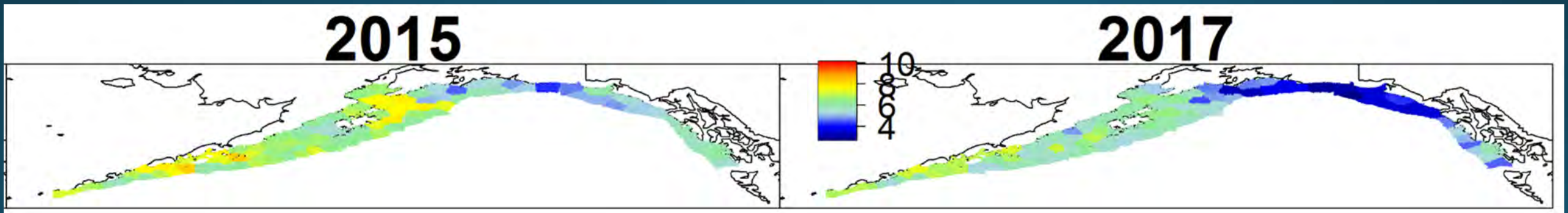
Gulf of Alaska Pacific cod

Steve Barbeaux, Kirstin Holsman, and Stephani Zador

ECCWO

Washington D.C.

June 4, 2018



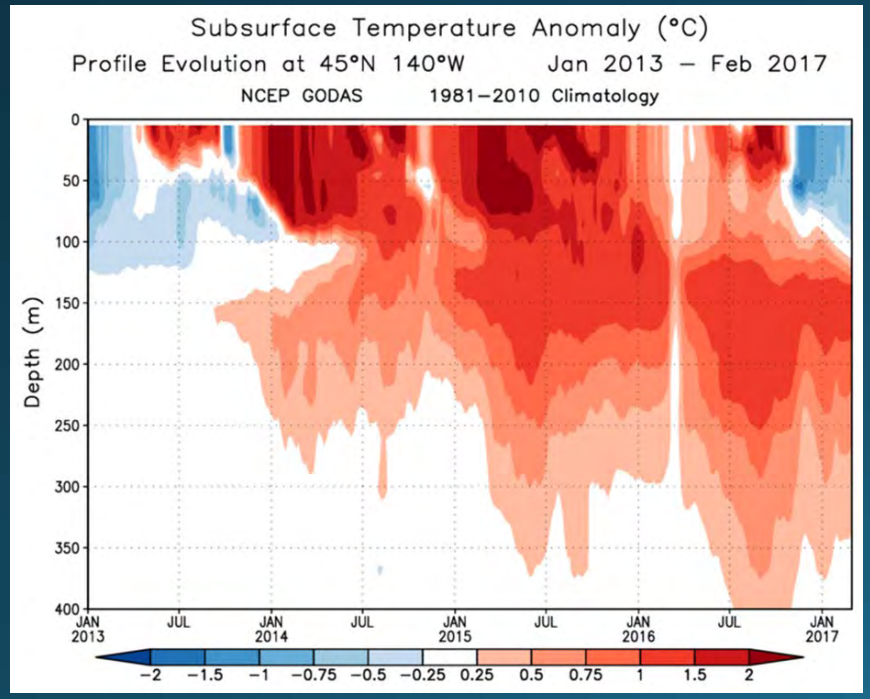
Gulf of Alaska Groundfish Economics

- The 2016 Gulf of Alaska groundfish fisheries generated $354 million in first-wholesale revenue which represents 15% of the Alaska groundfish value and ~30% of the value of all GOA groundfish fisheries.
- The GOA groundfish fisheries support jobs on over 650 vessels with approximately 23,000 crew weeks.
- The average annual first-wholesale revenue of Pacific cod over the past 10 years (2007-2016) is $103 million.

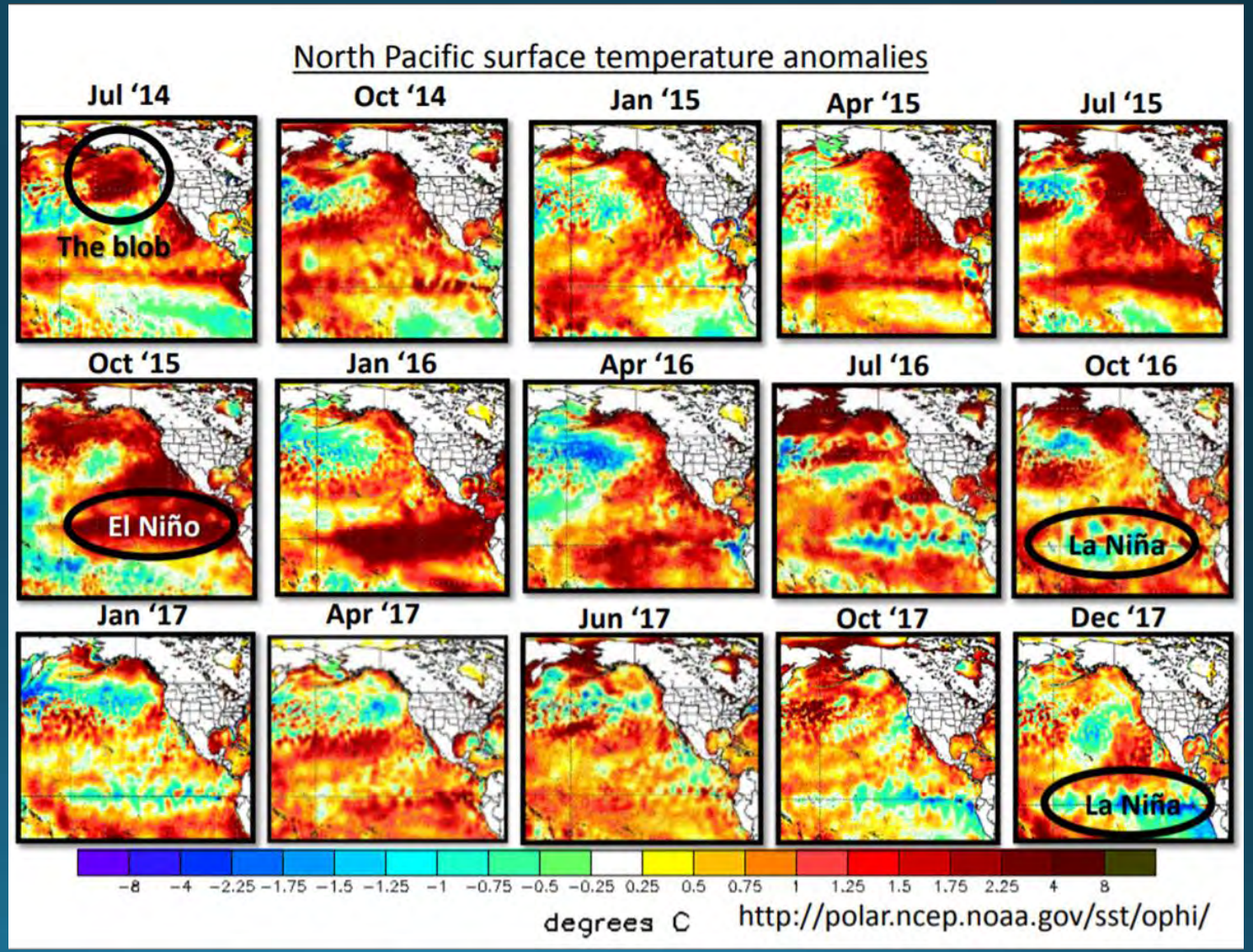
Economic analysis by Ben Fissel

2014-2016 North Pacific Marine Heatwave

- Anomalously warm waters 2014-2016
- Deep and continued throughout the year
- "Endless summer"



From presentation by Laurie Weitkamp



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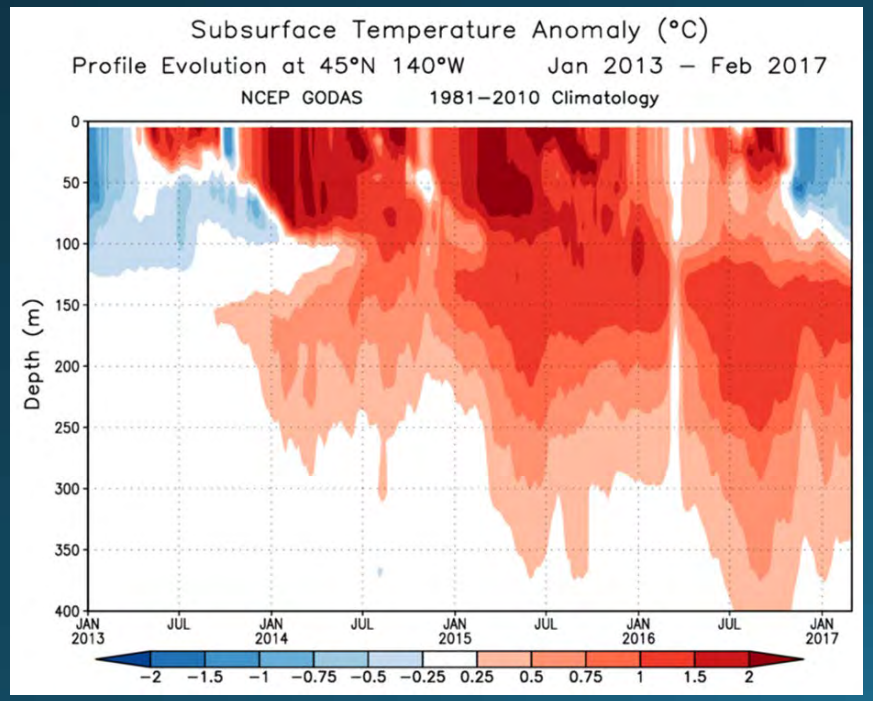

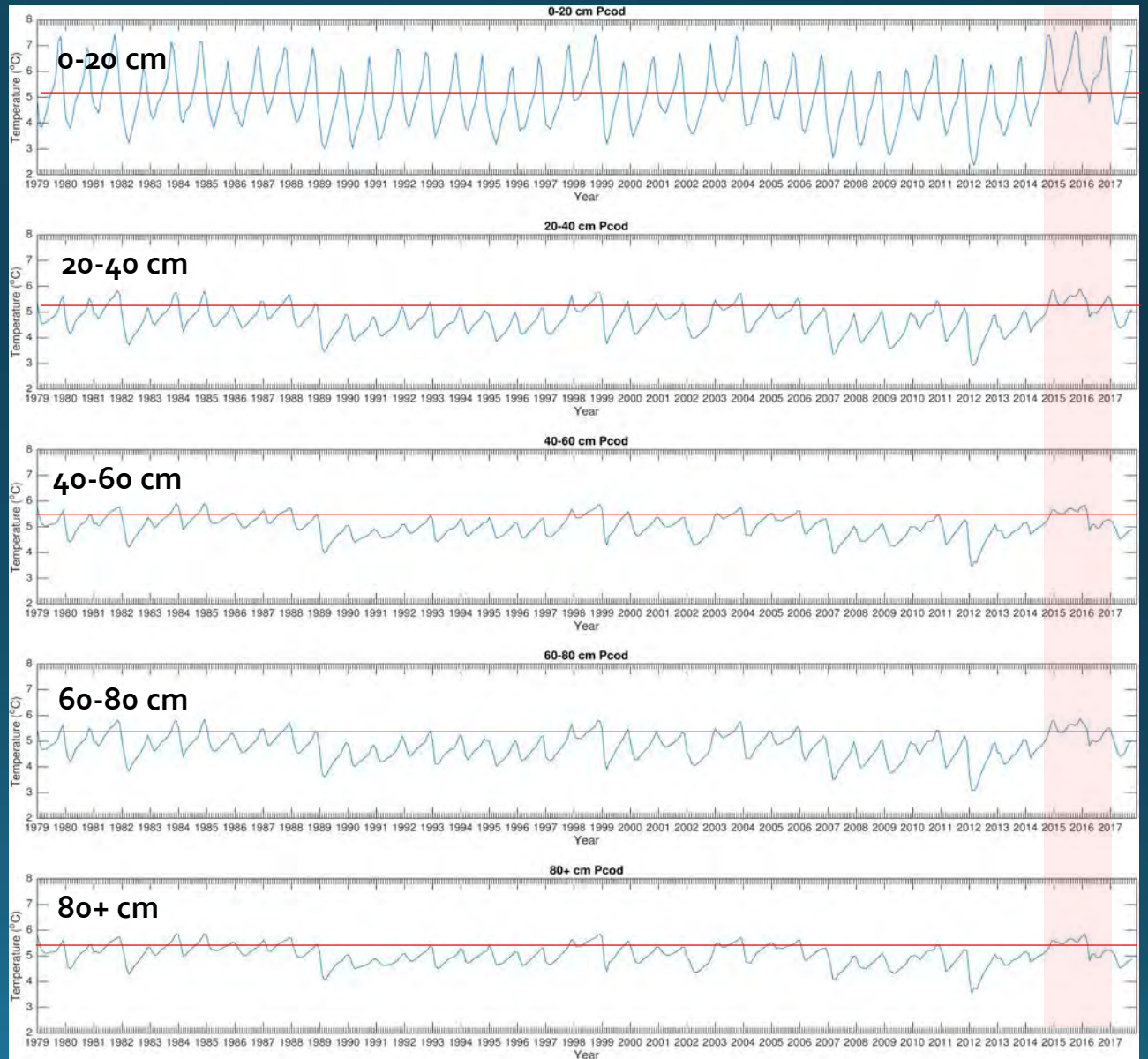

CFSR analysis by Qiong Yang, NPRB project 1509

2014-2016 North Pacific Marine Heatwave

- Impacts on seabirds and large cetaceans in GOA
  - Large-scale seabird die-offs and reproductive failure
  - Increase in large whale strandings in GOA


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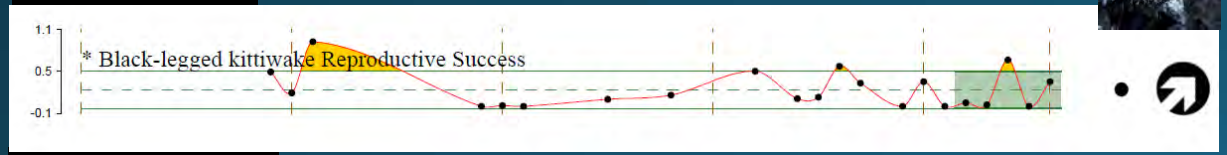
Science

Scientists think Gulf of Alaska seabird die-off is biggest ever recorded

Author: Yereth Rosen Updated: September 30, 2016 Published January 29, 2016

West



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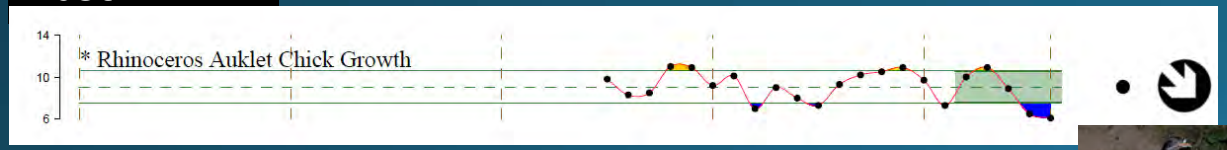
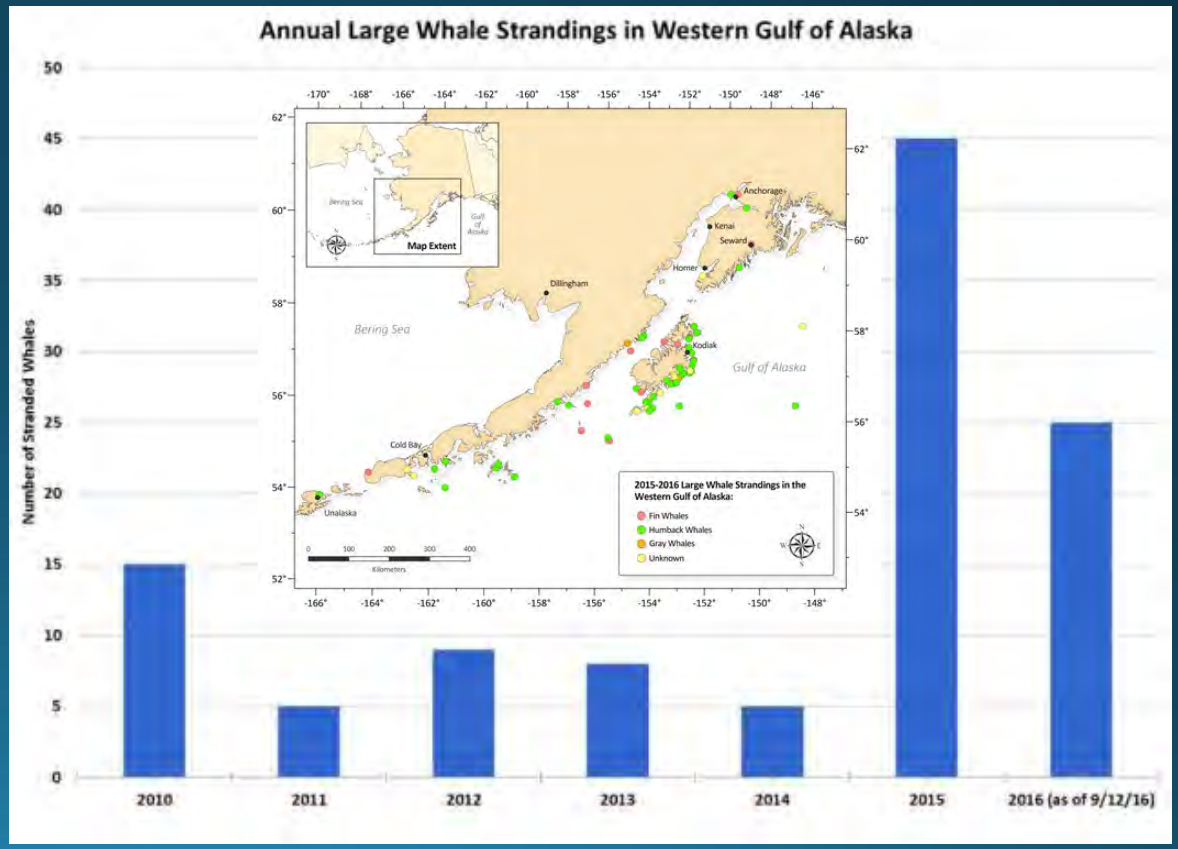


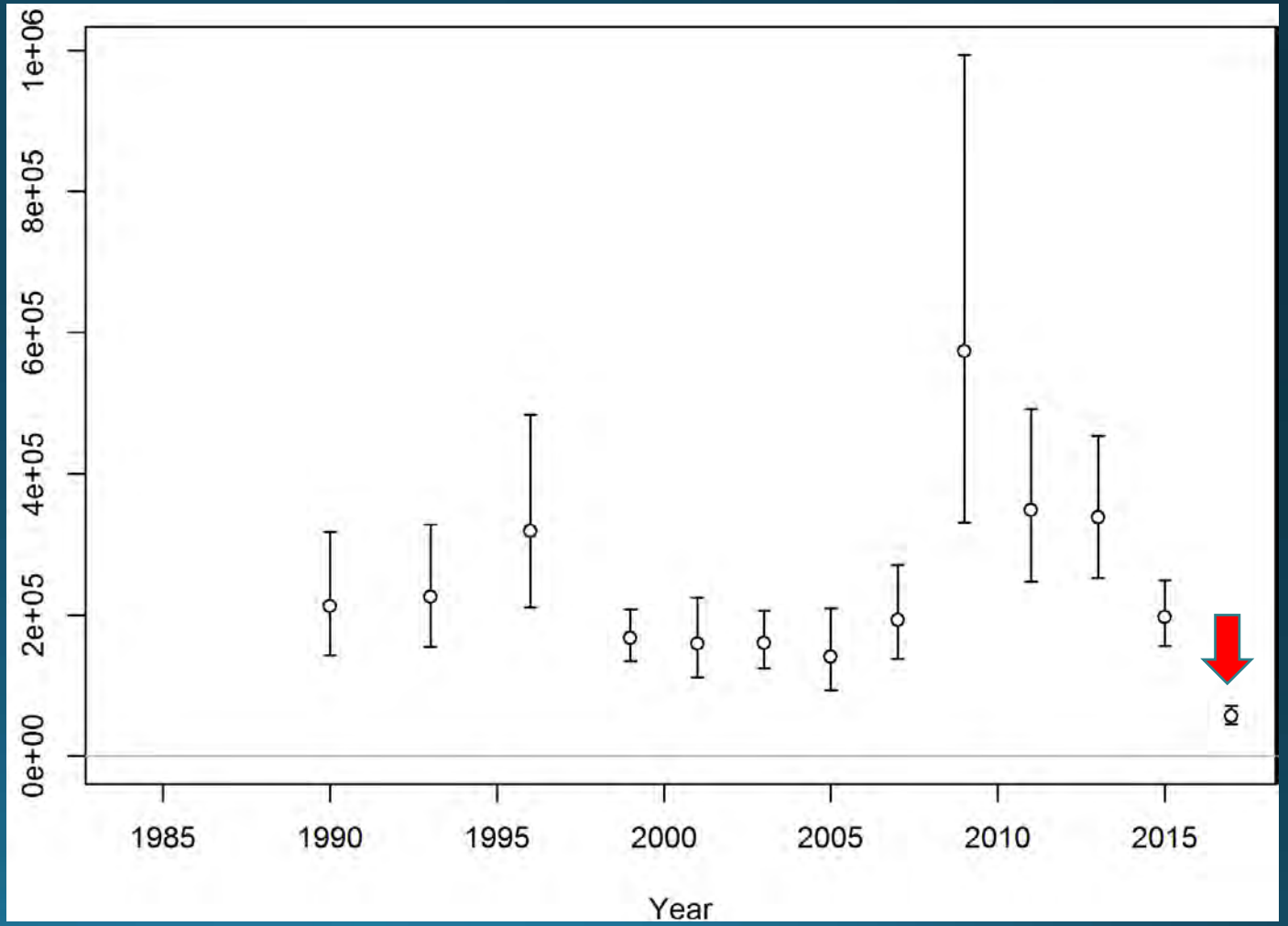
Analysis by Stephani Zador



GOA Pacific cod
2017 Bottom trawl survey

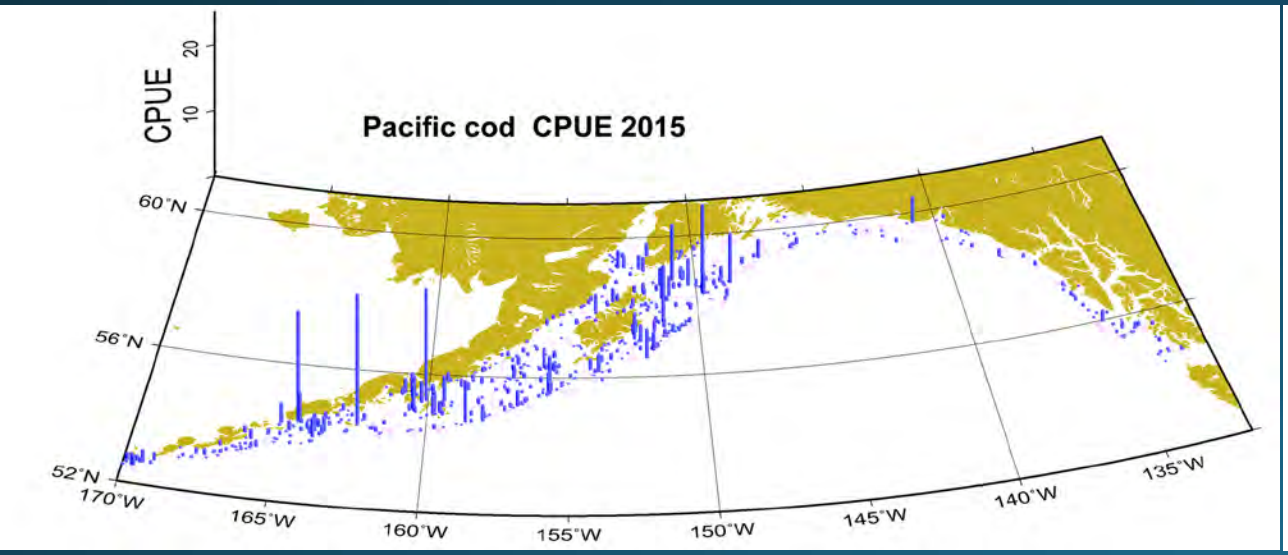
- Lowest estimate ever
  1.96×10^8 fish and 107,324 t
- Precise estimate (0.117 CV)

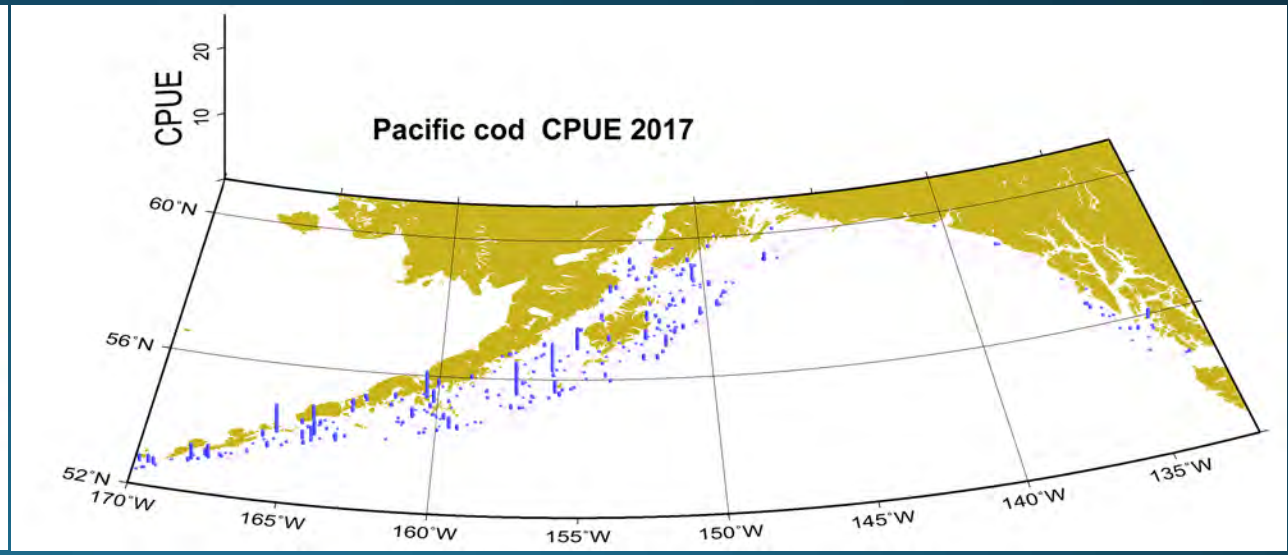
- 71% decline in abundance since 2015 (83% since 2013)
- 58% decline in biomass since 2015 (78% since 2013)



GOA Pacific cod
Bottom trawl survey

- Low density throughout the surveyed area
- Some medium-low density along Alaska Peninsula and south of Unimak Island

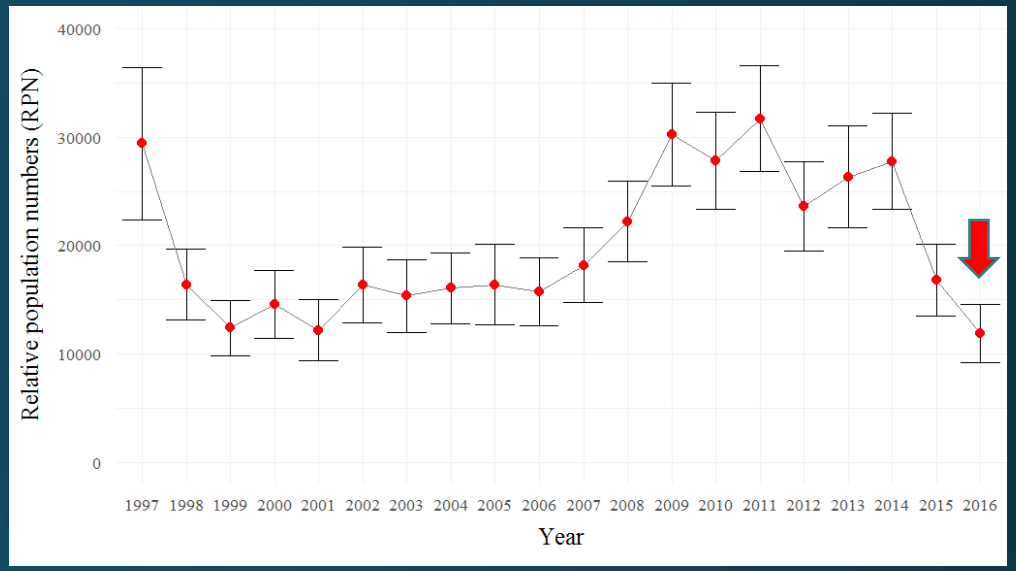




GOA Pacific cod Other surveys

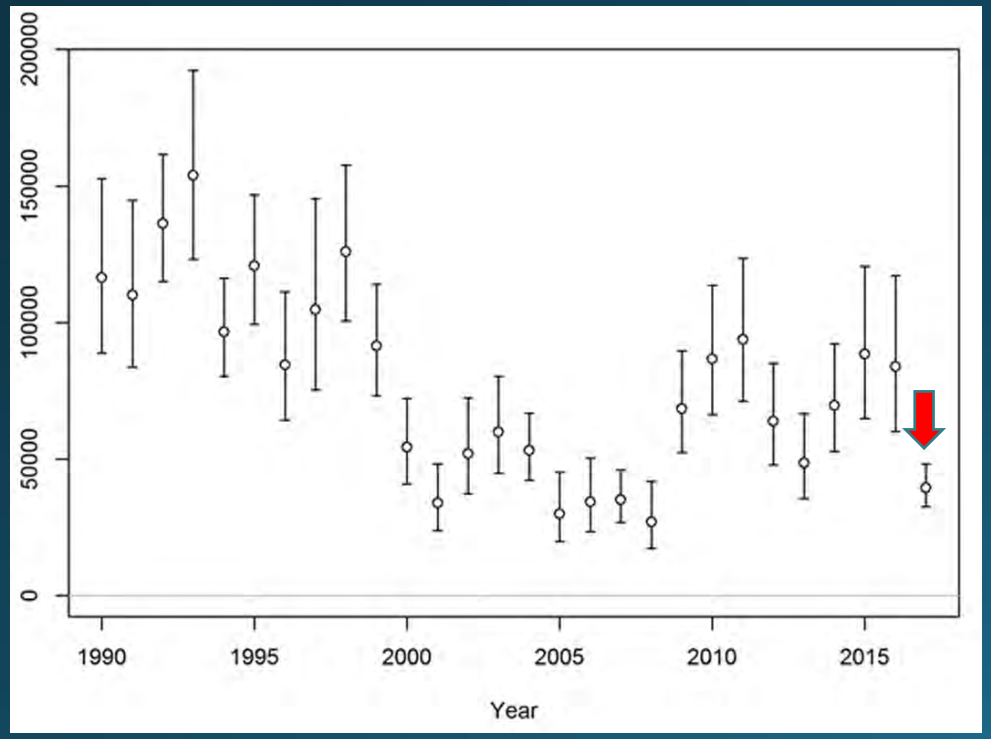
International Pacific Halibut Commission longline survey 1997-2016

- 2016 Lowest



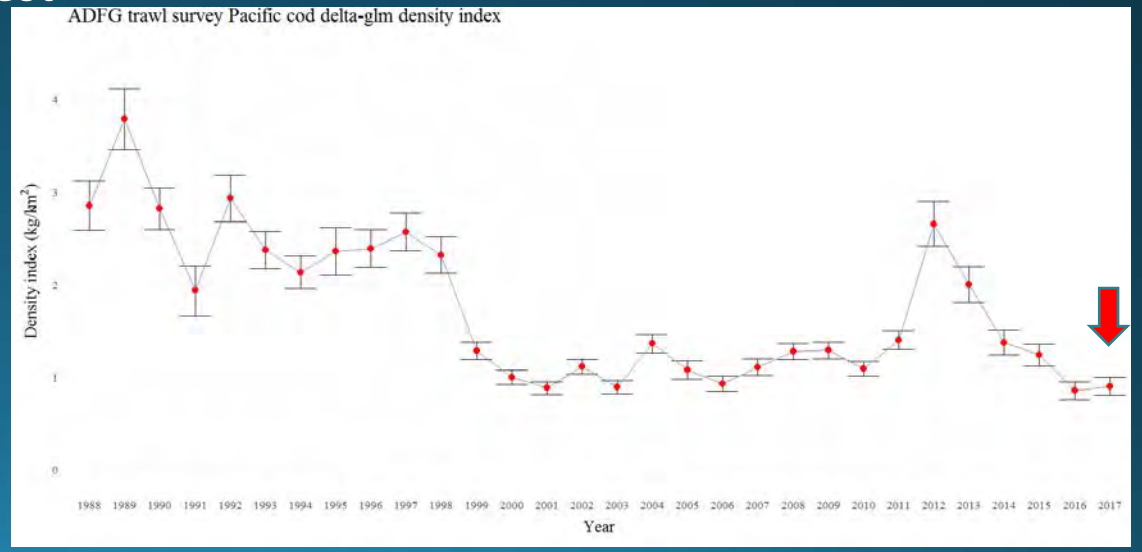
Alaska Fisheries Science Center longline survey 1990-2017

- 53% decline since 2016



Alaska Department of Fish and Game trawl survey 1988-2017

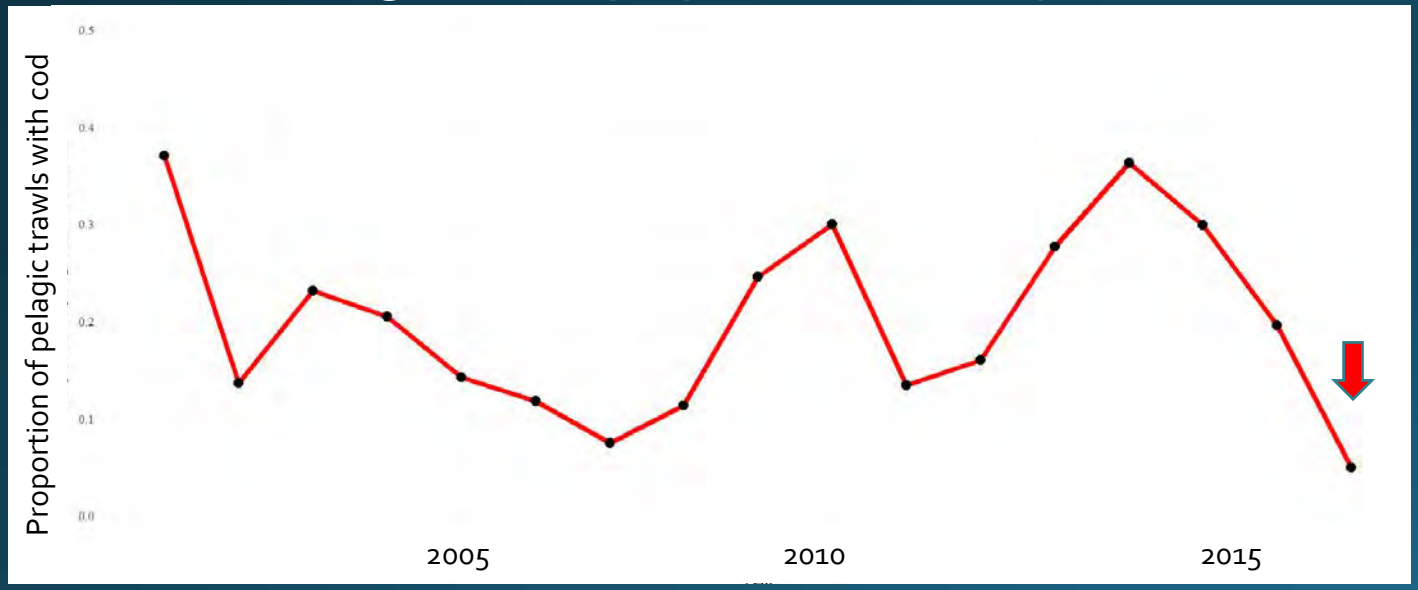
- 2016 lowest



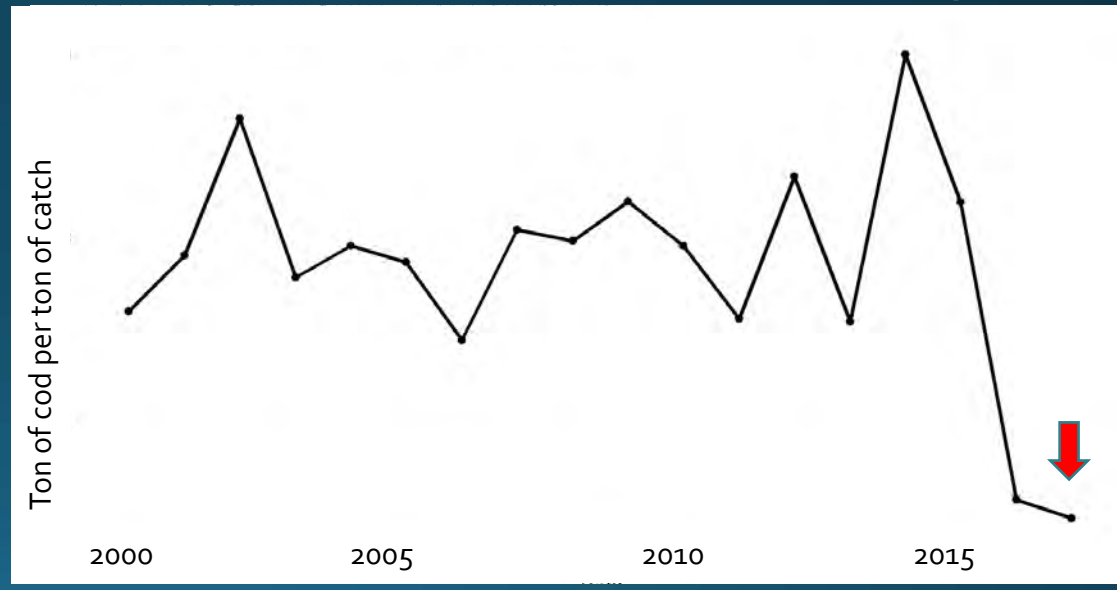
GOA Pacific cod
Bycatch in other fisheries

- Low catch rates of Pacific cod in other fisheries

Pelagic walleye pollock fishery

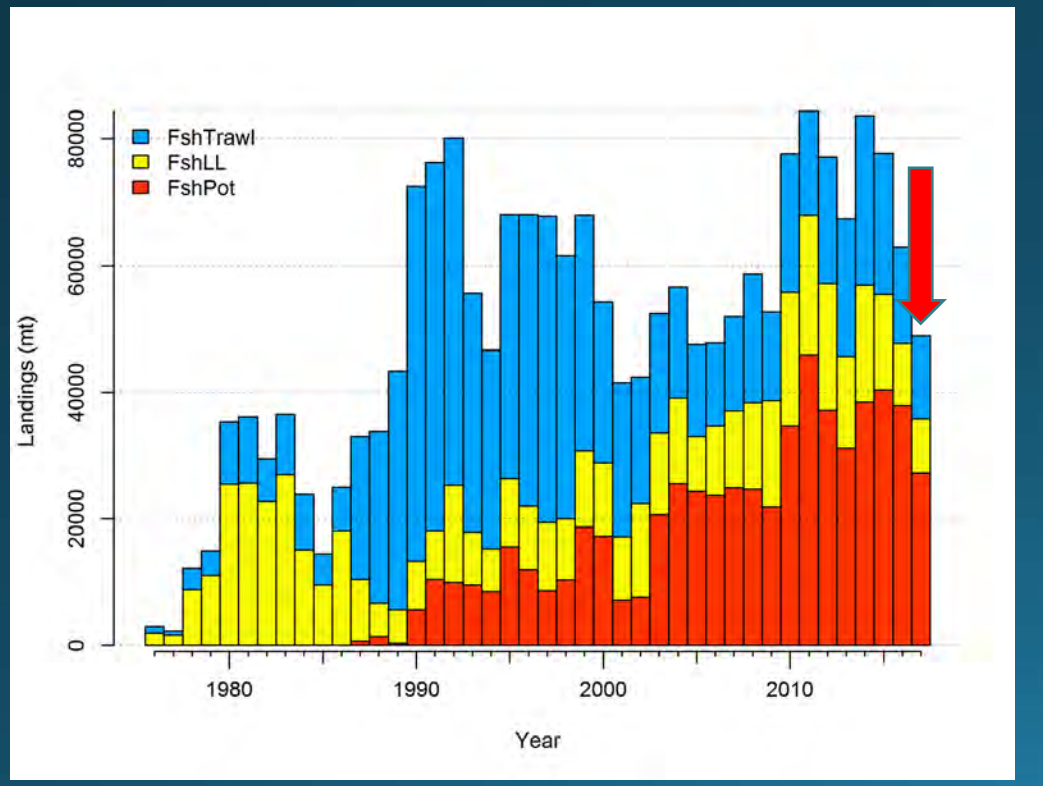


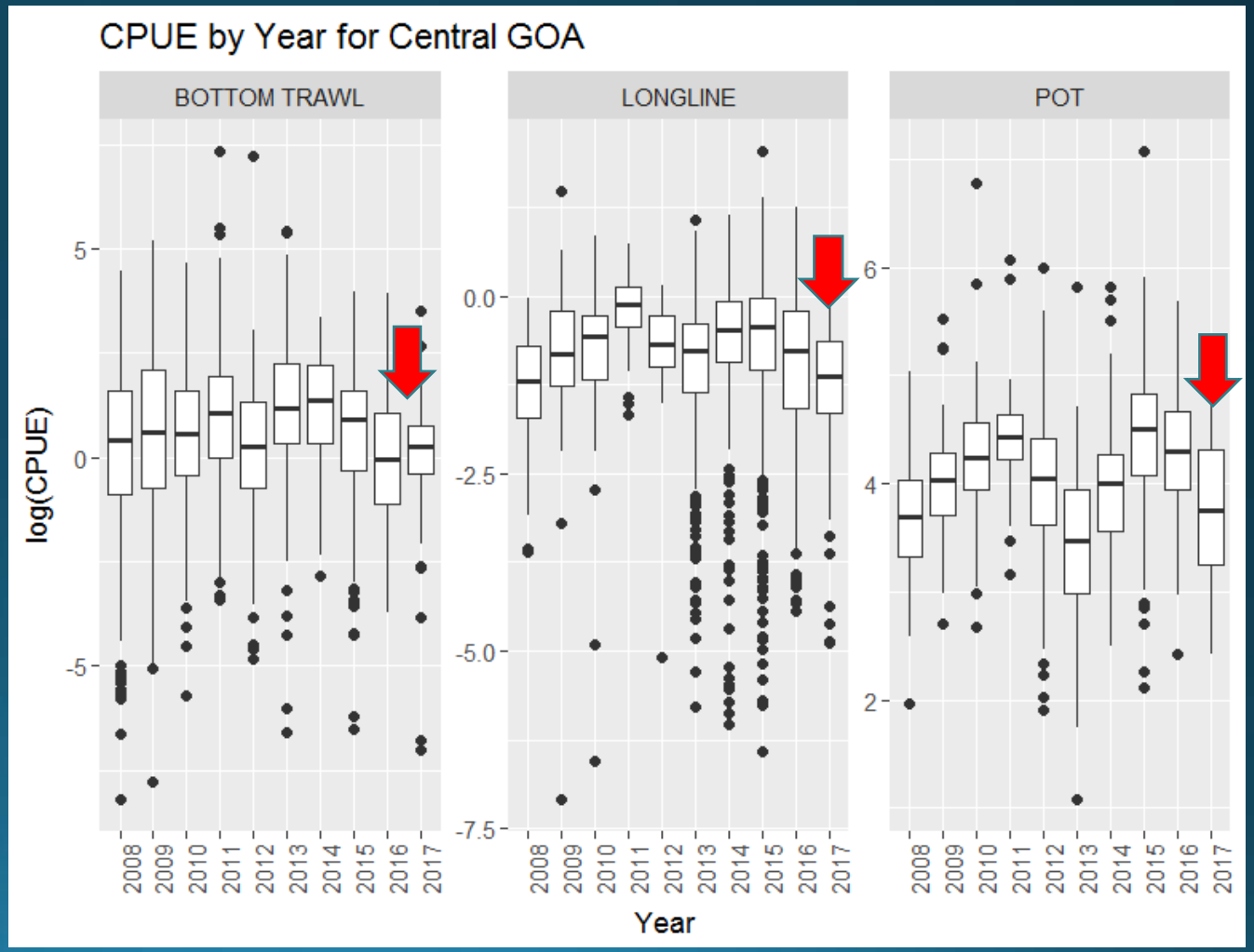
Shallow water flatfish fishery



GOA Pacific cod Fishery data

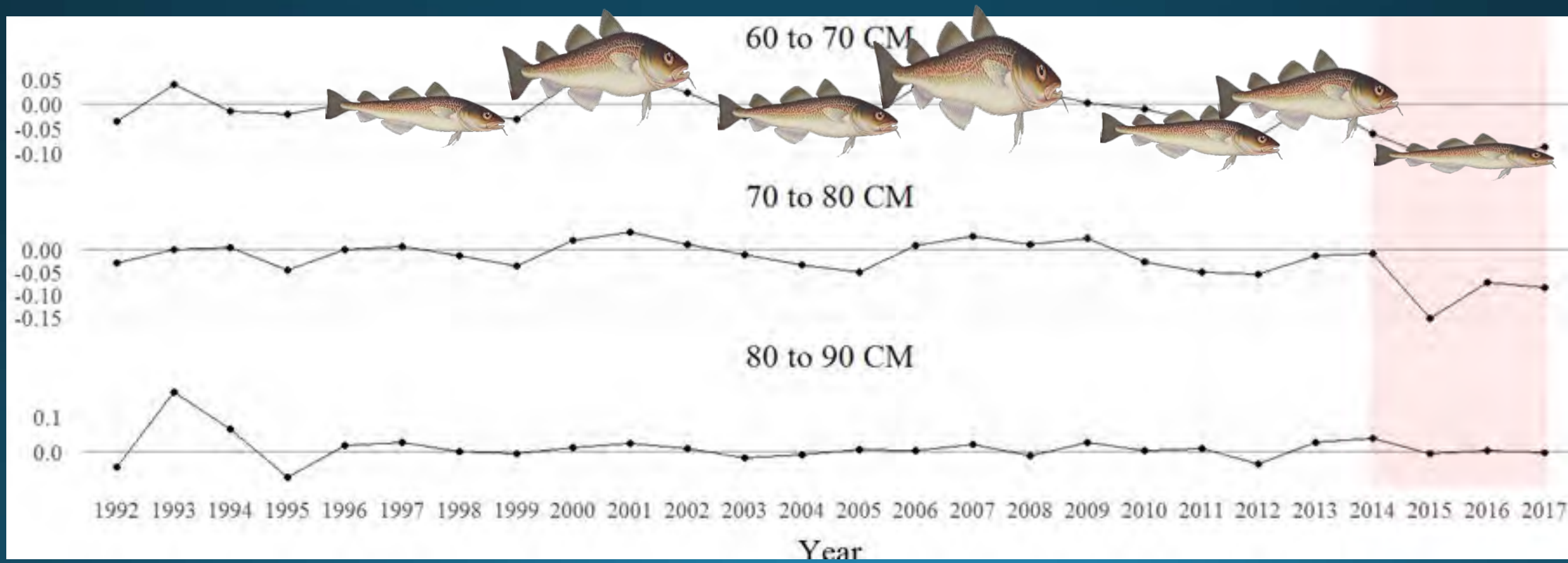
- 2017 catch at < 60% of the quota (TAC)
- Low CPUE in Central GOA all fisheries





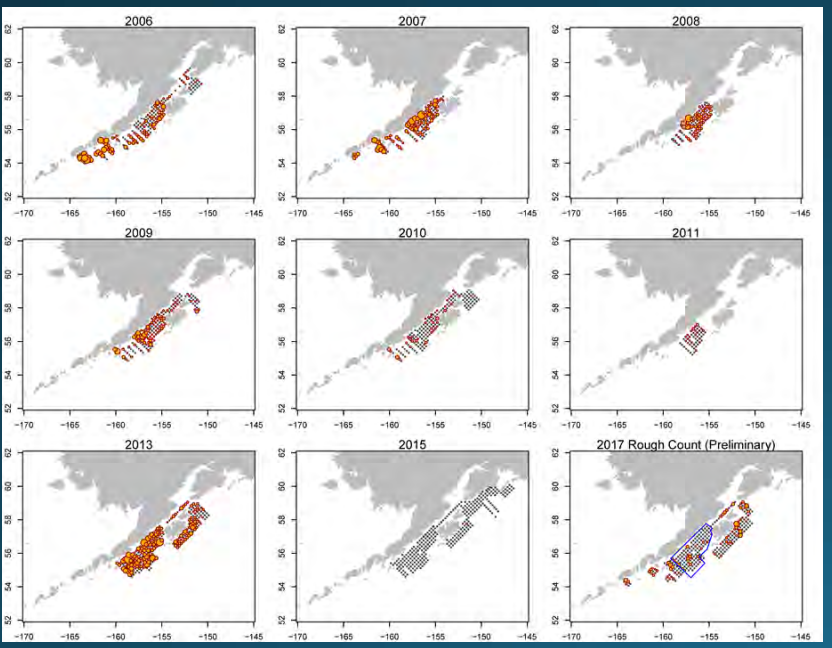
GOA Pacific cod Fishery data

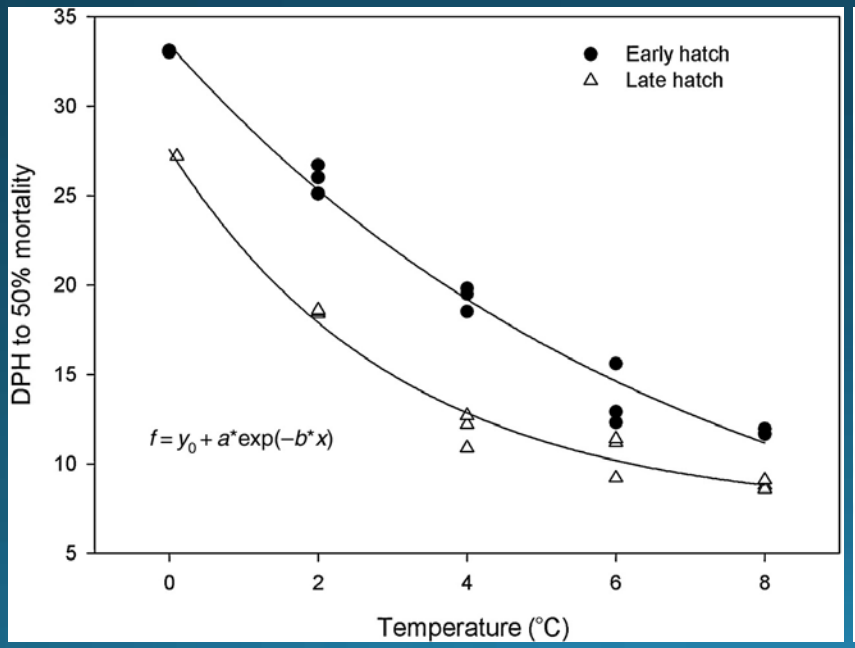
- Poor condition for 2014-2017 in longline and pot fisheries for fish < 80cm

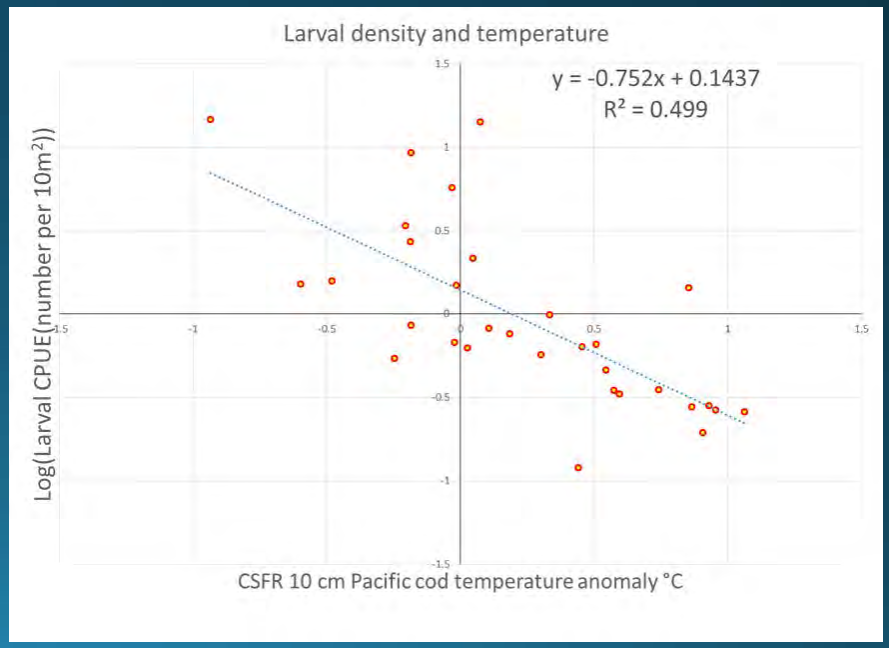


GOA Pacific cod
Heatwave impacts – Recruitment

- 2015 Spring icthyoplankton survey encountered very few Pacific cod larvae in 2015
- Poor larval survival may be linked to warm conditions (Laurel *et al.* 2008)

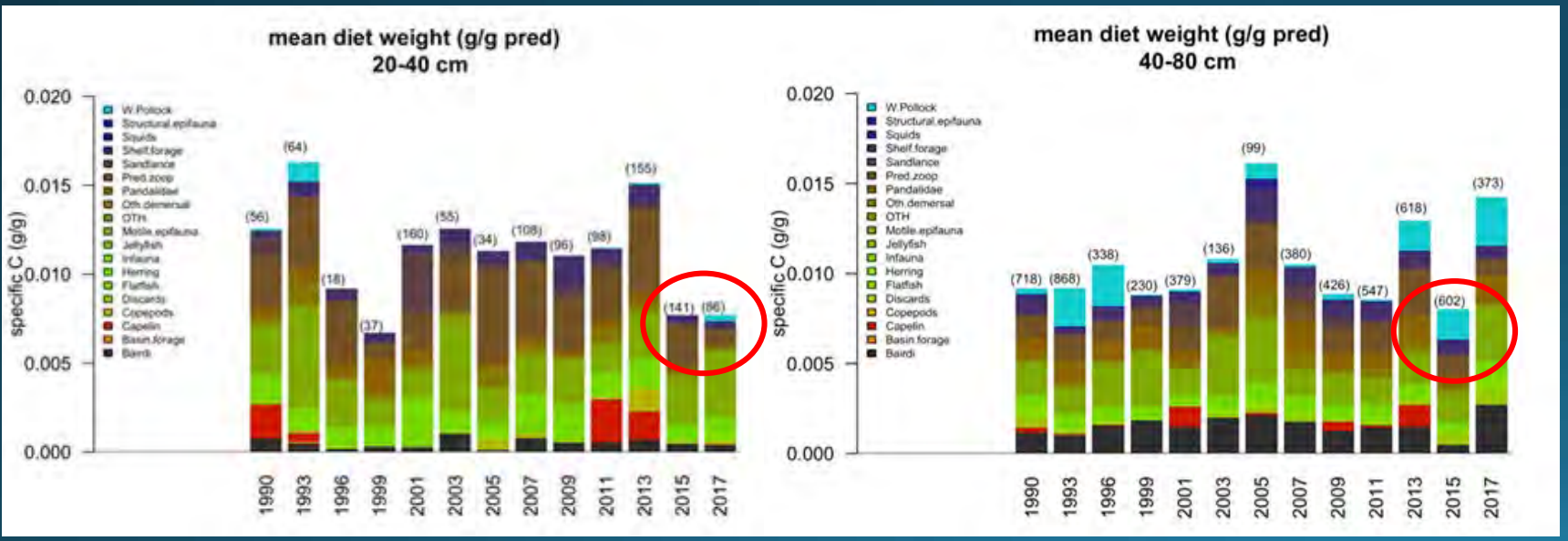


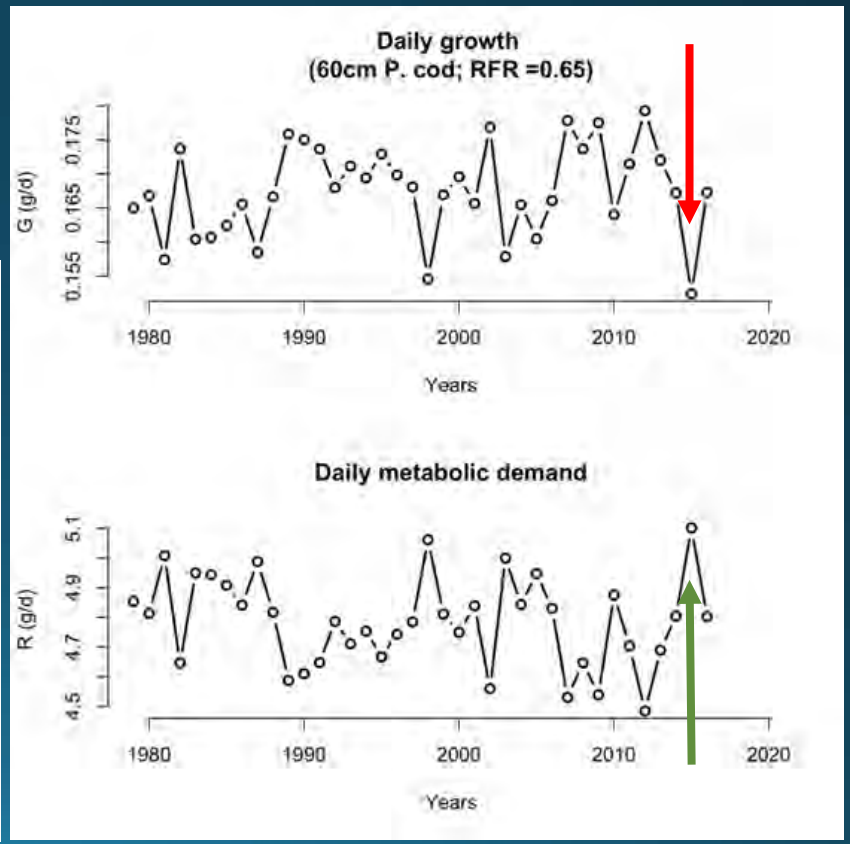




GOA Pacific cod
Heat wave impacts – Growth and survival

- Indications of low forage
- High metobolic demand and low growth
- Likely impact on Pacific cod natural mortality





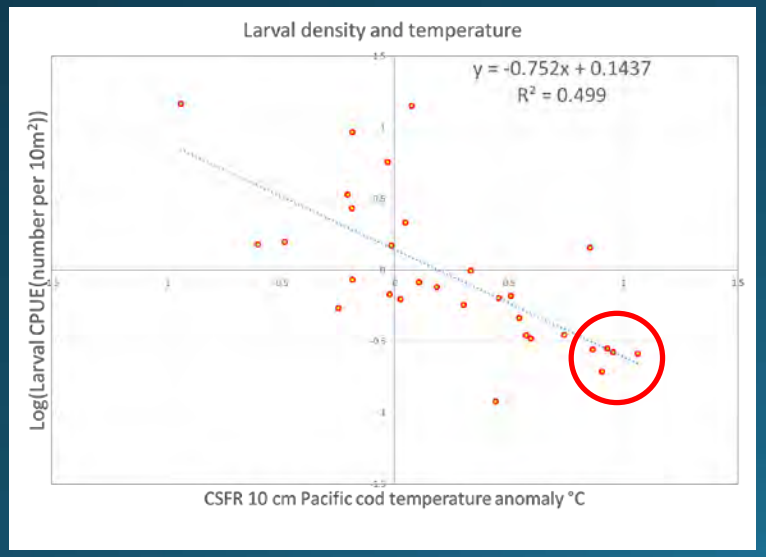
Bioenergetics analysis by Kirsten Holsman

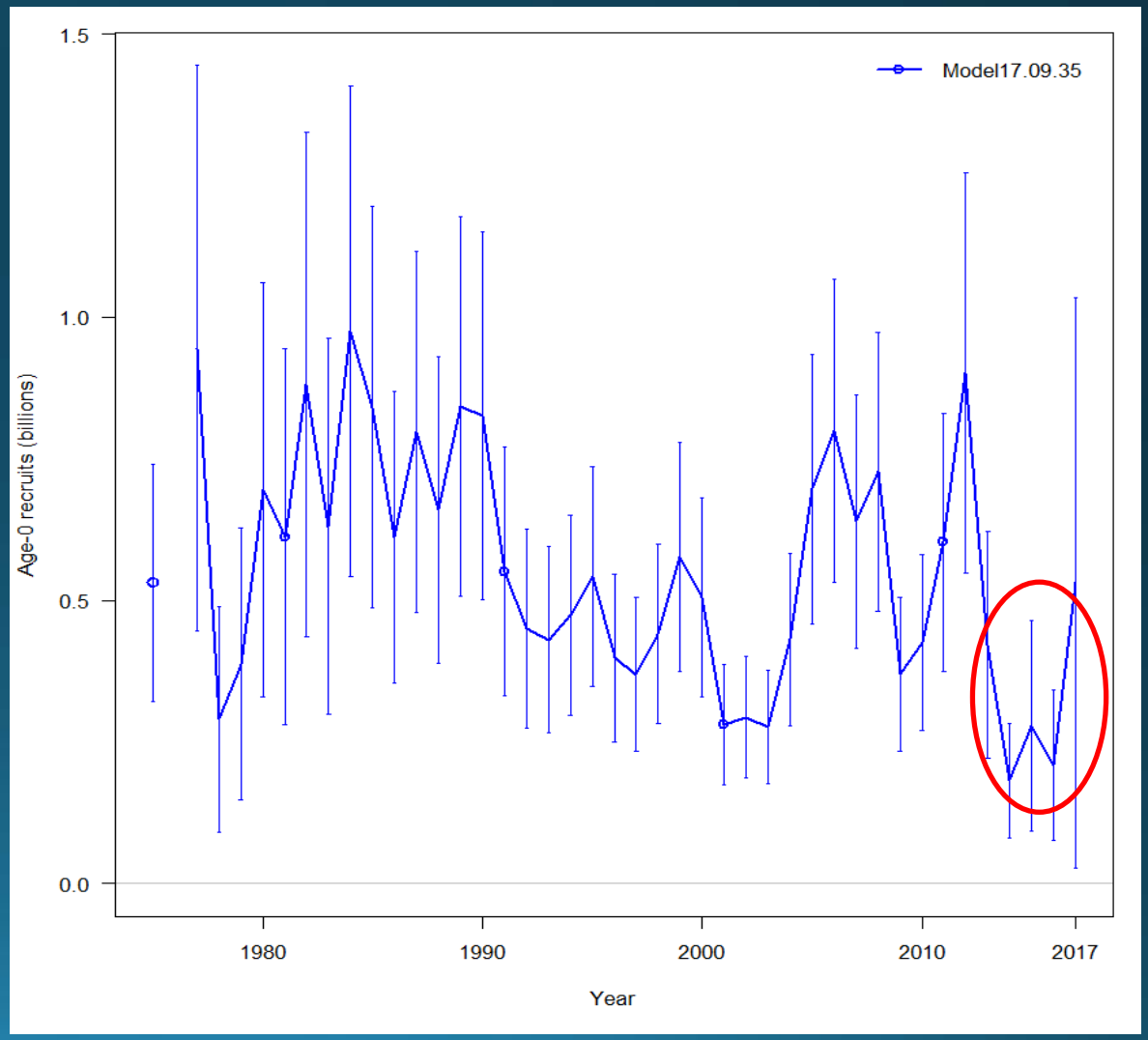
GOA Pacific cod
Heatwave impacts - Summary

- Warmer temperatures were throughout the year and water column
- High temperatures result in lower larval survival
- Higher metabolism for all ages led to higher forage requirements
- Indications of lower available forage in 2015-2016
- Combination likely lead to higher adult Pacific cod natural mortality and lower recruitment during heat wave

GOA Pacific cod Assessment Model Recruitment

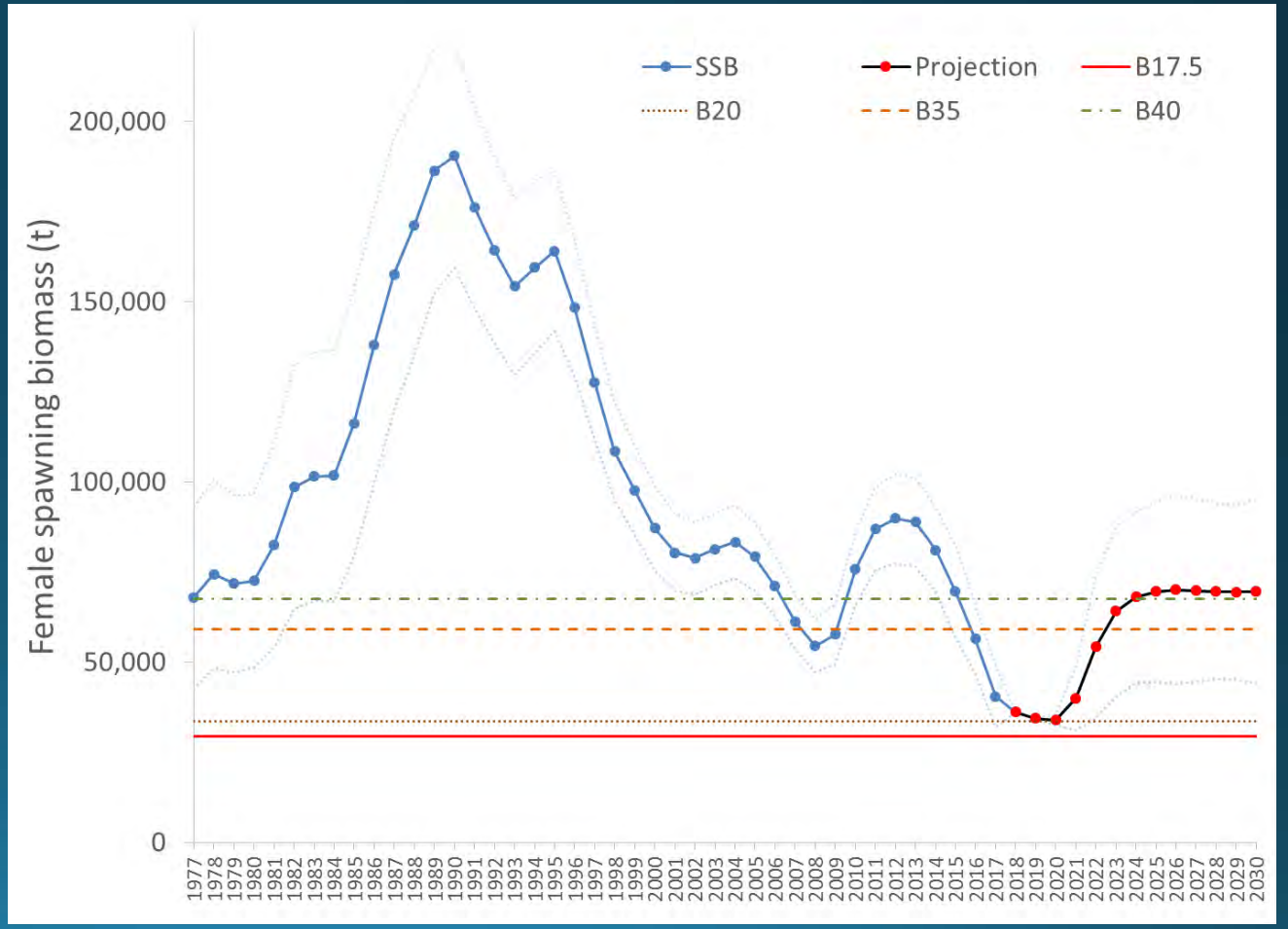
- Low recruitment in the 2014-2016
  - 2014 lowest recruitment estimate in time series at 0.14×10^9
  - 2016 and 2015 second and third lowest recruitment estimates





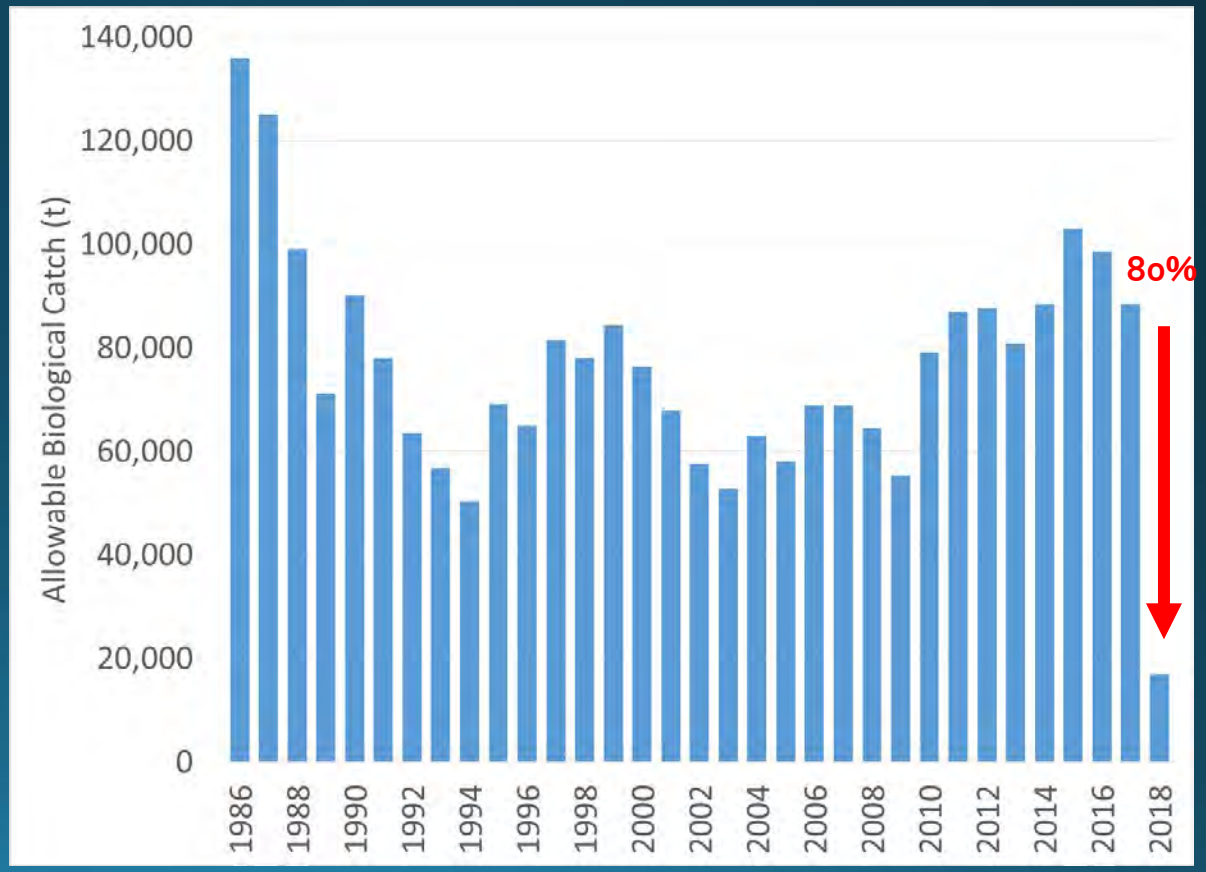
GOA Pacific cod Assessment Model Projections

- Peak female spawning biomass in 1990 (190,465 t)
- Lowest female spawning biomass in 2017 (47,326 t)
- Projected to reach all-time low in 2020
- First increase expected in 2021 given mean recruitment post-2016



GOA Pacific cod 2017 Management Actions

- Severe reduction in maximum allowable harvest levels (79,272t to 18,972t)
- Recommended adjustment downward of Allowable Biological Catch for precaution
- 80% reduction in total allowable catch for Gulf of Alaska Pacific cod to 17,000t



GOA Pacific cod Ecosystem Approach in North Pacific Fisheries

- Based on 40 years of cooperative research and adaptive management

What's different in the North Pacific?

Management System

Formal
- NPFMC
- FMPs and FEPs
- NMFS Catch accounting
- AFSC and AKFIN databases

Informal
- History of cooperation among stakeholders
- Personal contacts among stakeholders
- Access to scientists by all stakeholders

Species and Ecosystem Assessments

Quantitative
- Single species stock assessment models
- Multi-species assessment models
- Ecosystem models
- Bioenergetics models
- Ecosystem indicators
- MSEs

Qualitative
- Ecosystem evaluation
- Life history descriptions

Data

Fishery dependent
- NMFS Observer program
- ADFG fish ticket/logbooks
- ADFG Port Sampling

Fishery independent
- AFSC cooperative surveys
- IPHC cooperative surveys
- ADFG trawl surveys

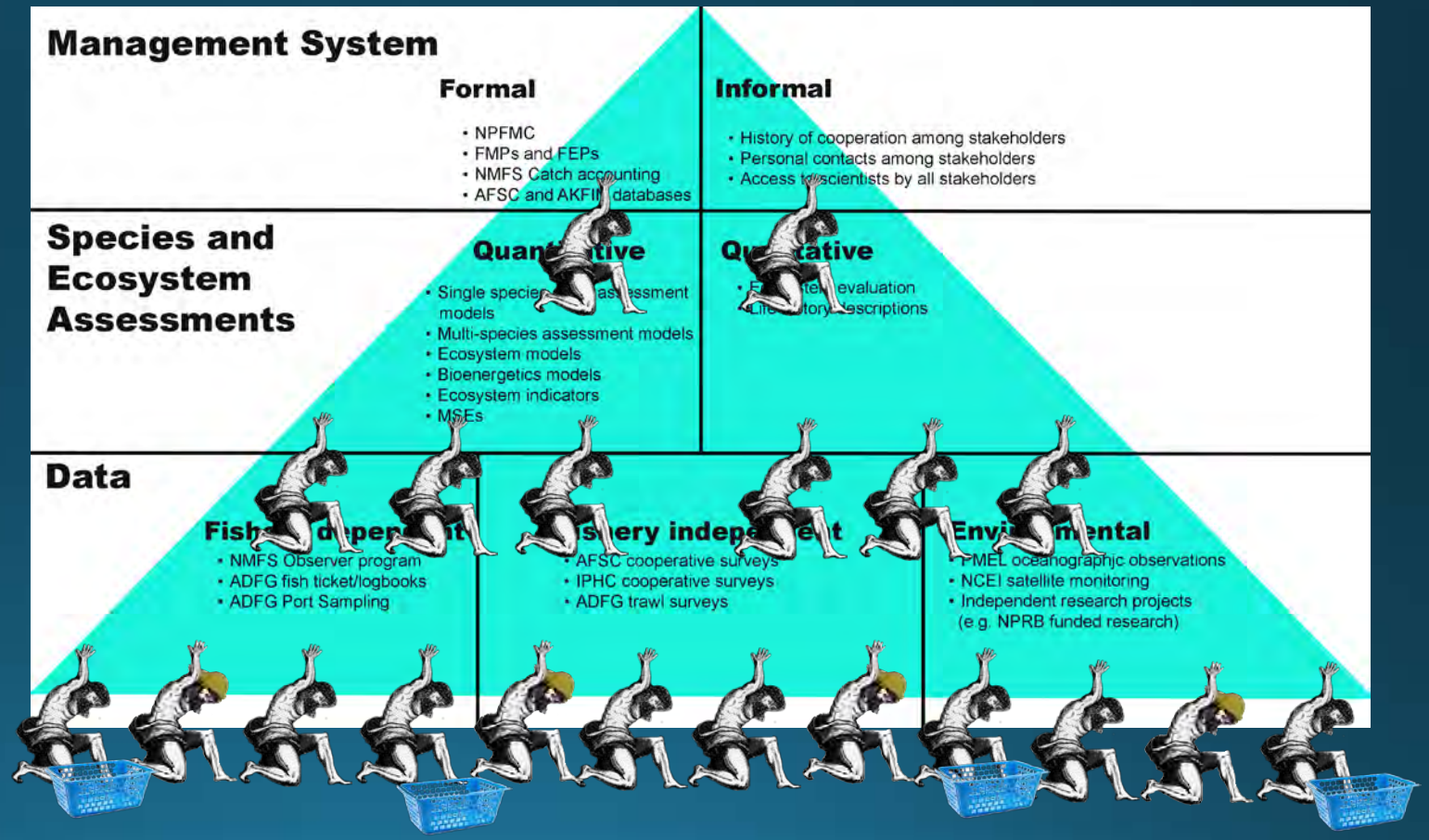
Environmental
- PMEL oceanographic observations
- NCEI satellite monitoring
- Independent research projects (e.g. NPRB funded research)

As essment authors?

GOA Pacific cod
Bringing it all together for GOA Pacific cod in 2017

- Perception of a shared responsibility among stakeholders
- Diverse expertise
- Communication
- Trust

What's different in the North Pacific?

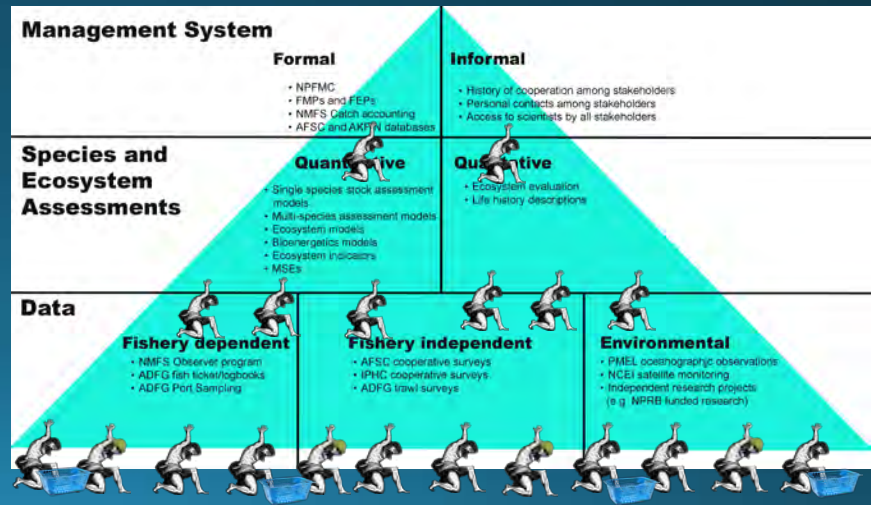


GOA Pacific cod
Bringing it all together for GOA Pacific cod in 2017

- **Collaboration** among researchers of **diverse expertise** with access to extensive **data** sets
- Development of a **coherent story** based on state-of-the-art assessment model, oceanography, bioenergetics, and ecological evidence.
- Frequent informal **communication** among all stakeholders to evaluate consistency of findings with their **experience**
- Early and wide **communication** of preliminary results through NPFMC public meetings and the media allowing for managers and fishing industry participants time for planning and adaptation

GOA Pacific cod
2017 Management Results

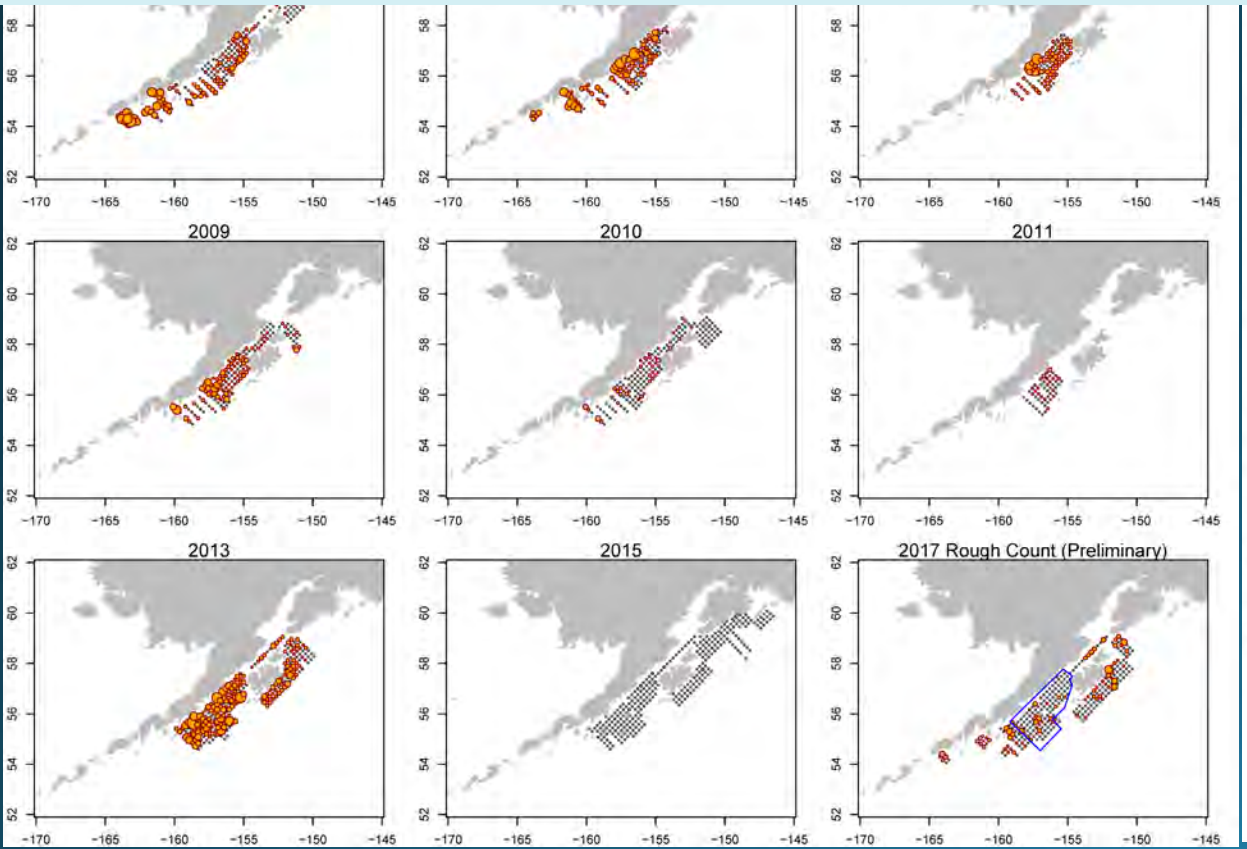
- Recognition of severe decline in Gulf of Pacific cod abundance by all stakeholder groups
- Buy-in and support of scientific findings by fishing industry
- Reduction of 2018 allowable biological catch (ABC) by 80%

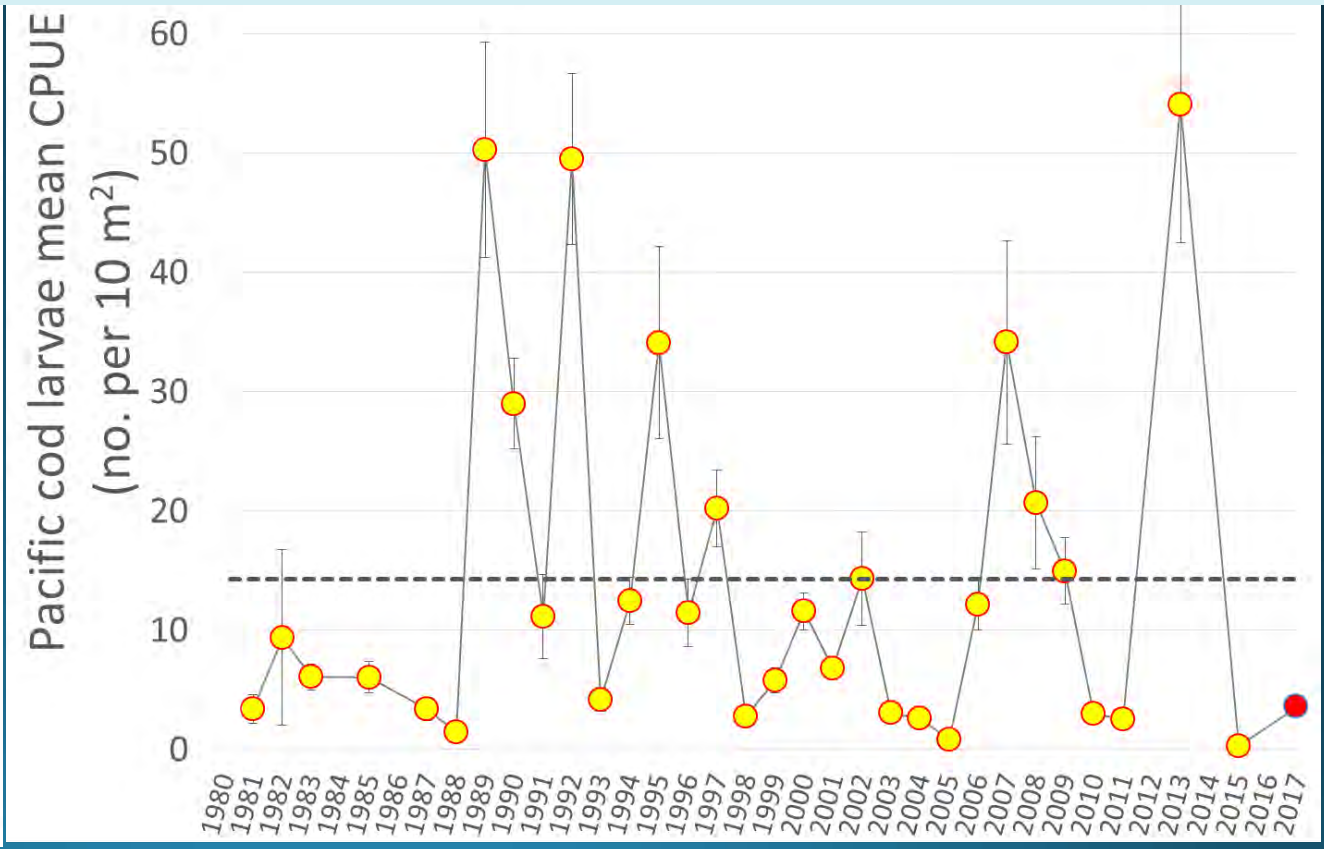


GOA Pacific cod
Future outlook

- Preliminary 2017 larval survey densities below average

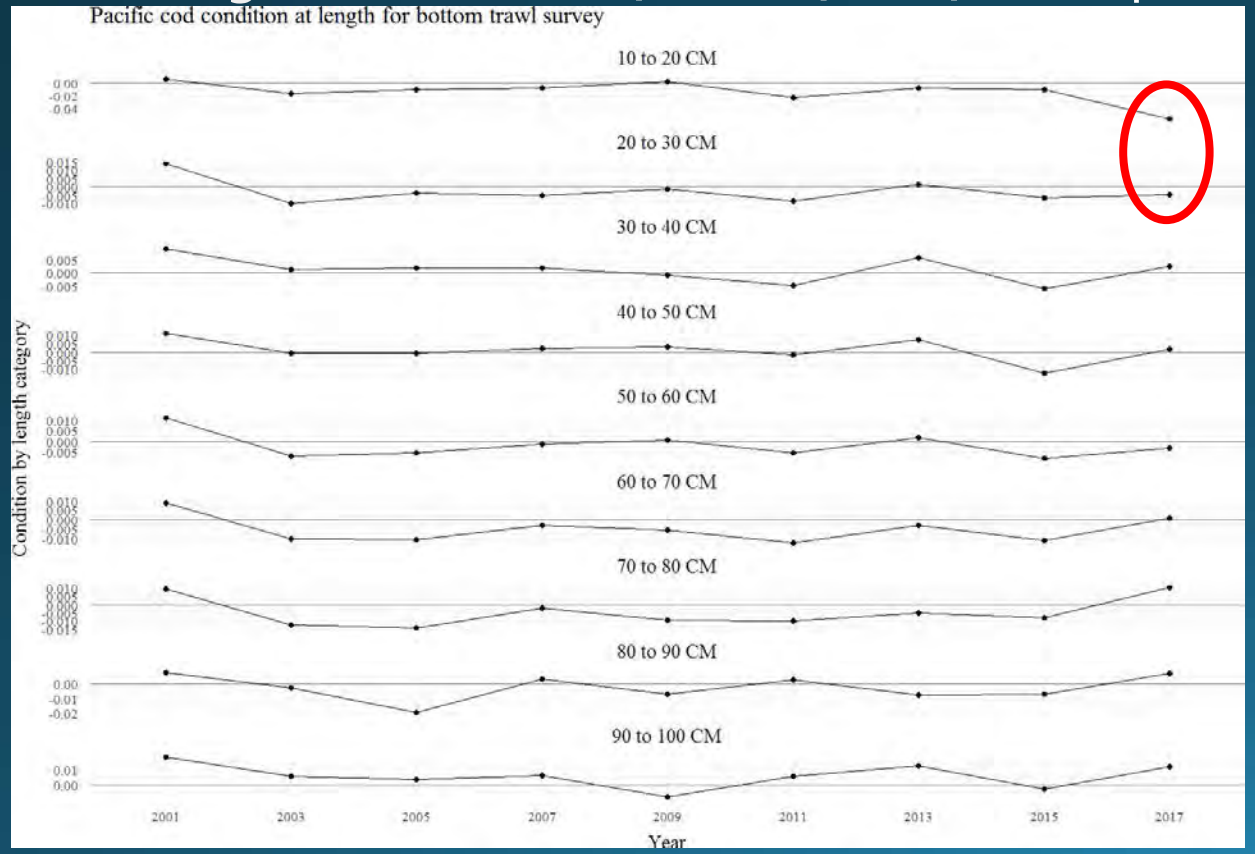
Larval abundance is not correlated with recruitment

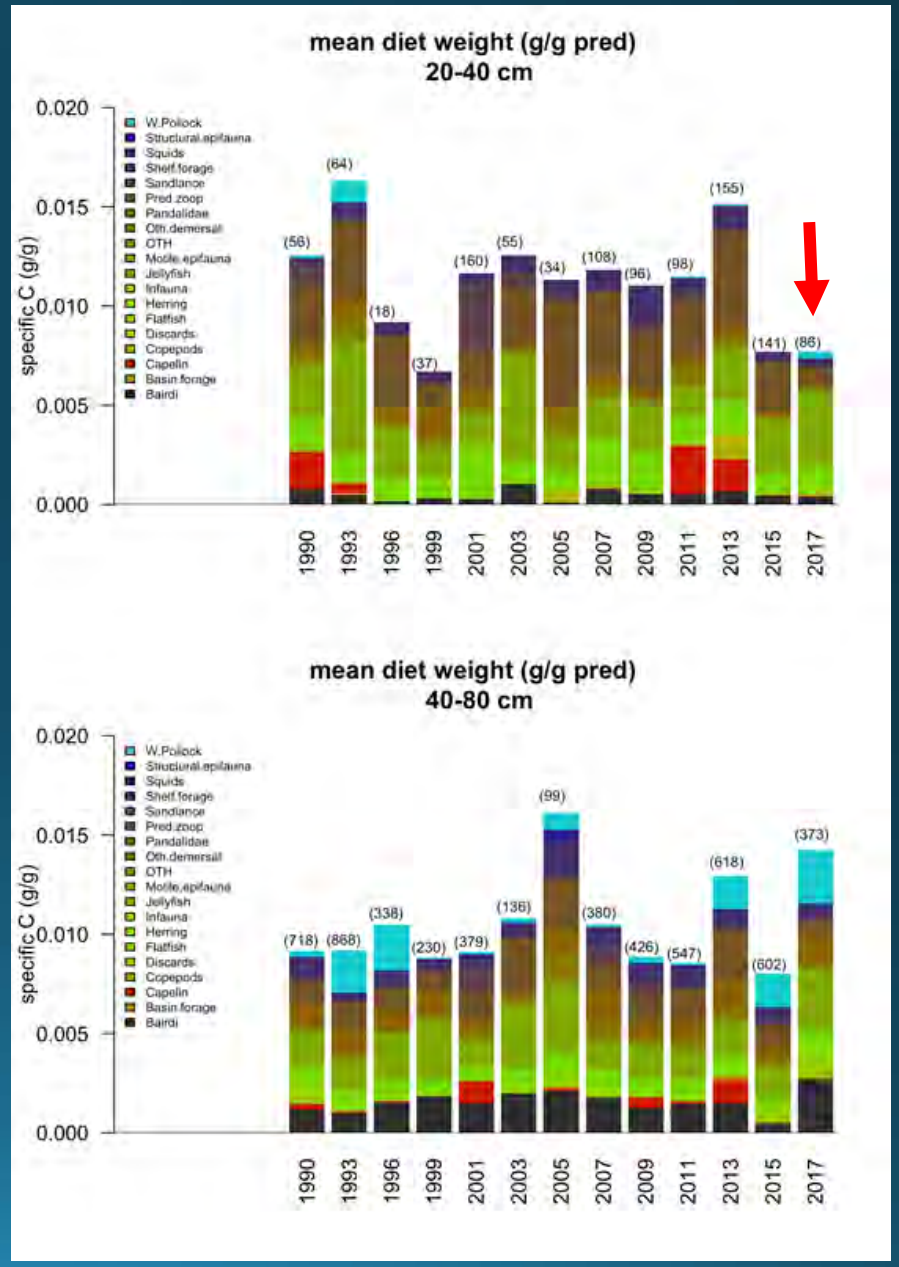




GOA Pacific cod
Future outlook

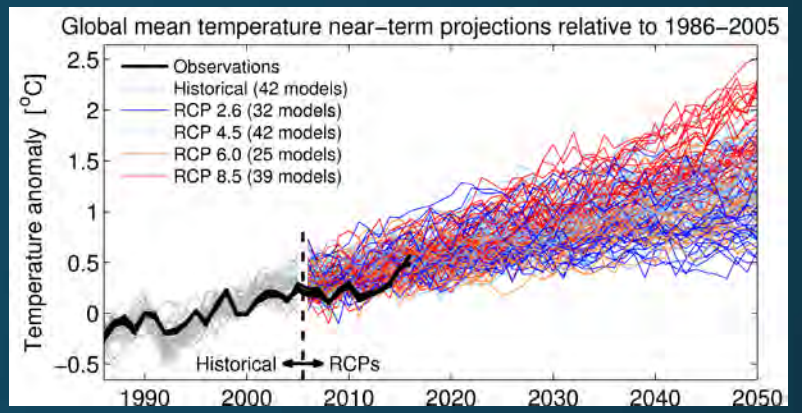
- 2017 stomach analysis
  - small fish remain below average
  - large fish (Pollock, Bairdi, Oth, shrimp ↑)

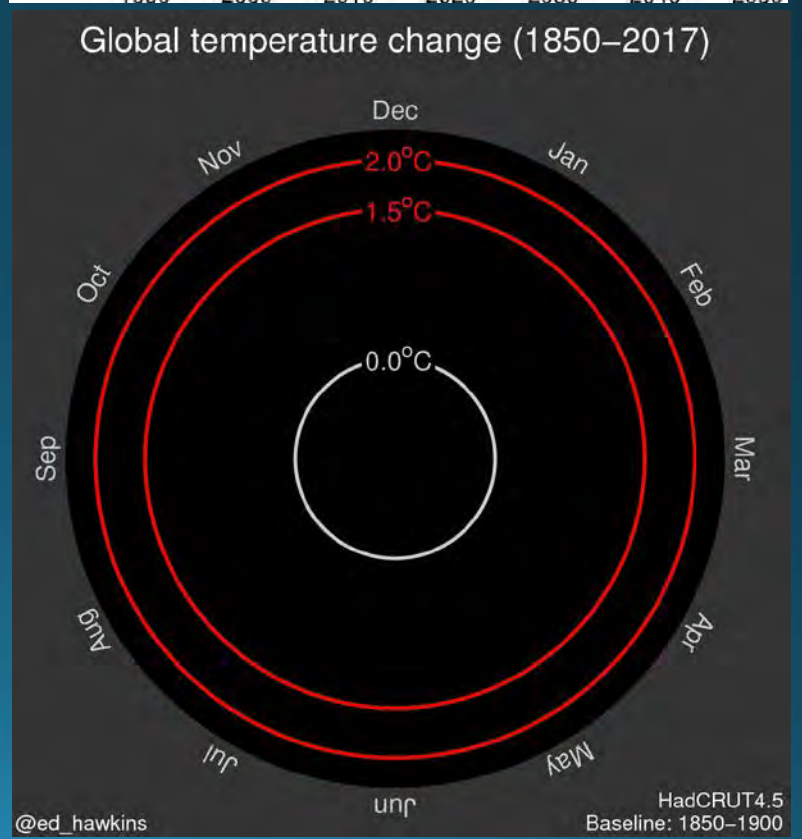




GOA Pacific cod Under climate change?

- Climate models suggest the endless summer conditions to be more common in the future.
- Pacific cod recruitment appears to be temperature limited.
- The long-term (+30 years) outlook doesn't look particularly good for GOA Pacific cod.





Questions?

Steven Barbeaux

Kirstin Holsman

Stephani Zador