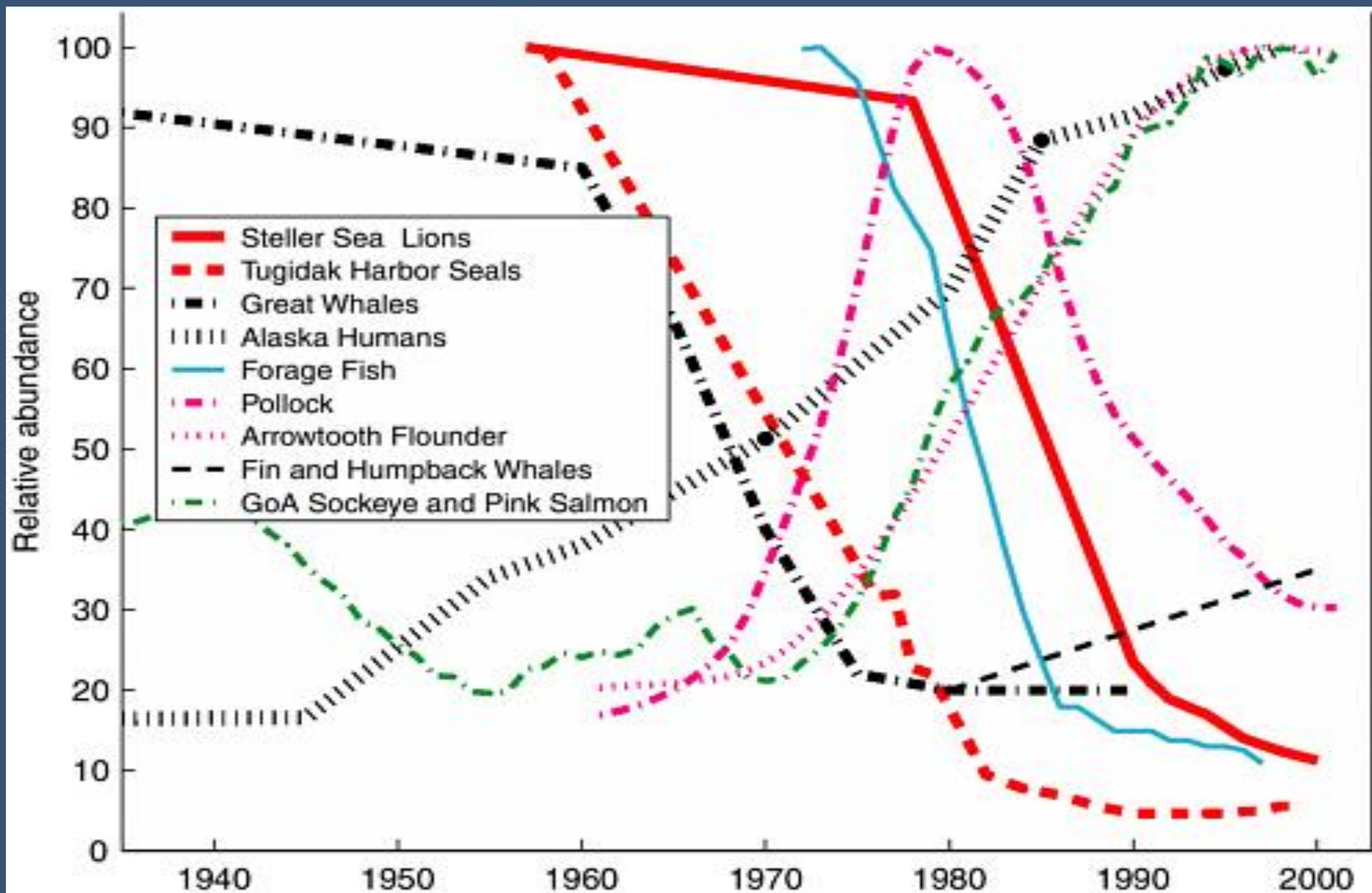


Harmful Algal Blooms in Alaska A Case for Declining Predators

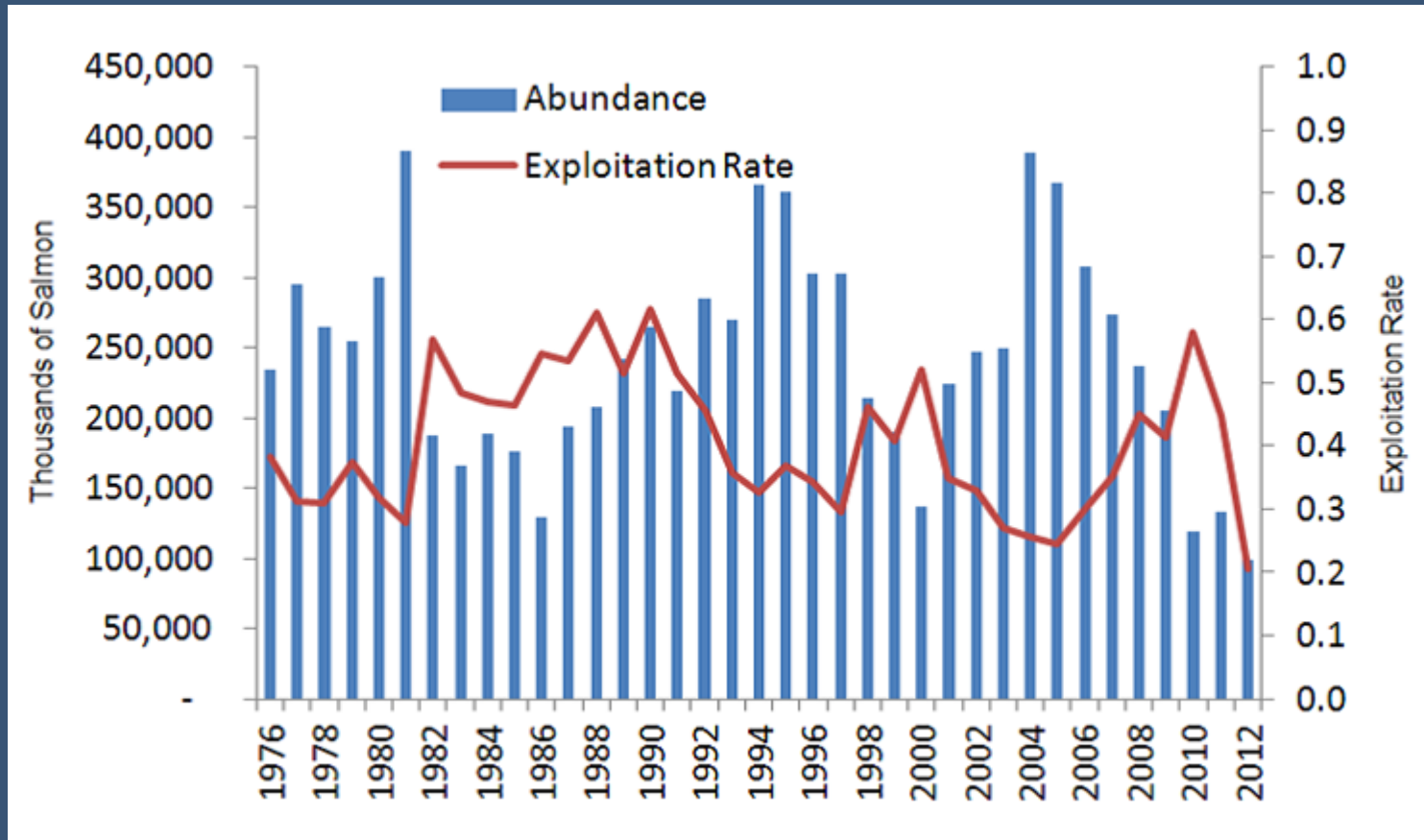
Bruce Wright

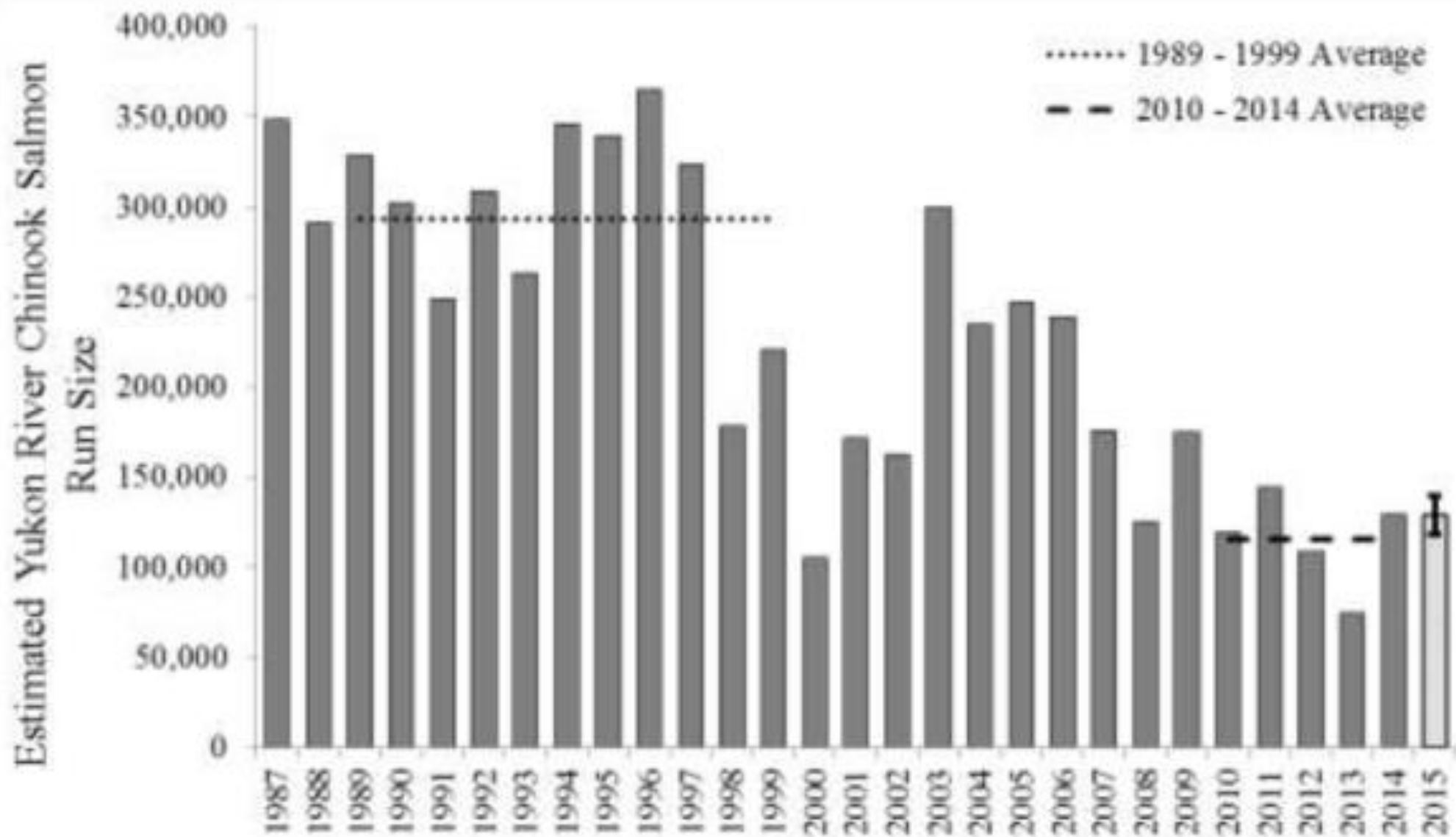
Senior Scientist, Aleutian Pribilof Islands Association

July 19, 2016



Kuskokwim River King Salmon





Note: The error bars associated with the 2015 bar represent the outlook range of 118,000 to 140,000.

300,000 Murres Starved





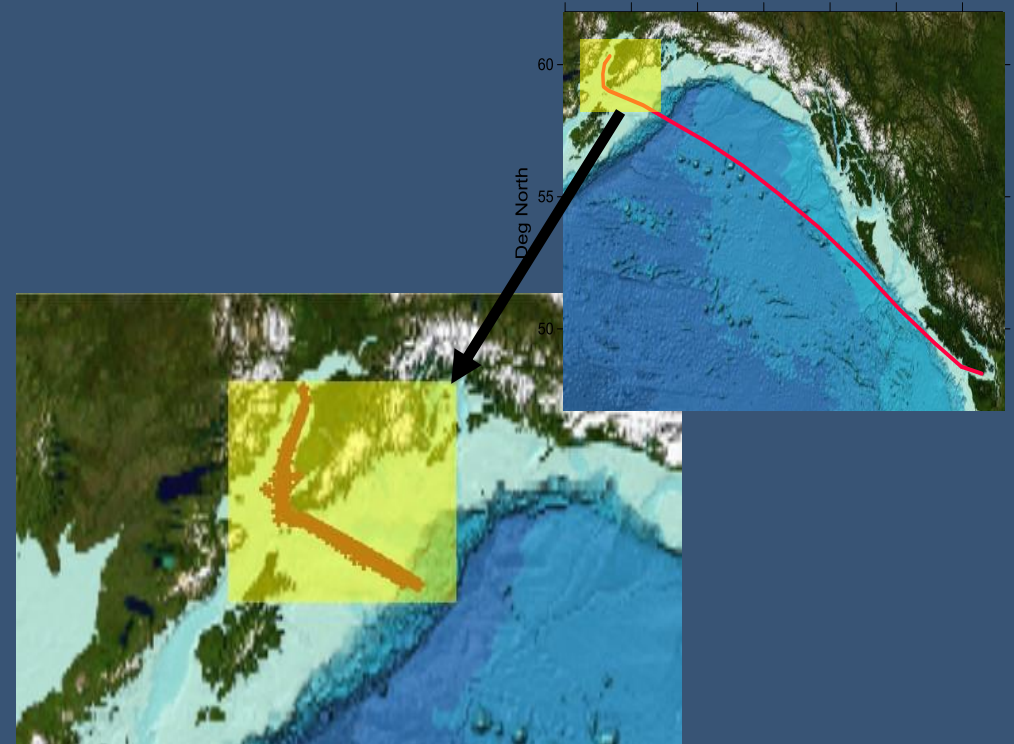
Continuous Plankton Recorder Data

Courtesy of Sonia D Batten, SAHFOS, Global Alliance of CPR Surveys

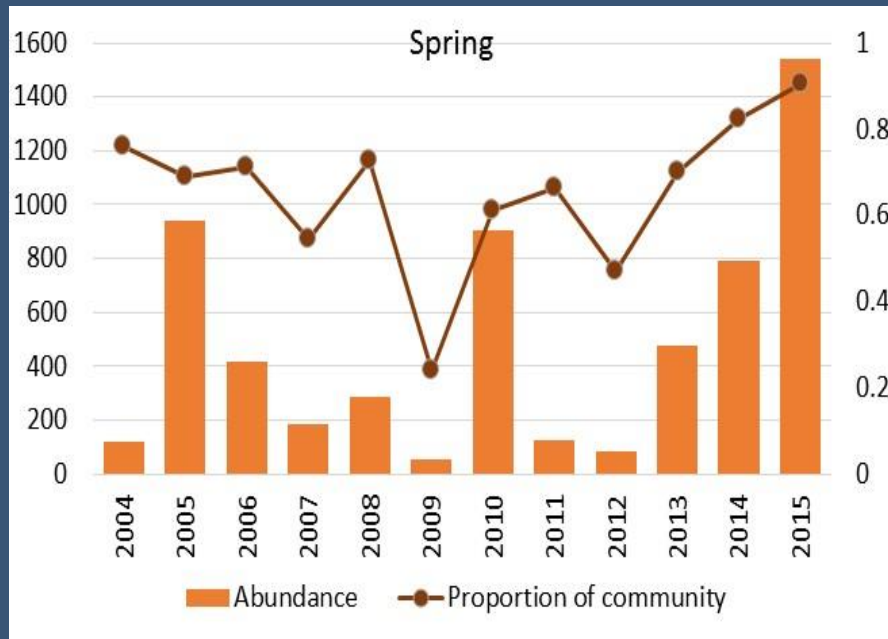
The Continuous Plankton Recorder samples a transect from Tacoma to Anchorage, typically monthly between April and September, 2004 to today.

Lower trophic level taxonomically resolved abundance data are available from samples each representing 18km of the transect, over the Alaskan Shelf, for Gulf Watch Alaska.

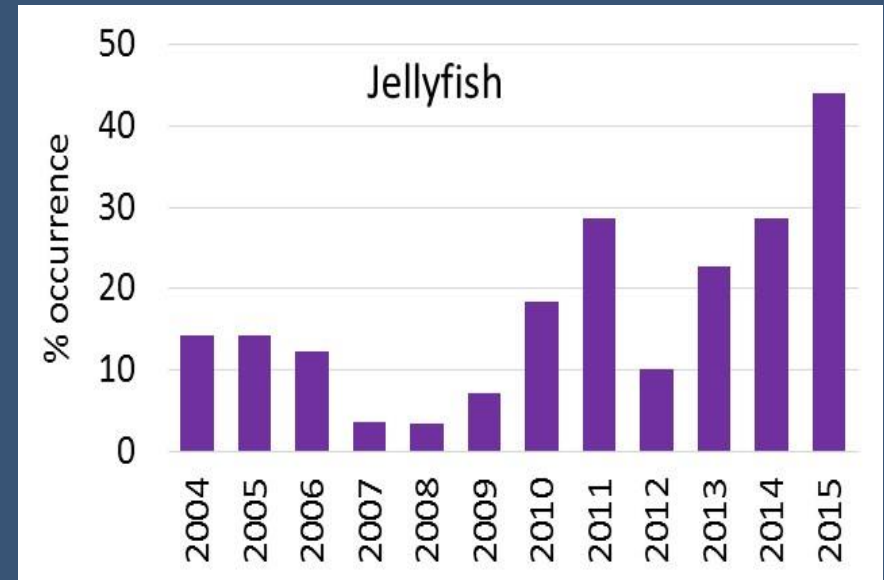
In these slides, data have been averaged over the whole shelf region.



Impacts of “The Blob” – zooplankton, Continuous Plankton Recorder Data

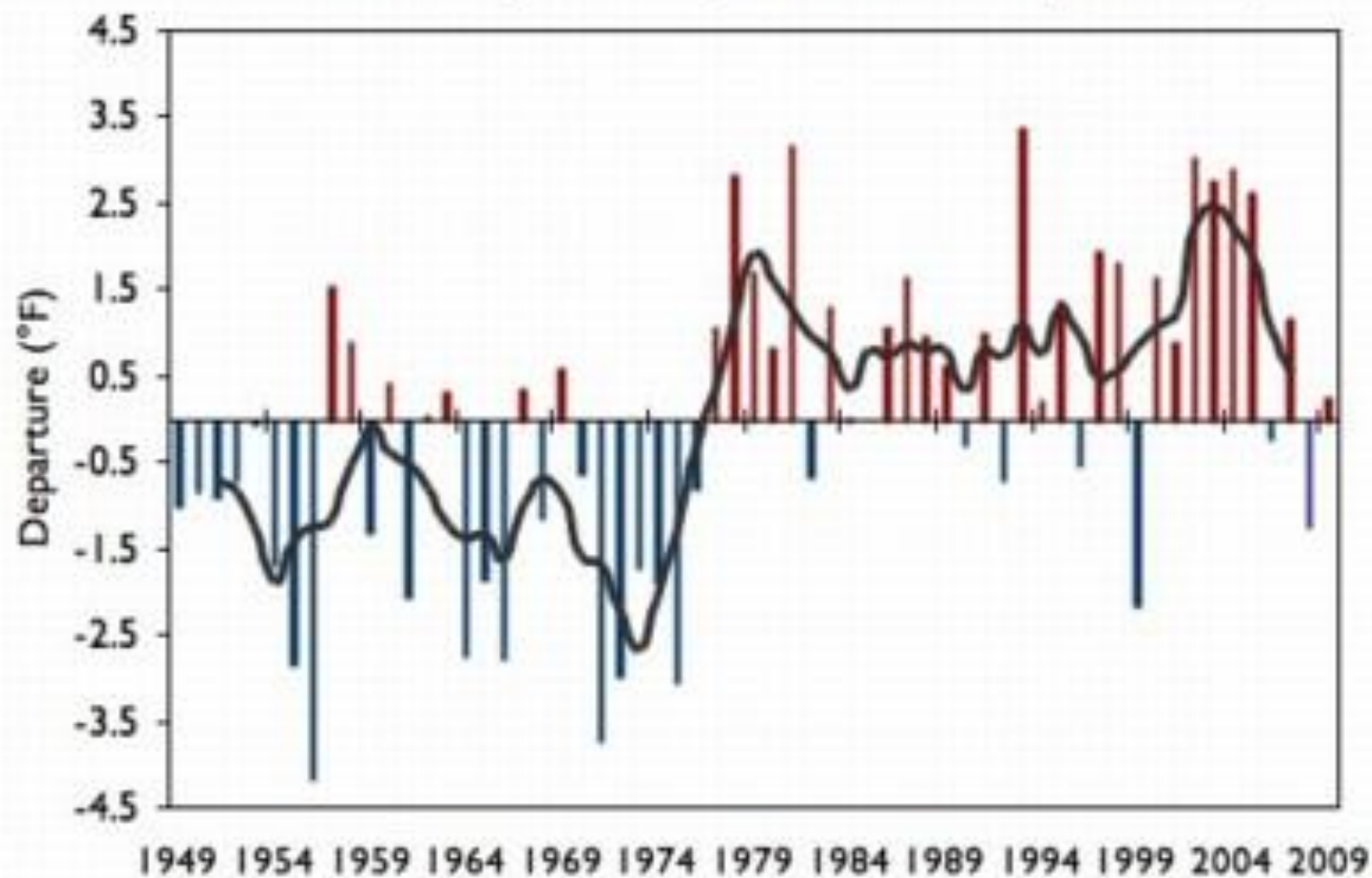


- Small copepods (< 2mm) were abundant in spring, especially in 2015.
- They comprised a record high proportion of the zooplankton community in both 2014 and 2015. i.e. although zooplankton was abundant it was biased towards smaller organisms.



- Jellyfish are only measured as presence/absence but occurrences were high in 2014, and higher again in 2015.

Mean Annual Temperature Departure for Alaska (1949 - 2009)



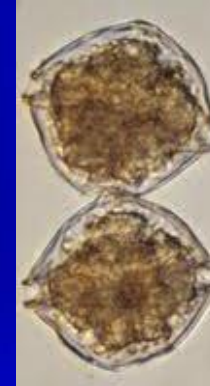


**Long - Term Changes In
The Gulf Of Alaska
Marine Ecosystem**

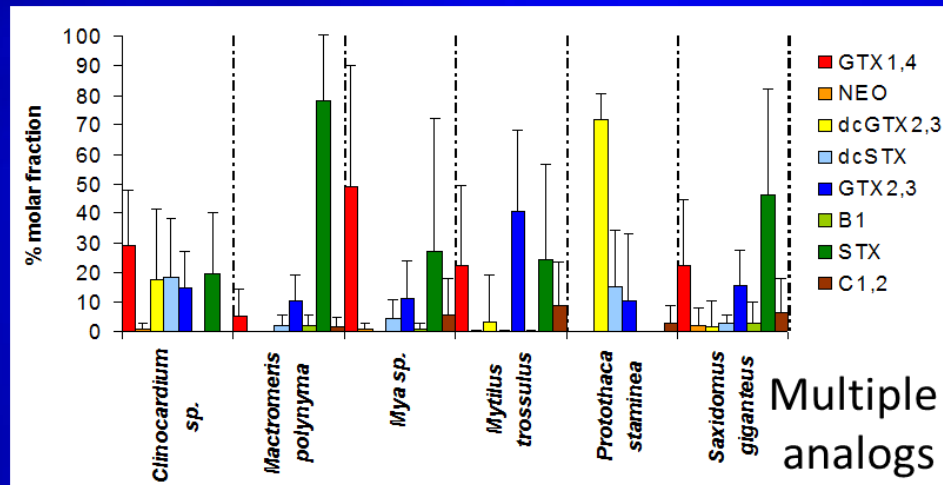
Paralytic Shellfish Poisoning (PSP)

- Caused by *Alexandrium* micro algae
- PSP is NOT red tide
 - Red is likely nontoxic *Noctiluca*
- PSP is a complex toxin
- FDA limit 80

A. fundyense



Noctiluca sp



In 2008 Ray RaLonde and Wright asked, “is domoic acid an emerging toxin?” We predicted it was coming (see North Pacific Research Board report **0821 Using blue mussels as an indicator species for testing domoic acid toxicity in subsistence bivalve harvest**).

- Pseudo-nitzschia, a diatom
- Responsible for Amnesic Shellfish Poisoning (ASP)
- FDA limit 20



Why the toxins? To control the grazers.

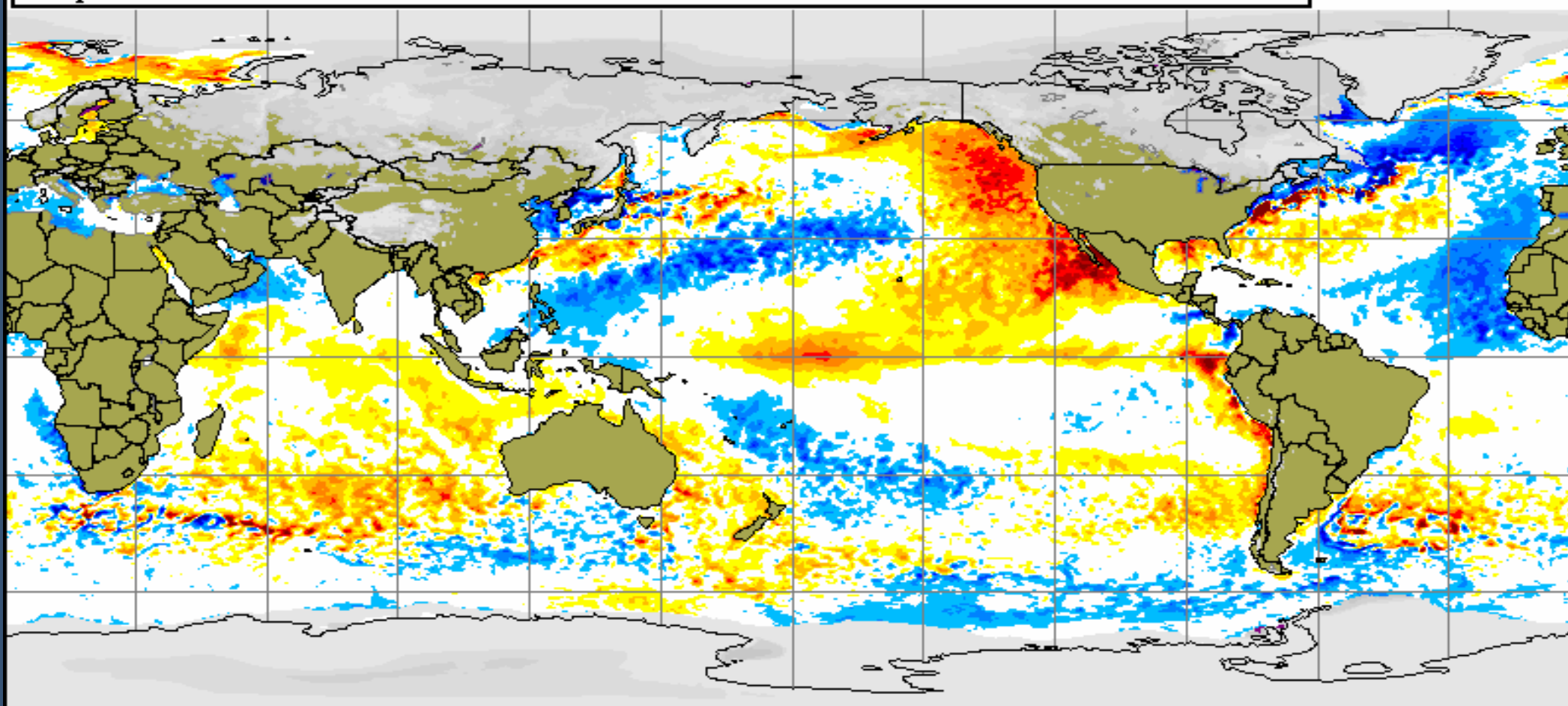
Hong et al. 2012: “algal toxins may influence the copepod’s feeding behavior, and suggest how some harmful algal species may alter top-down control exerted by grazers like copepods.”

Waggett et al. 2012: “Analysis indicates that (algal toxins) impacts grazer populations via multiple synergistic mechanisms: (1) decreased ingestion rates, (2) decreased egg production, and (3) increased mortality of copepods through a combination of toxicity and nutritional inadequacy.”

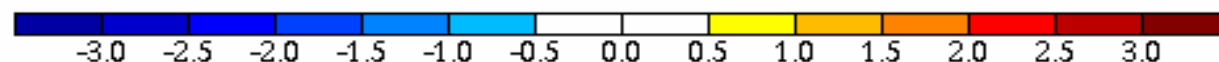
Roncalli 2016: “These results suggest that blooms of *Alexandrium fundyense* in the Gulf of Maine may be an environmental challenge for (copepod) populations, with a potential negative effect on copepod recruitment.”

Global sea surface anomaly and snow cover
09 Apr 2015

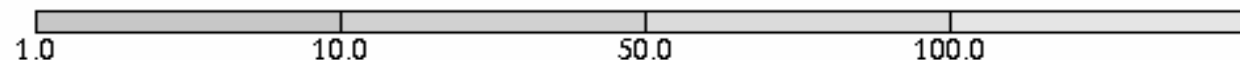
Anomalie de la température de la mer et épaisseur de la neige
09 Avr 2015



Sea surface temperature anomaly / Anomalie de la température de la mer (°C)



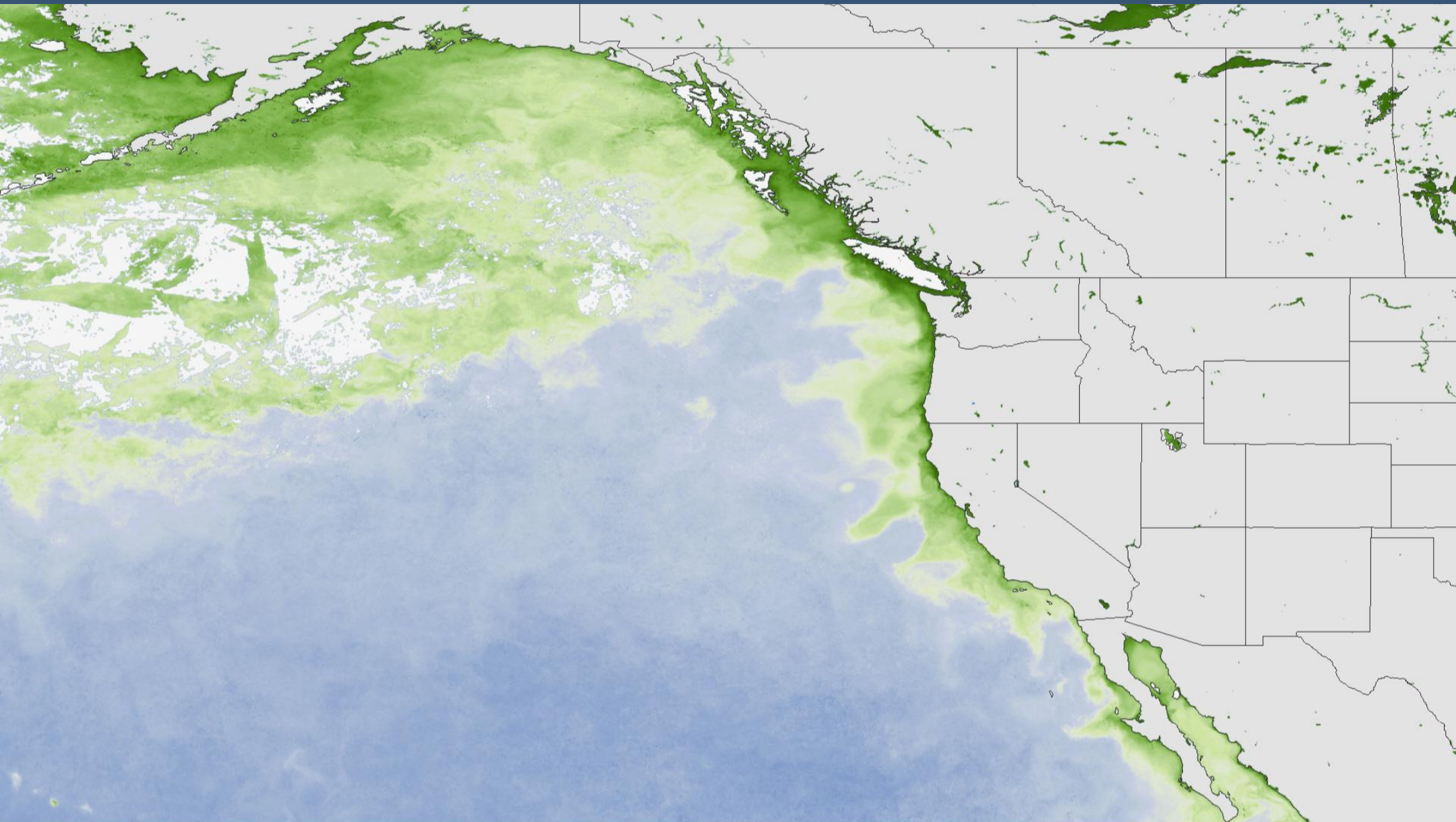
Snow depth / Épaisseur de la neige (cm)



Uncovered sea ice
Glace marine à découvert
Climatologie 1995-2009 Climatologie



CMC Environnement Canada
CMC Environnement Canada

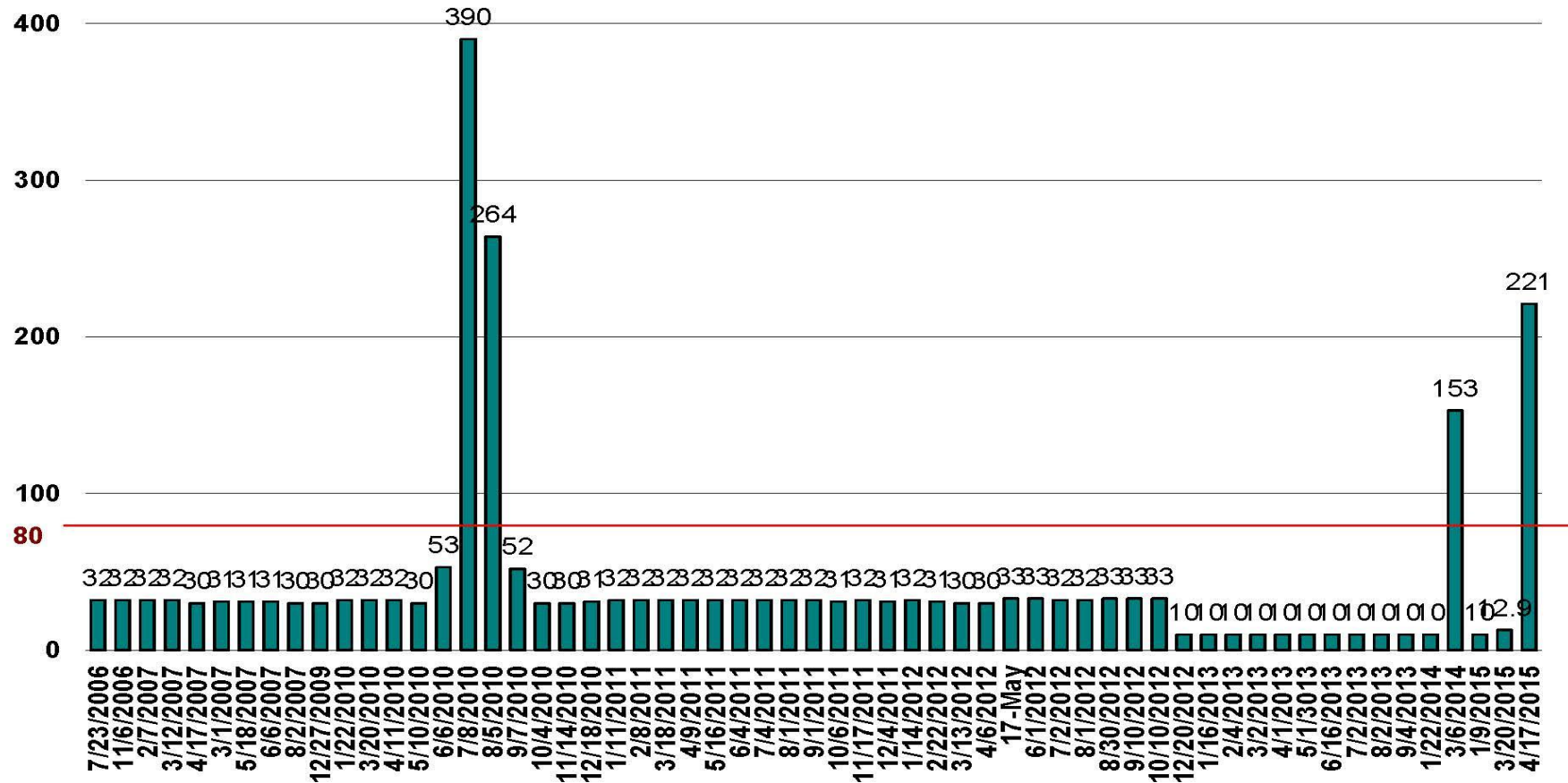


July 2015

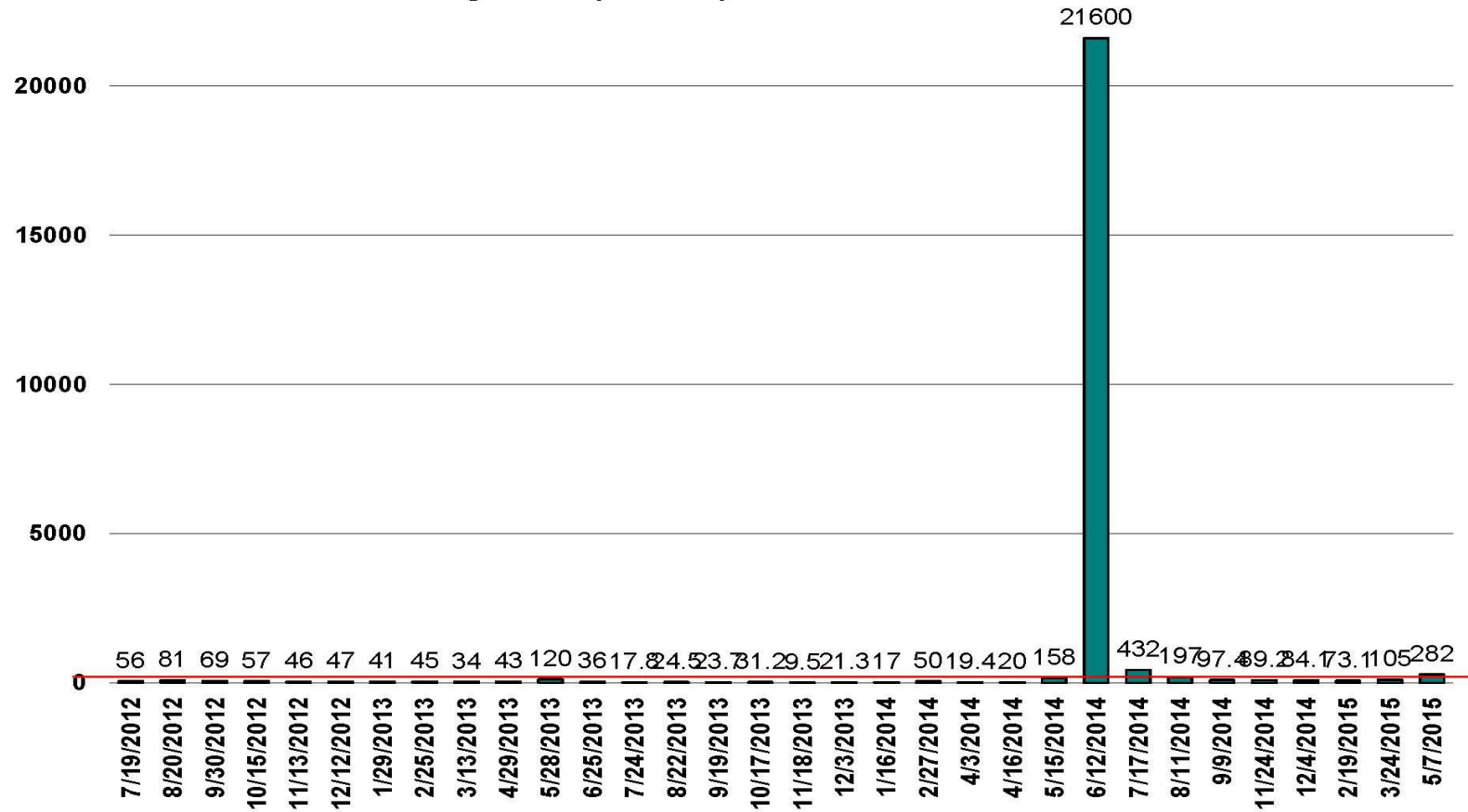


NOAA Climate.gov
Data: Suomi NPP
NOAA View

Akutan (Trident Church) Mussels PSP Results



Viking Cove (Haines) Mussels PSP Results

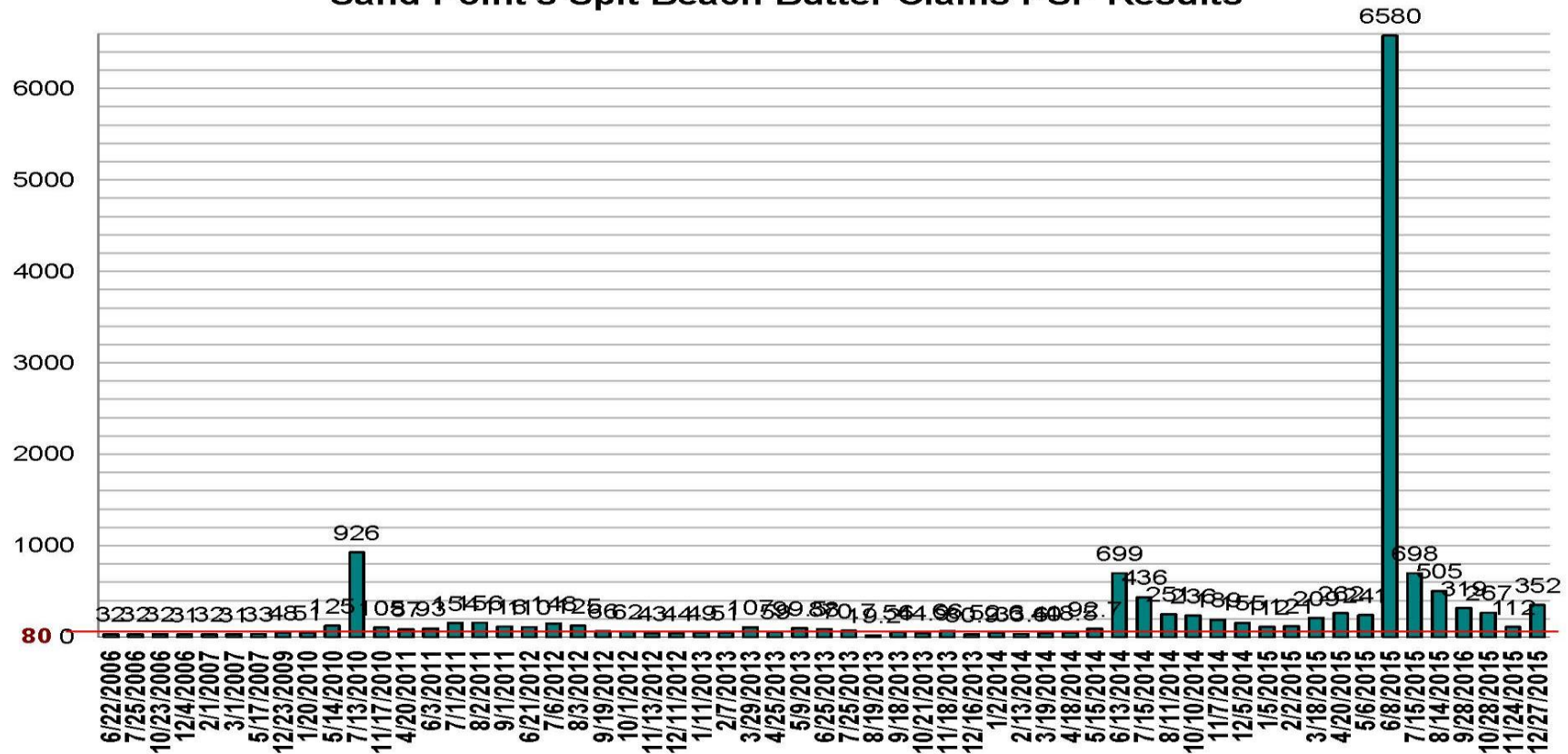


King Cove: Black-legged kittiwake collected 7/21/15

Domoic Acid <0.049 mg/kg

Paralytic Shellfish Toxins <10.1 ug/100g

Sand Point's Spit Beach Butter Clams PSP Results



Cook Inlet die-off fall 2015 *Thysanoessa spinifera*.
High levels of PSP and low levels of DA.





Conclusions

- *Adding to and Improving Scientific Understanding*
- Educate people of the current research findings and risks
- *Strengthen long-term HAB monitoring activities*
- Monitor HABs in top predators
- Track HABs in prey species
- Develop advances in remote sensing
- *Develop, improve, and validate HAB models*
- Model HABs-caused declines in top predators
- Predictive HABs models for Alaska marine ecosystems