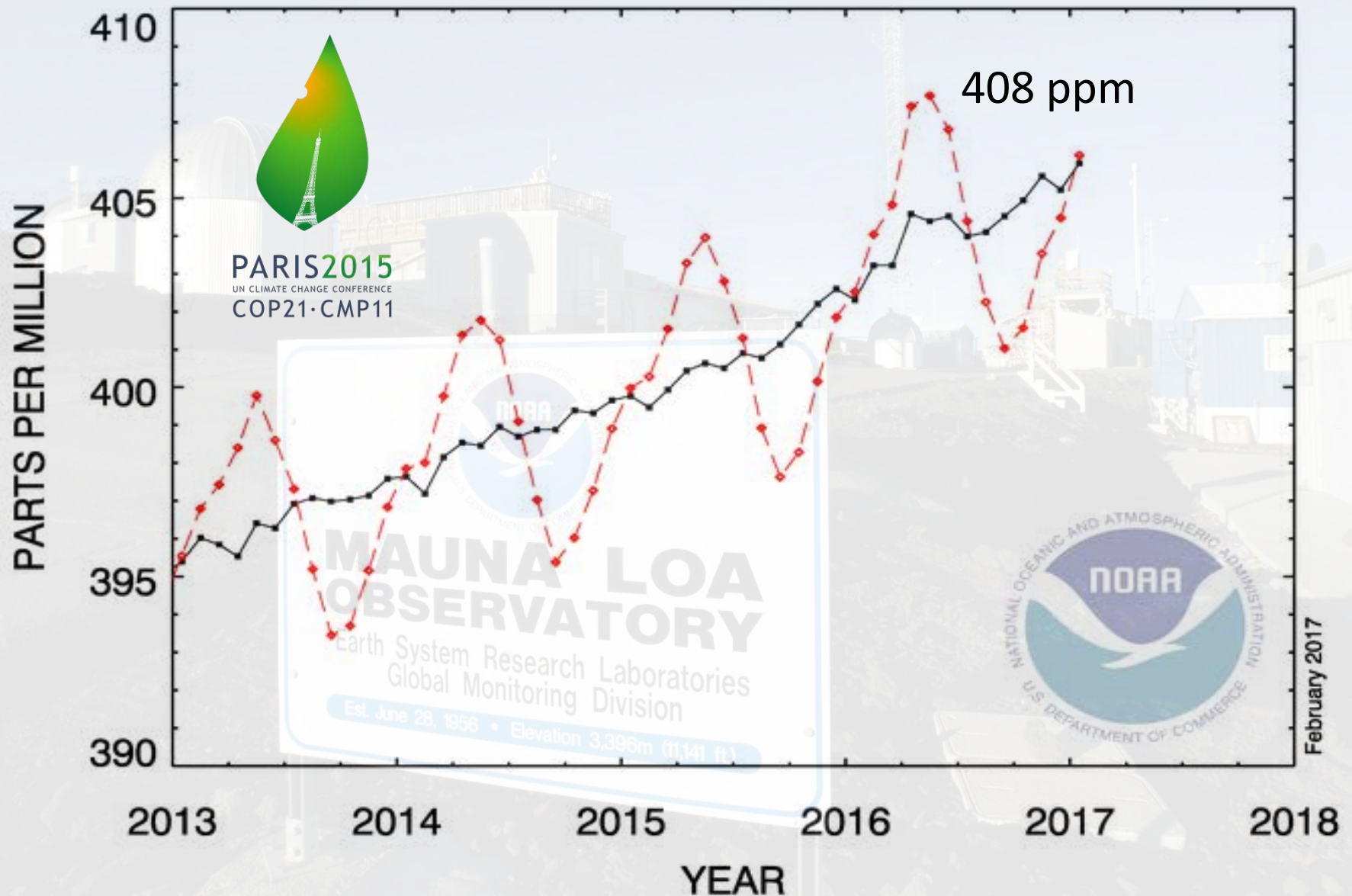


Alaska State Legislature  
House Resources Committee  
February 2017

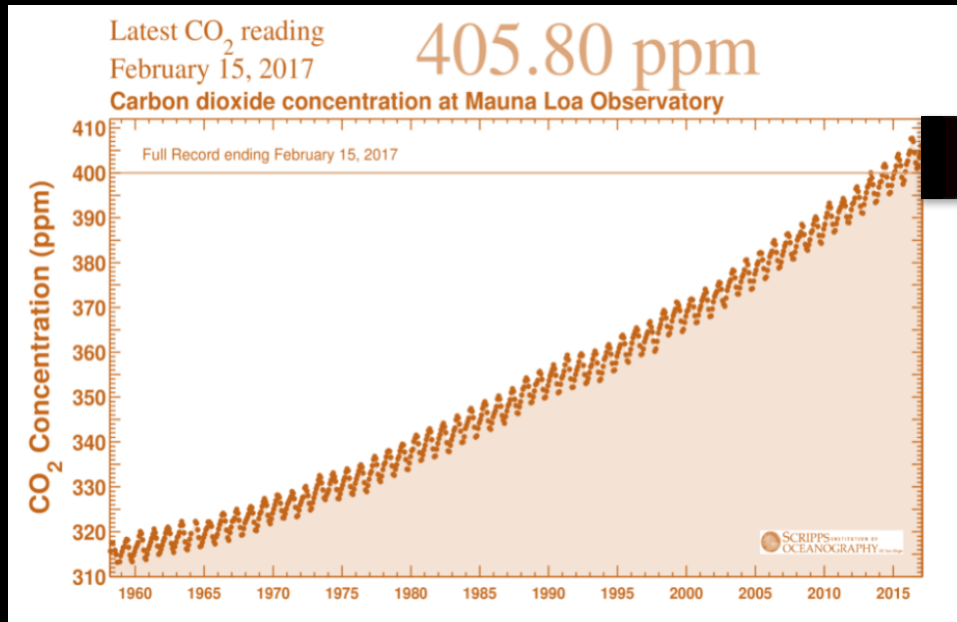
# Global CO<sub>2</sub> Levels Continue to Rise



# Global CO<sub>2</sub> Levels Continue to Rise







**22 TONS EVERY DAY**

**1/3** OF ALL CO<sub>2</sub> RELEASED IS  
ABSORBED BY THE OCEAN.

ALASKAN  
COASTAL  
WATERS ARE  
**NATURALLY**  
HIGH IN CO<sub>2</sub>

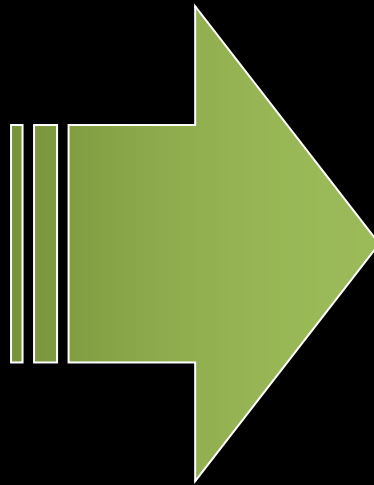
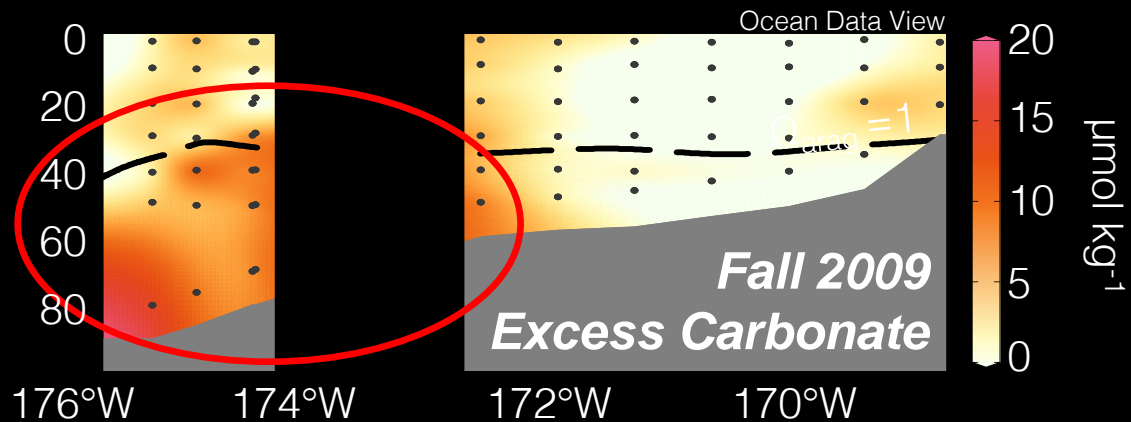


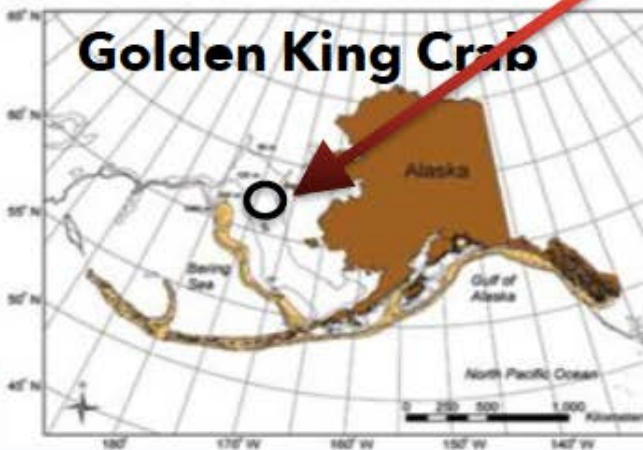
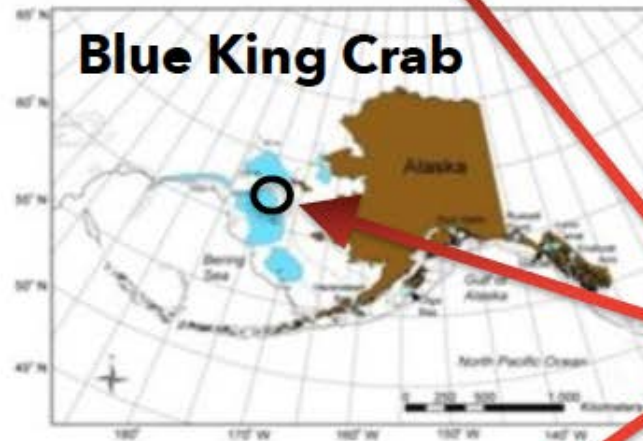
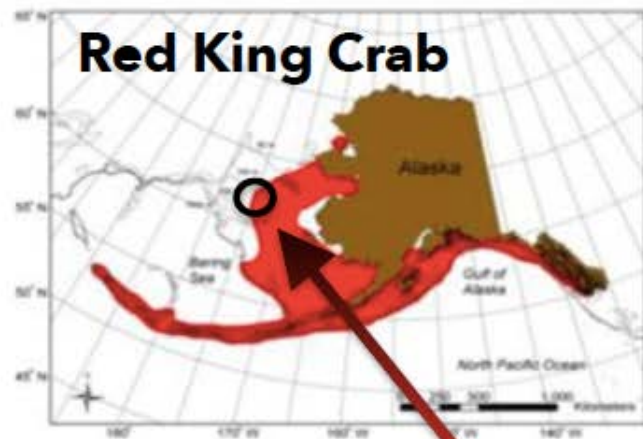
Photo: Lou Dematteis



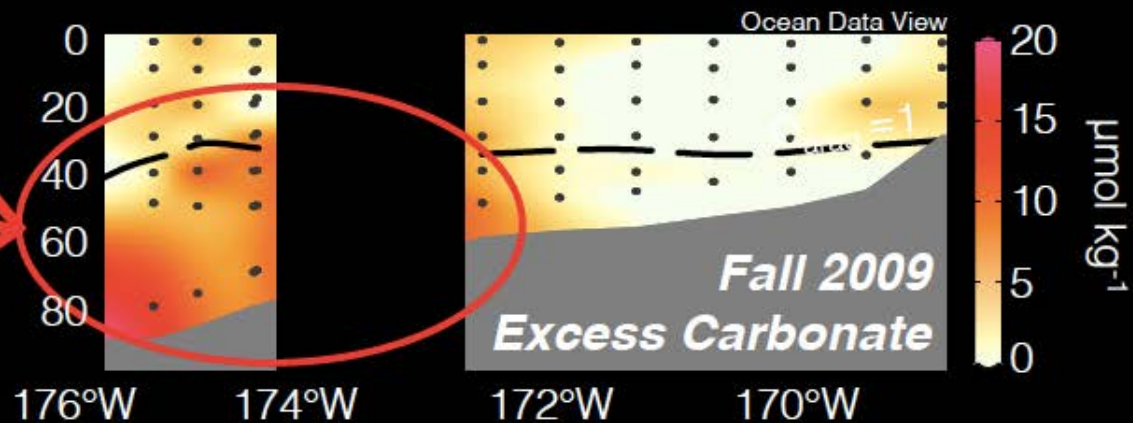


Ocean Acidification is **already** causing carbonate minerals to dissolve in the Bering Sea.





Ocean Acidification is **already** causing carbonate minerals to dissolve in the Bering Sea.



Population Distributions Courtesy R. Foy  
National Marine Fisheries Service  
Alaska Fisheries Science Center

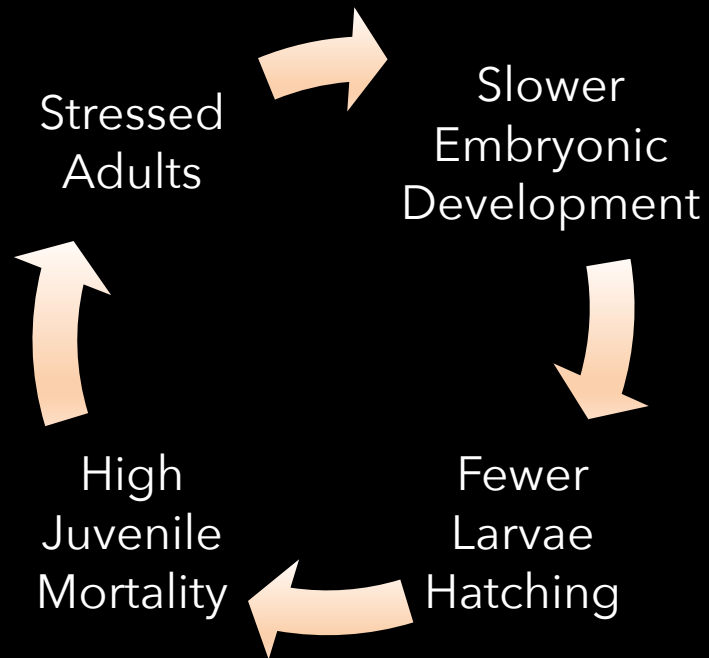
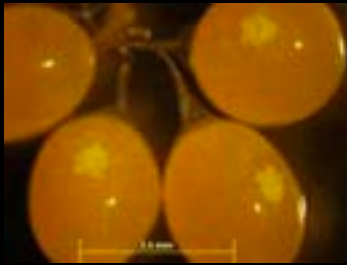


# **Ocean Acidification could threaten Alaskan fishing and food security.**

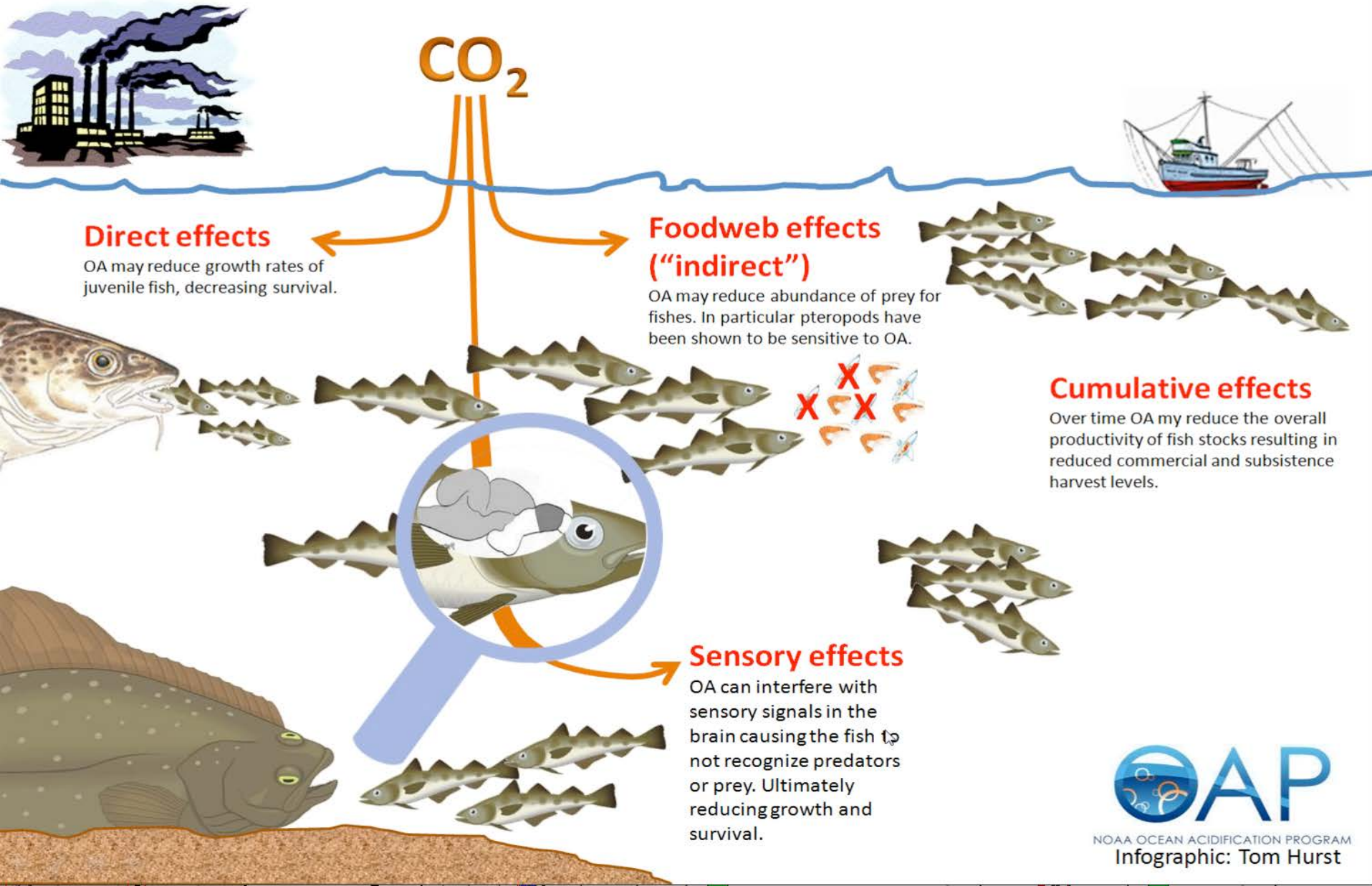




# Ocean Acidification Impacts Shellfish...



# Ocean Acidification Impacts Fish...



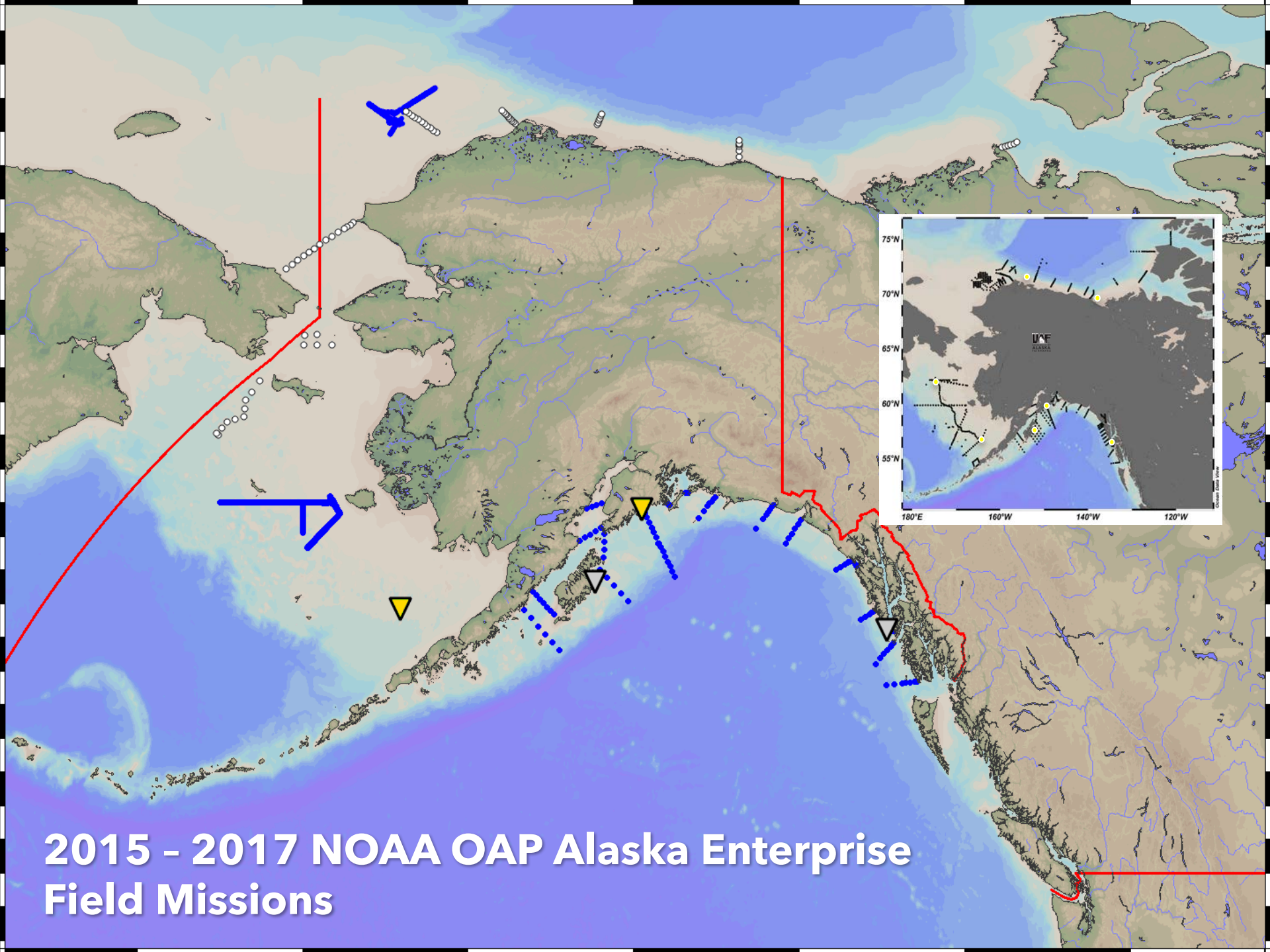
# **...and Ocean Acidification impacts food sources**



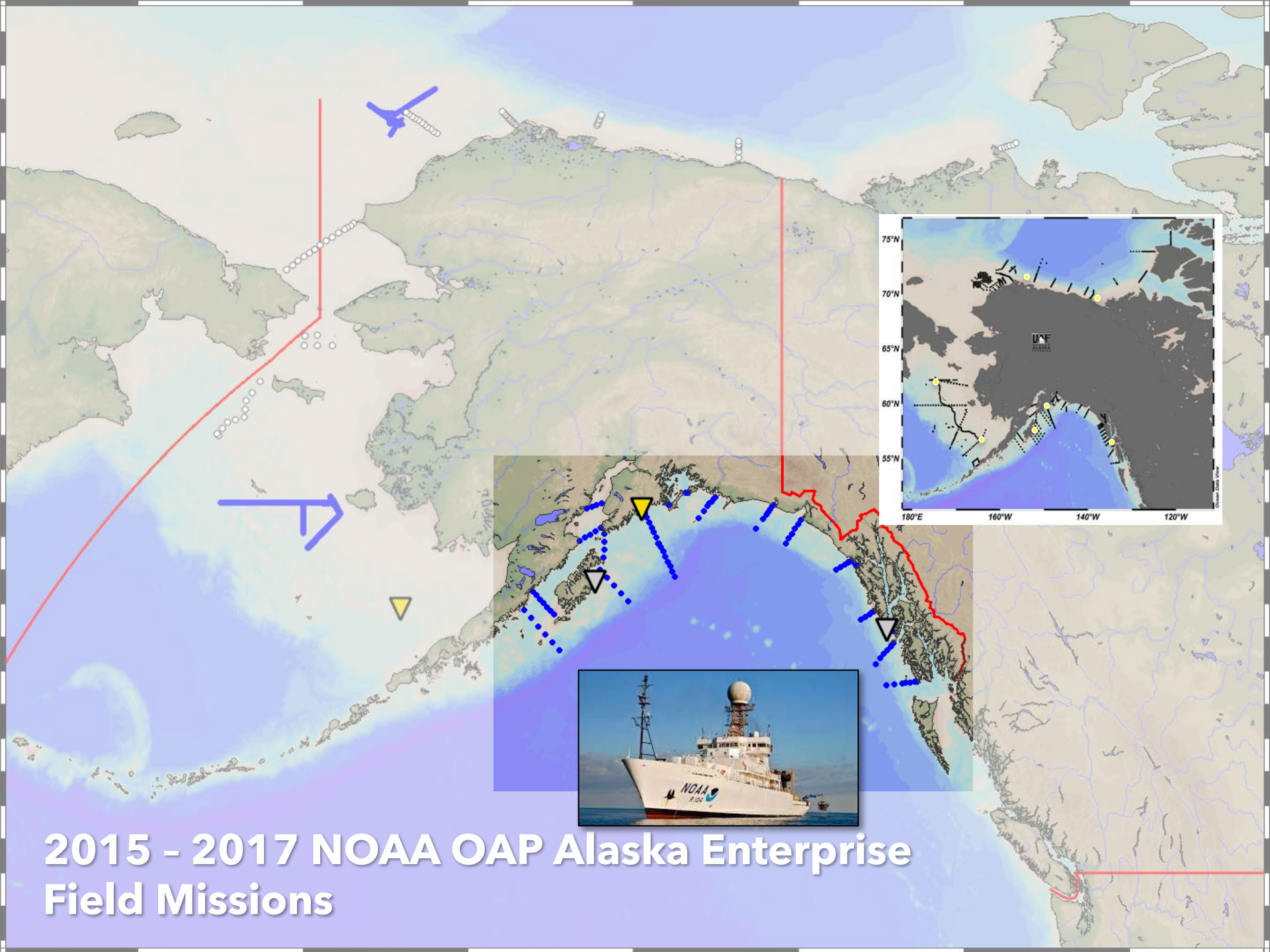
## **Pteropods: The OA Poster Child**

- **Low pH disrupts shell building**
- **In-situ dissolution already observed**
- **Important food web resource**



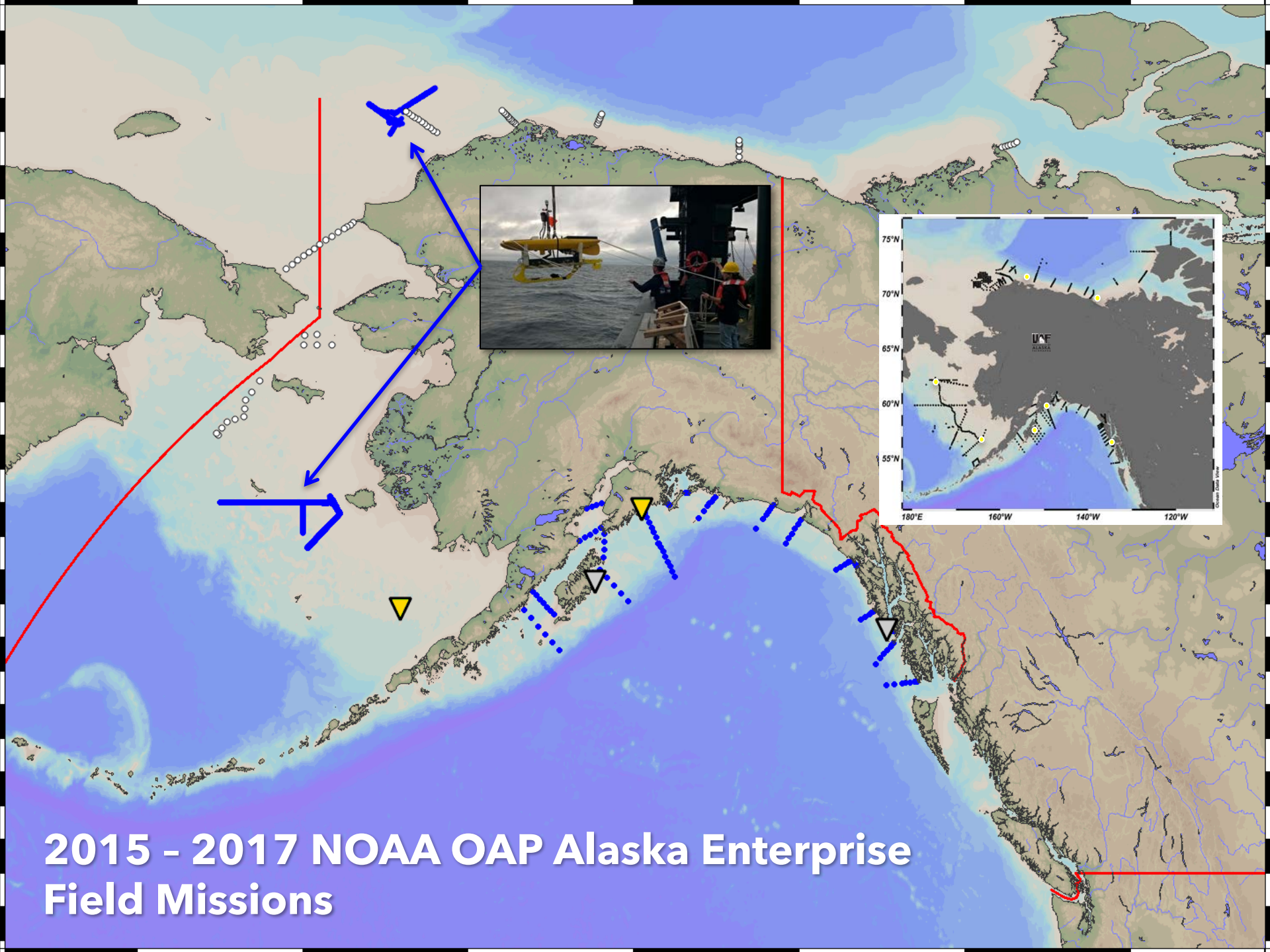


**2015 - 2017 NOAA OAP Alaska Enterprise  
Field Missions**



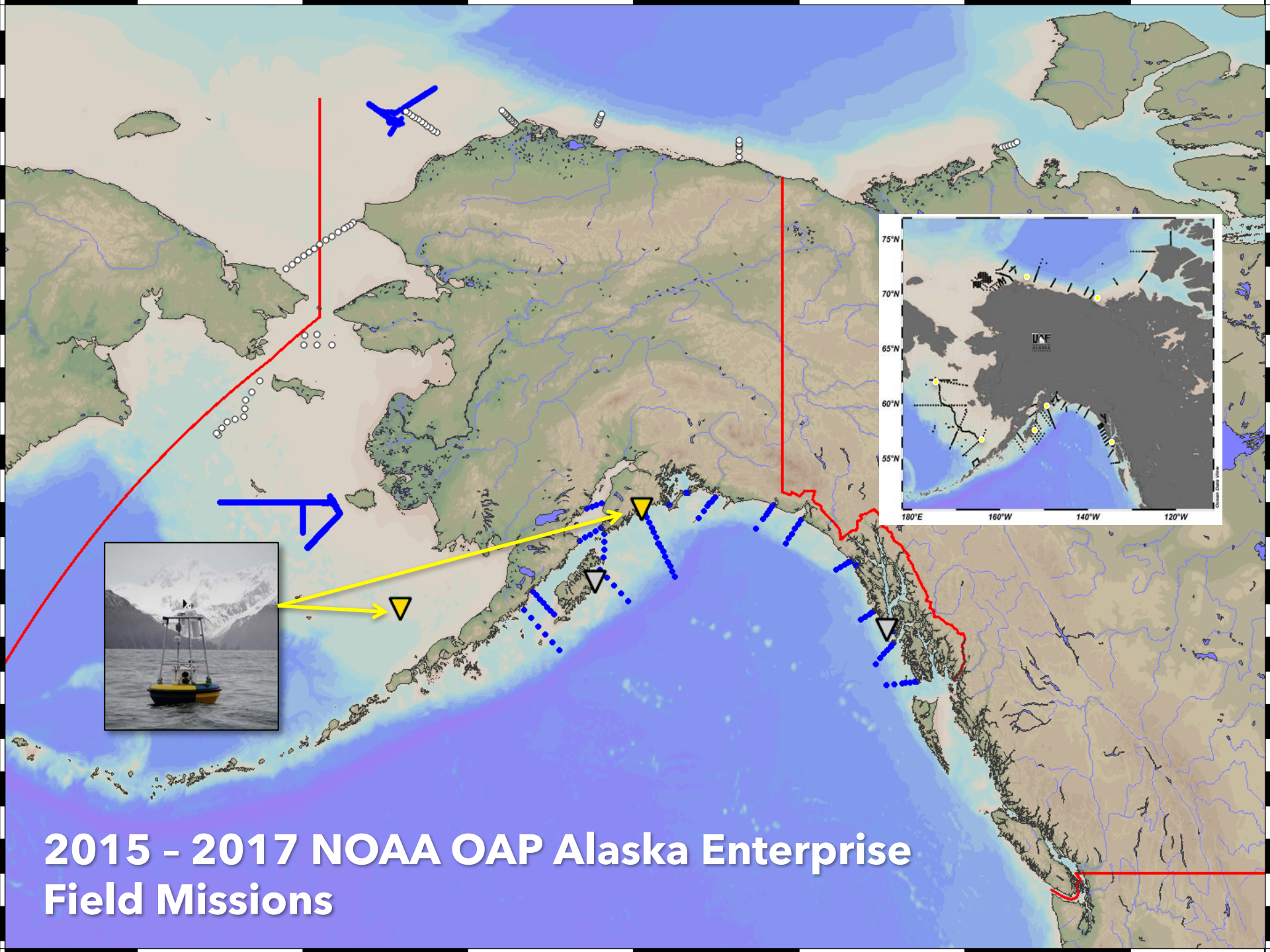
**2015 - 2017 NOAA OAP Alaska Enterprise  
Field Missions**





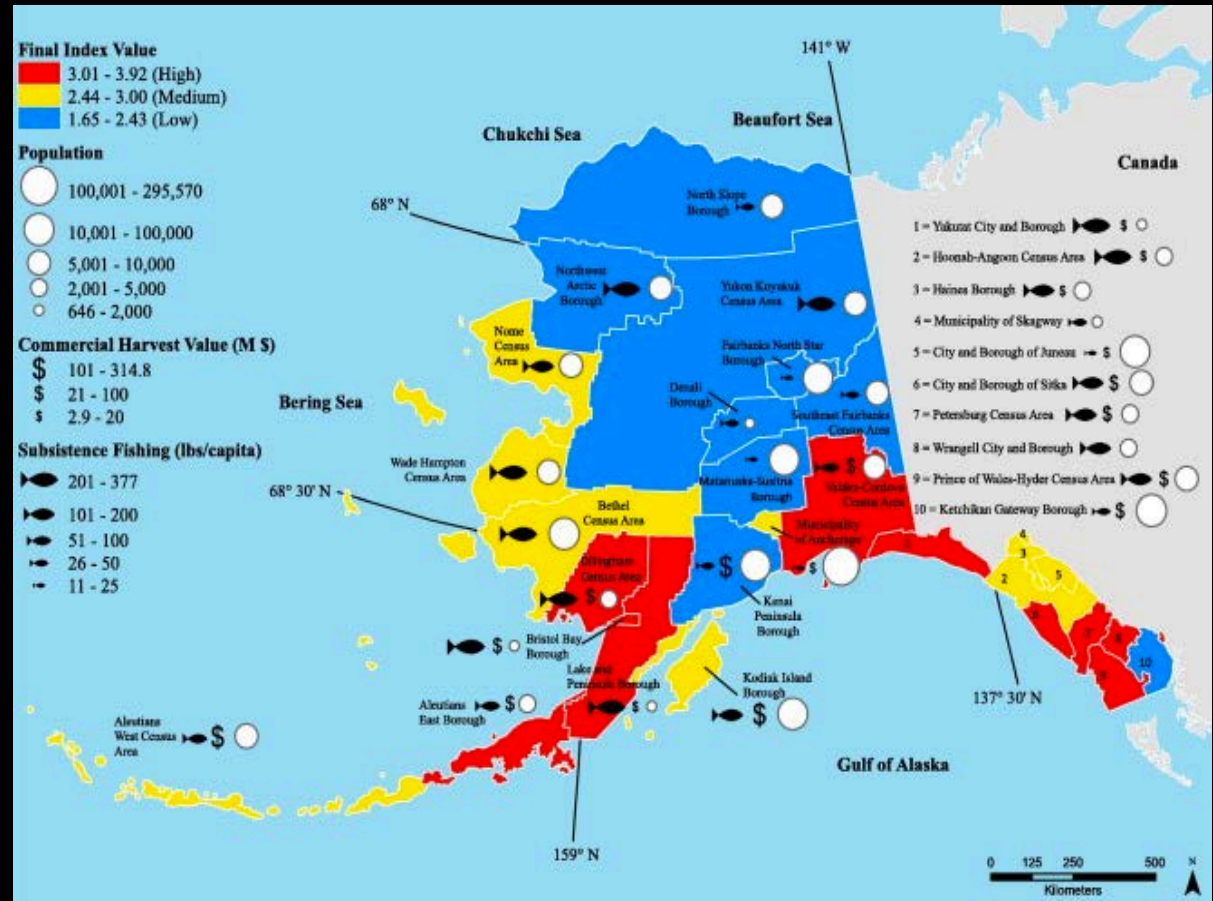
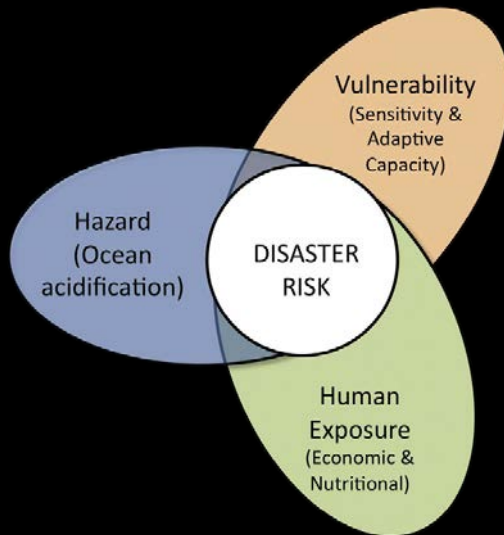
**2015 - 2017 NOAA OAP Alaska Enterprise  
Field Missions**





# 2015 - 2017 NOAA OAP Alaska Enterprise Field Missions

# Ocean Acidification Risk Assessment Alaska Fishery Sector



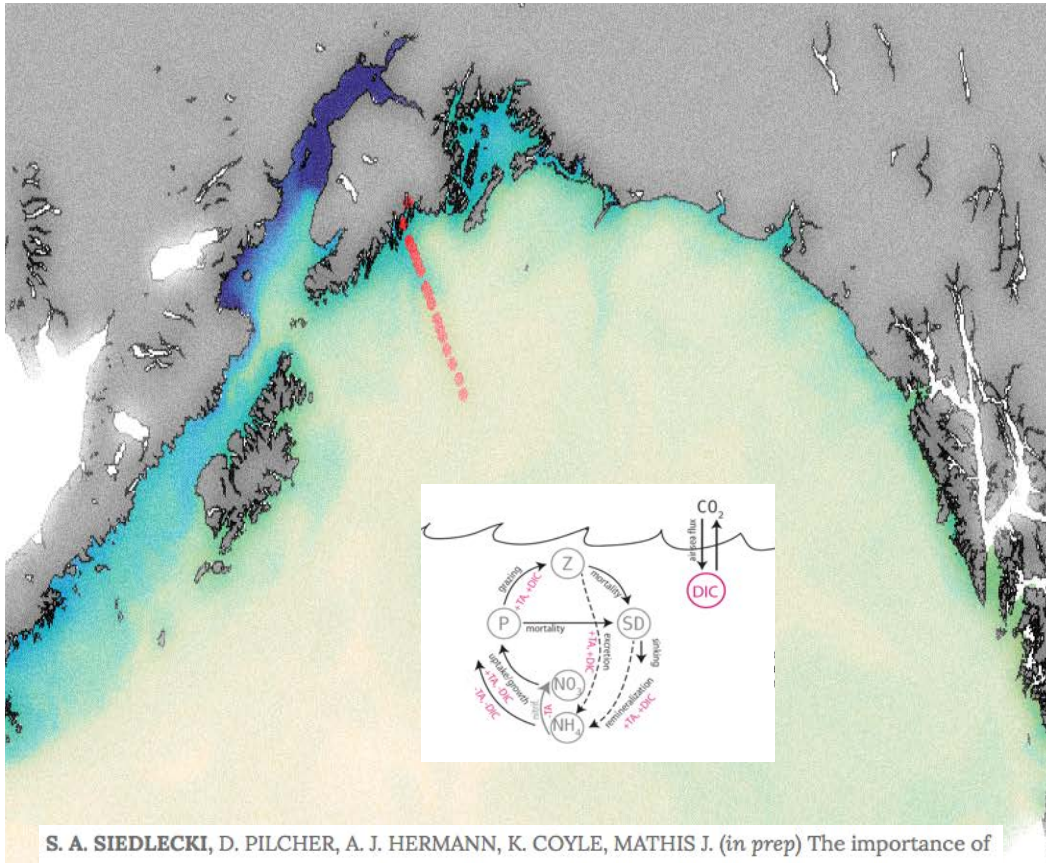
Ocean acidification risk assessment for Alaska's fishery sector

J.T. Mathis<sup>a,b,\*</sup>, S.R. Cooley<sup>c,1,2</sup>, N. Lucey<sup>d</sup>, S. Colt<sup>e</sup>, J. Ekstrom<sup>f</sup>, T. Hurst<sup>g,h</sup>, C. Hauri<sup>i</sup>, W. Evans<sup>a,b</sup>, J.N. Cross<sup>a,b</sup>, R.A. Feely<sup>a</sup>

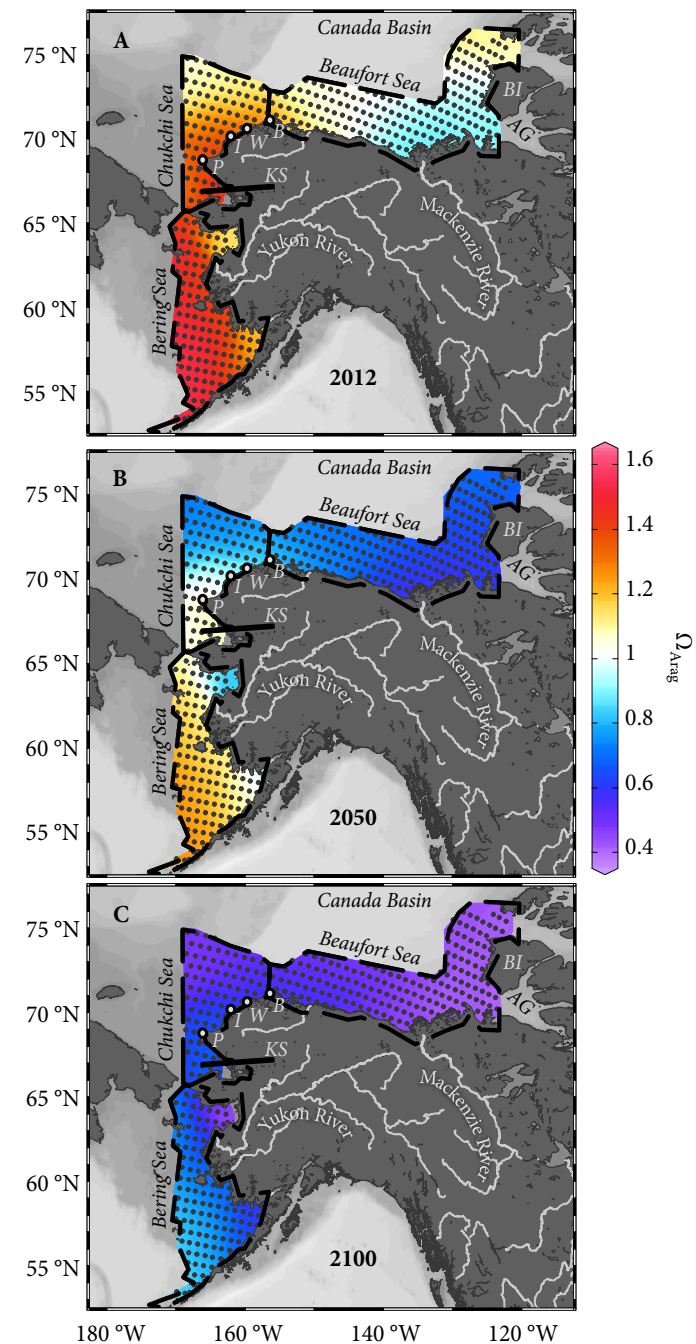




# Ocean Acidification is likely to get worse

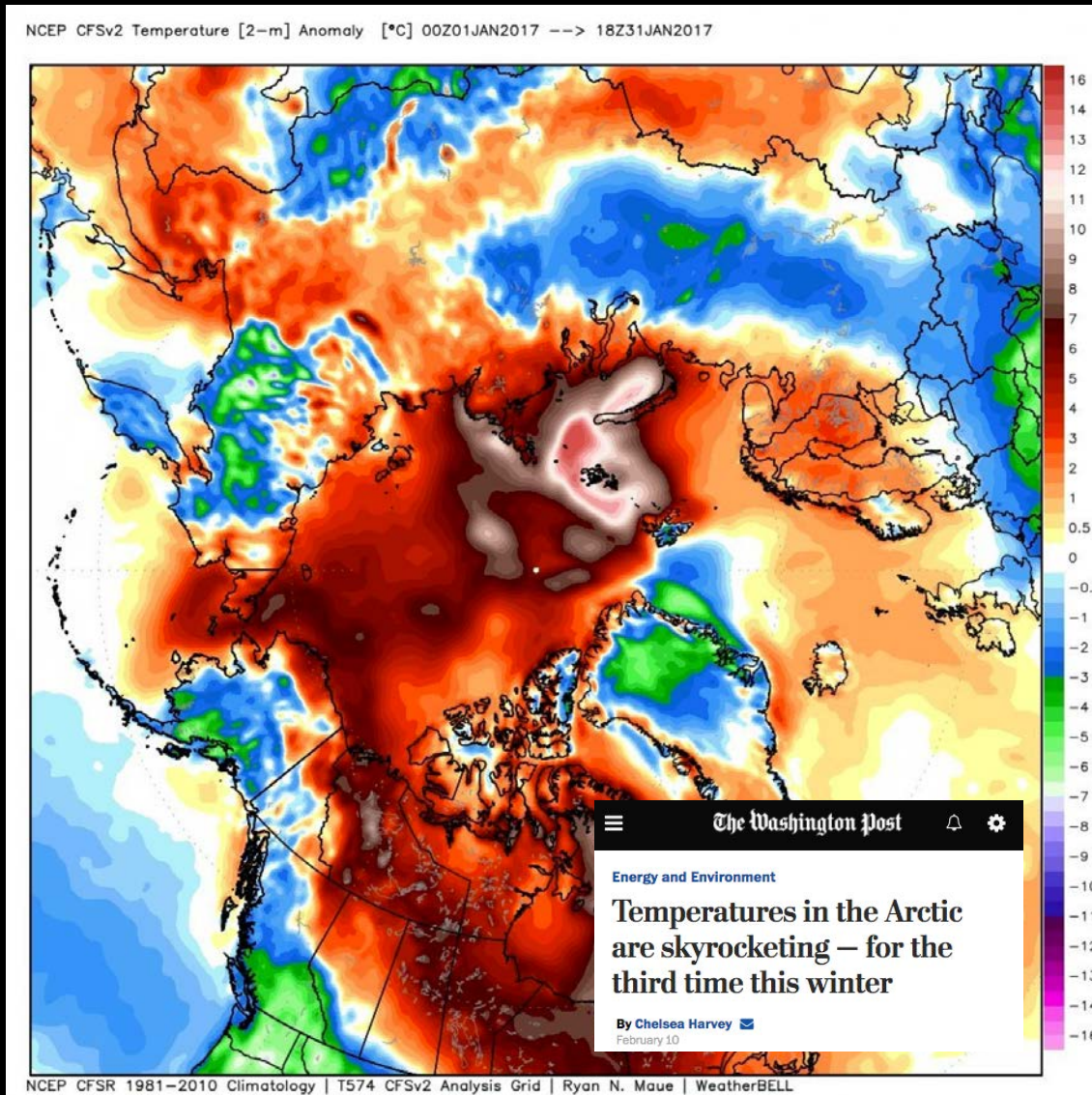


S. A. SIEDLECKI, D. PILCHER, A. J. HERMANN, K. COYLE, MATHIS J. (in prep) The importance of freshwater to spatial variability of aragonite saturation state in the Gulf of Alaska

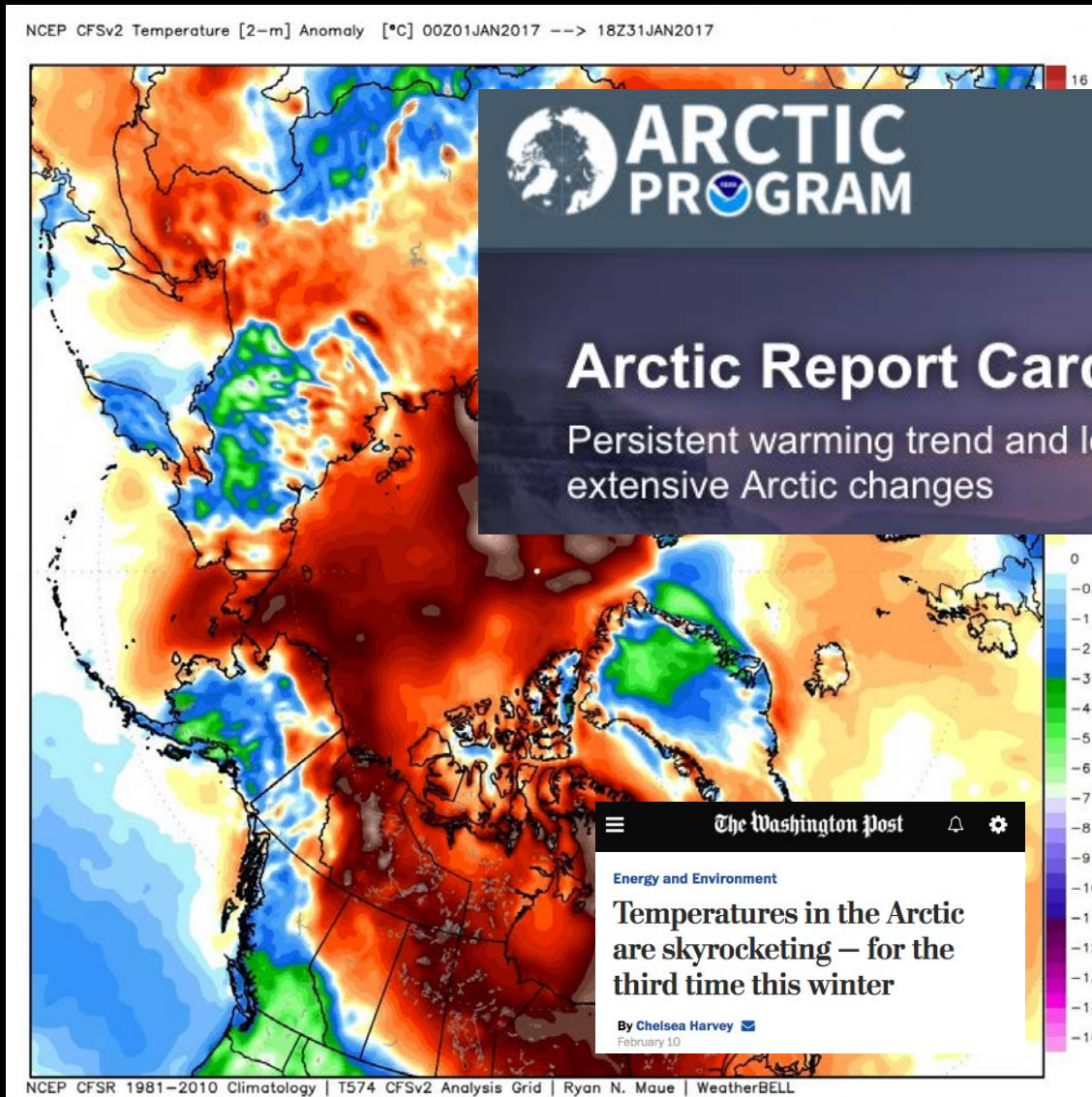




# OA does not happen in a vacuum

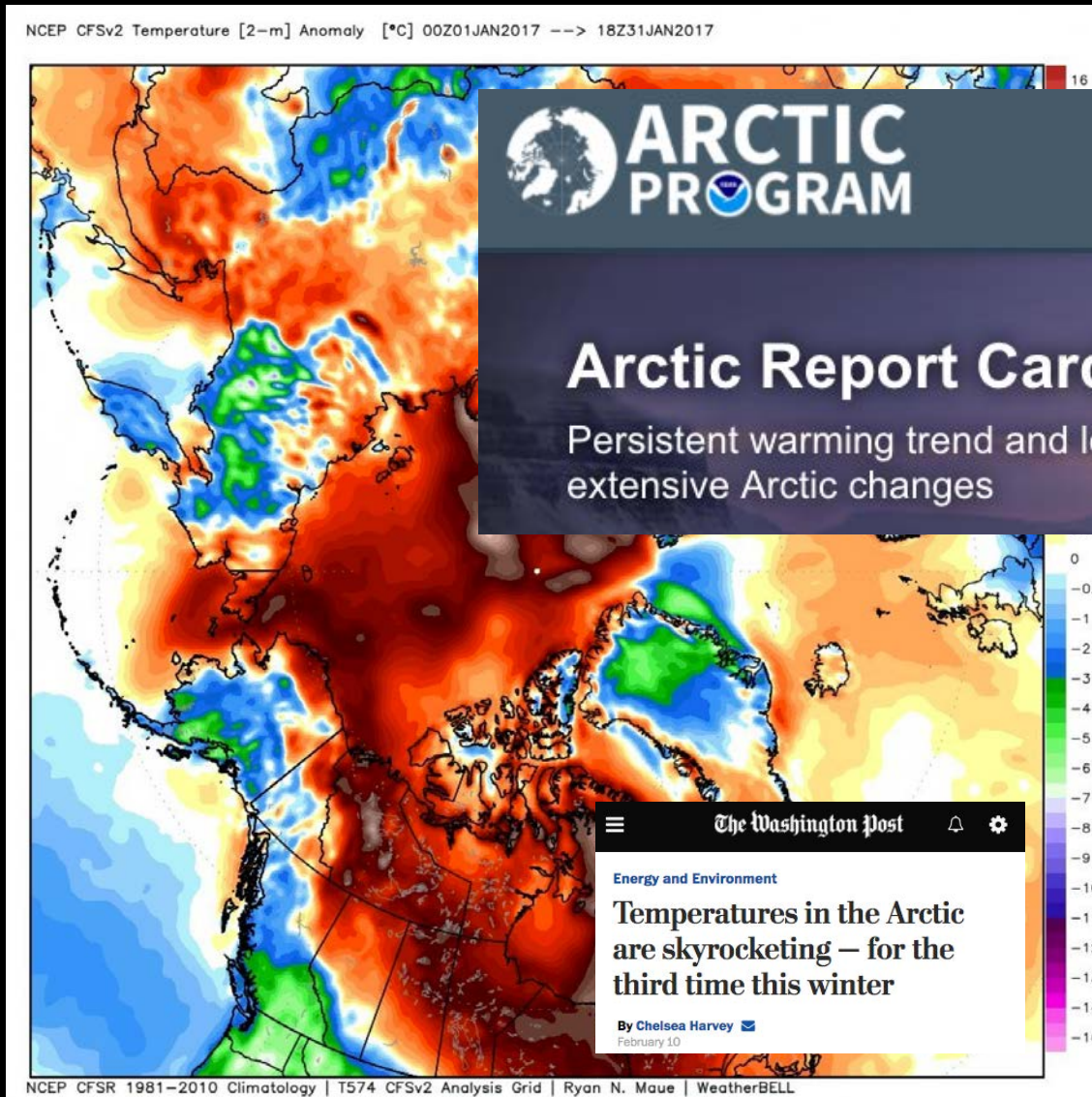


# OA does not happen in a vacuum





# OA does not happen in a vacuum



## 'Multiple Stressors'

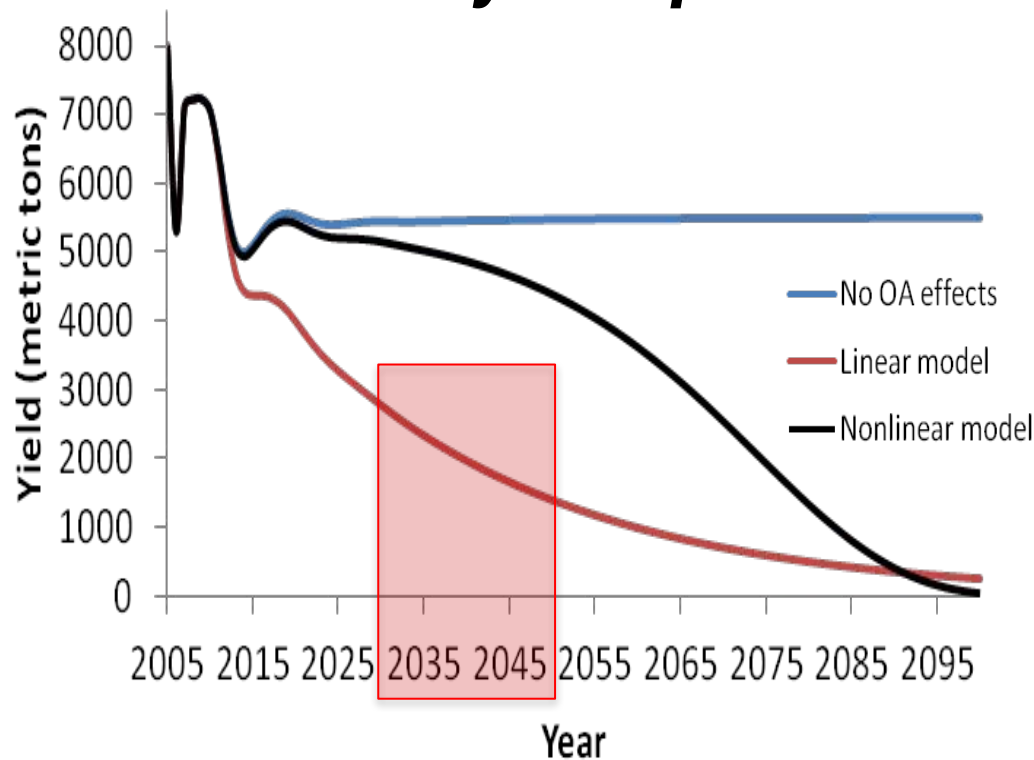
- Warm temps
- Ice Loss
- Low O<sub>2</sub>

**And now ocean acidification...**



# If Organisms Cannot Adapt...

## Bristol Bay Red King Crab *Recruitment failure could lead to fishery collapse*



CHANG K. SEUNG et al, *Clim. Change Econ.* **06**, 1550017 (2015) [35 pages] DOI: <http://dx.doi.org/10.1142/S2010007815500177>

**ECONOMIC IMPACTS OF CHANGES IN AN ALASKA CRAB FISHERY  
FROM OCEAN ACIDIFICATION**



# Building Adaptive Capacity and Community Resilience

*Resilience is the capacity of a system to continually change and adapt, yet remain within critical thresholds.*



# Risk Mitigation Strategies



Diversify economies in high and moderate risk regions



Provide job training and educational opportunities



Increase access to alternative protein sources



Reduce other environmental stressors





# Alaska Ocean Acidification Network

## *Connecting Scientists and Stakeholders*

Network Coordinator: Darcy Dugan, AOOS

- Alex Harper (NOAA OA Program)
- Bob Foy (NOAA AFSC)
- Davin Holen (AK Center for Climate Assessment & Policy)
- Gary Freitag (AK Sea Grant – Ketchikan)
- Hannah Heimbuch (AK Marine Conservation Council)
- Jeff Hetrick (Alutiiq Pride Shellfish Hatchery)
- John Kiser (AK Shellfish Growers Assoc.)
- Melissa Good (AK Sea Grant – Unalaska)
- Mia Heavener (Alaska Native Tribal Health Consortium)
- Mike Miller (Sitka Tribe/IPCoMM)
- Molly McCammon (AOOS)
- Natalie Monacci and Jeremy Mathis (UAF OA Research Center)
- Ruth Christiansen and Mark Gleason (Alaska Bering Sea Crabbers)



**AOOS**  
Alaska Ocean Observing System

# Alaska Cares!



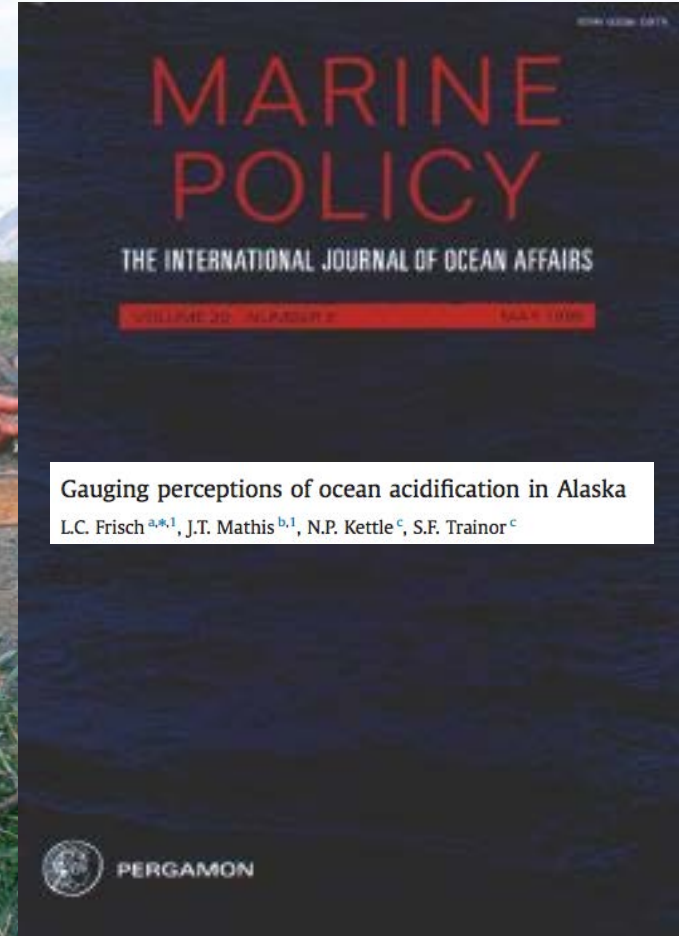
Ocean Acidification Research Center

AT THE UNIVERSITY OF ALASKA FAIRBANKS





**OA awareness in Alaska is about three times higher than the rest of the US.**



Gauging perceptions of ocean acidification in Alaska

L.C. Frisch<sup>a,\*</sup>, J.T. Mathis<sup>b,1</sup>, N.P. Kettle<sup>c</sup>, S.F. Trainor<sup>c</sup>



# GLACIER TO GULF:

## Multi-platform Ocean Acidification Monitoring in Prince William Sound



Department of Commerce Silver Medal for  
Exceptional Service, 2014



In 2014, this  
award-winning  
study used **six  
types of  
technology** to  
track glacial melt  
signals for **five  
months**, finding  
strong ocean  
acidification  
events near glacial  
plumes.



# Your OA Researchers



## Leadership



Libby.Jewett@noaa.gov



Mike.Sigler@noaa.gov

## Ocean Chemistry



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Jessica.Cross@noaa.gov

## Species Response



**Fish**

Thomas.Hurst@noaa.gov



**Crabs**

Robert.Foy@noaa.gov



**Corals**

Bob.Stone@noaa.gov

## Economic Modeling



Michael.Dalton@noaa.gov



# Looking Forward

## Innovation and Technology Development

**WIRED** GEAR SCIENCE ENTERTAINMENT BUSINESS SECURITY DESIGN OPINION

AUTOPIA | gallery | magazine-22.03

### The Drone That Will Sail Itself Around the World

BY ADAM FISHER 02.18.14 | 6:30 AM | PERMALINK

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# Summary



- **Ocean Acidification is already impacting Alaskan coastal areas important to commercial and subsistence fisheries.**
- **Coastal communities in Southeast and Southwest Alaska face the highest risk from ocean acidification.**
- **As human CO<sub>2</sub> emissions rise, Ocean Acidification will get worse.**
- **Risk Mitigation and Adaptation Strategies:**
  - Diversify the economies in high and moderate risk regions
  - Provide job training and educational opportunities
  - Increase access to alternative sources of protein
  - Reduce other environmental stressors
  - **REDUCE CO<sub>2</sub> EMISSIONS - Everything else is just buying time.**



*Science, Service, Stewardship*



# Ocean Acidification in Alaska: Ecosystems and Economies

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NOAA/PMEL  
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Alaska State Legislature  
House Resources Committee  
February 2017