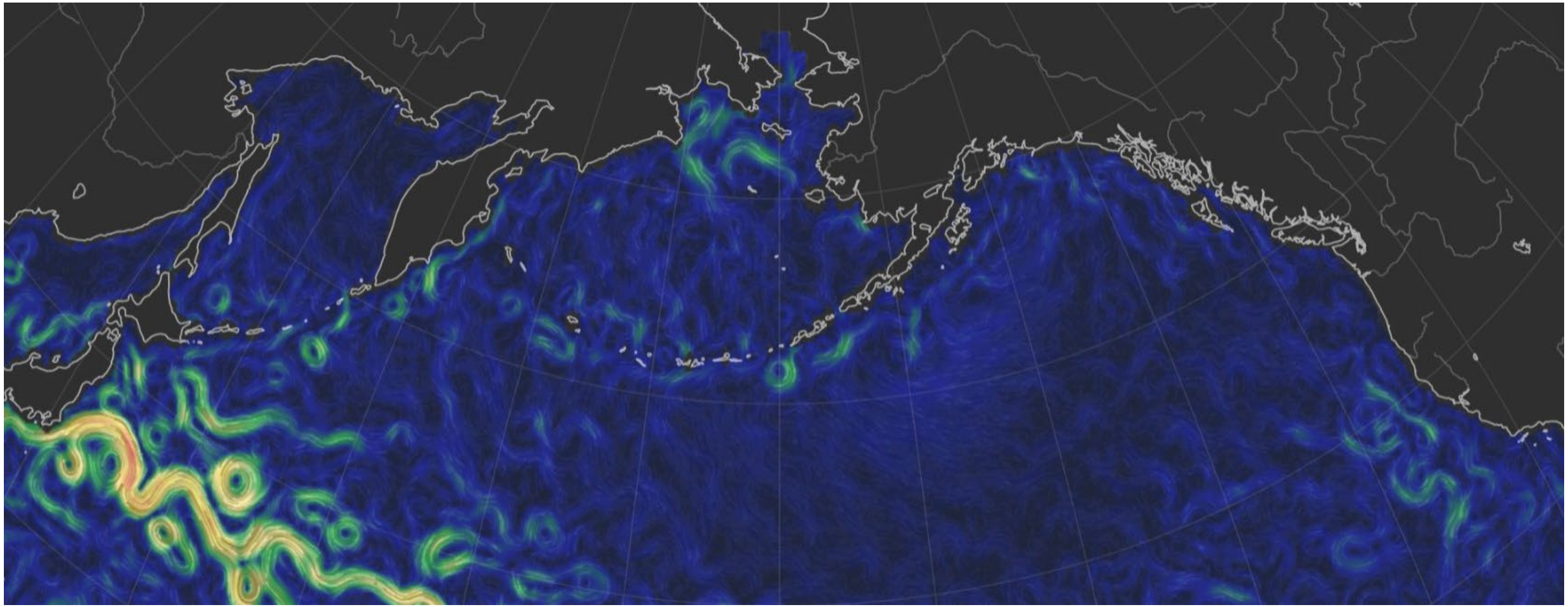


Dr. Katie Howard,
Fisheries Scientist

BOF Hatchery Committee
3/23/2022

An Introduction to the Salmon Ocean Ecology Program and Overview of Scientific Understanding of Salmon Competition at Sea

Salmon Ocean Ecology Program (SOEP)

Who We Are:

- Initiated over 1 year ago
- Statewide Fisheries Scientist, AYK Marine Biologist, Statewide Fishery Biologist 2

What We Do:

- Understand the marine life of Alaskan salmon
- Use this information to assist fishery management decision making
- Answer pressing questions about what drives salmon population dynamics

How We Do It:

- Build capacity and collaborations
- Support marine research programs
- Work to fill knowledge gaps

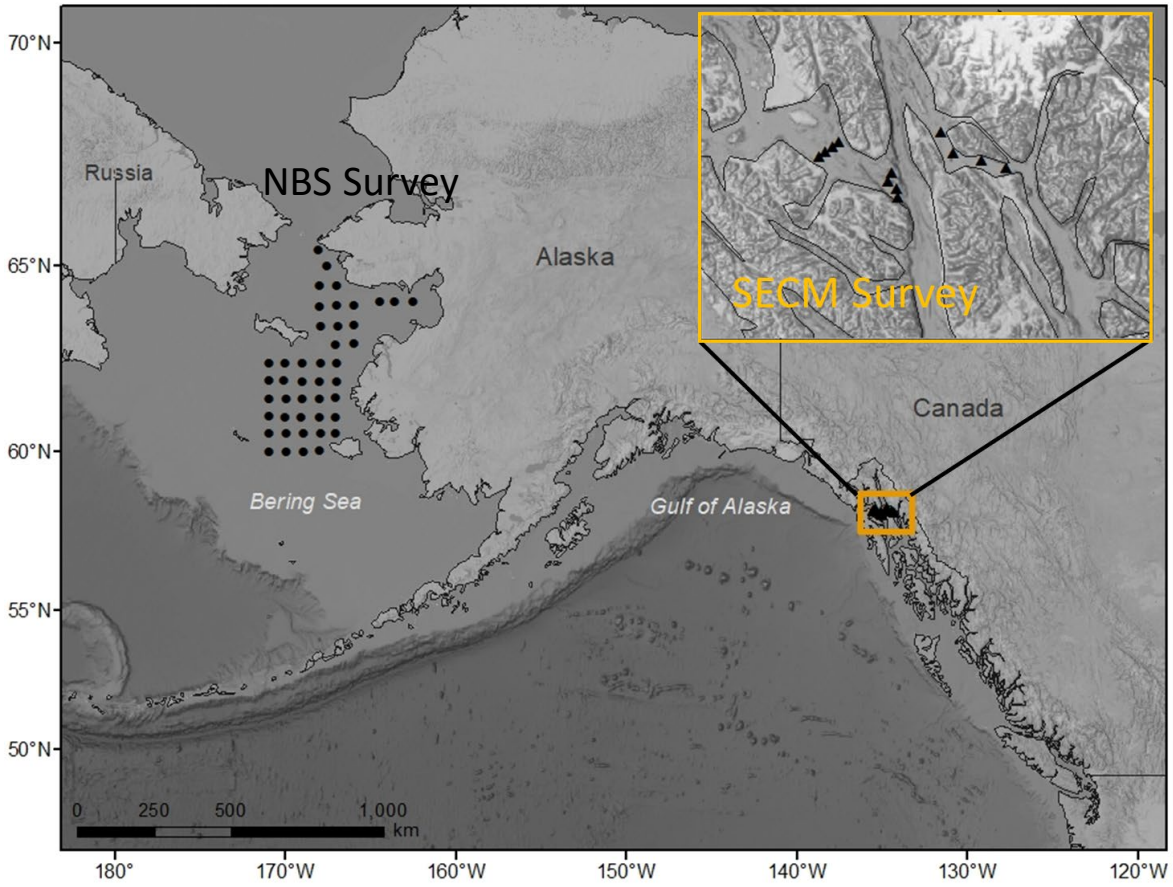
How We Do It

Northern Bering Sea Ecosystem Survey (NBS; NOAA and ADF&G):

- Assesses juvenile Yukon River and Norton Sound salmon stocks since 2002.
- Forecast Yukon River Chinook salmon (3-years) and pink salmon (next year). Efforts underway to create similar forecasts for chum salmon.

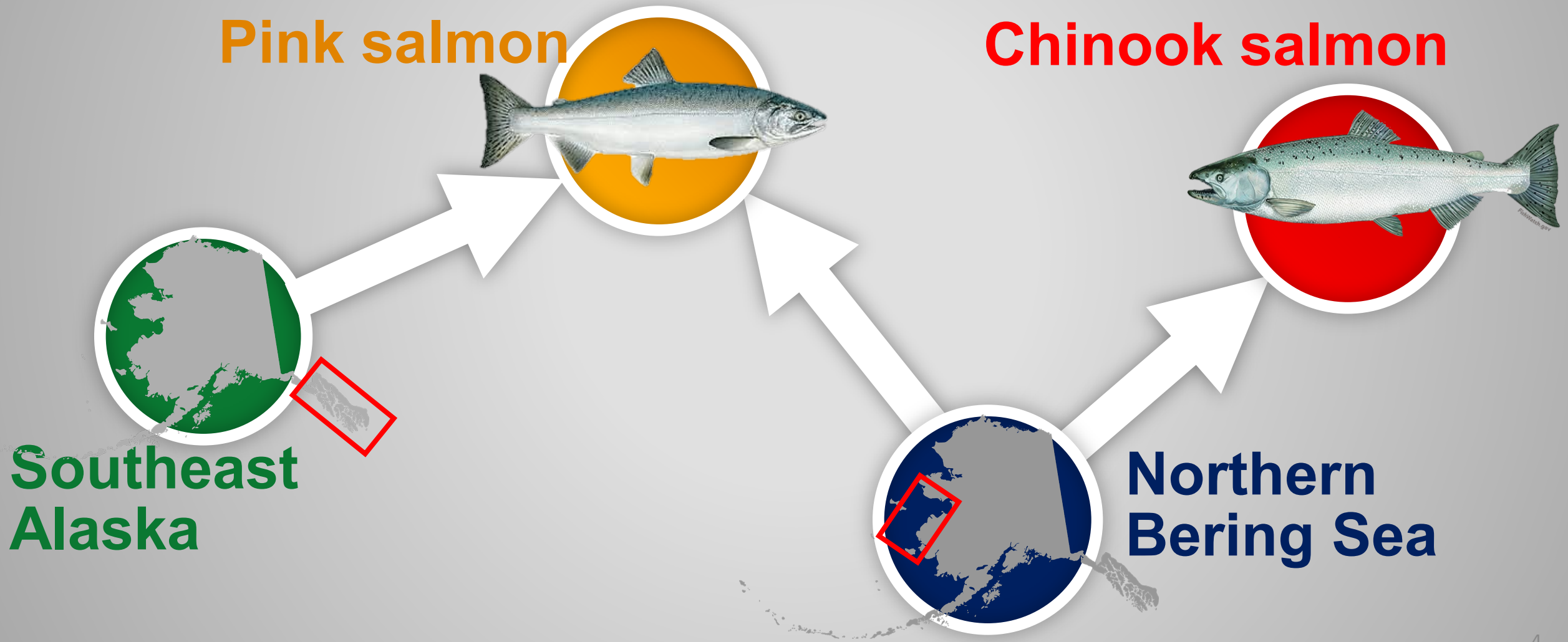
Southeast Alaska Ecosystem Monitoring (SECM; NOAA & ADF&G)

- Assesses juvenile Southeast Alaska salmon stocks since 1997.
- Forecast SEAK pink salmon. Efforts underway to create similar forecasts for other species.

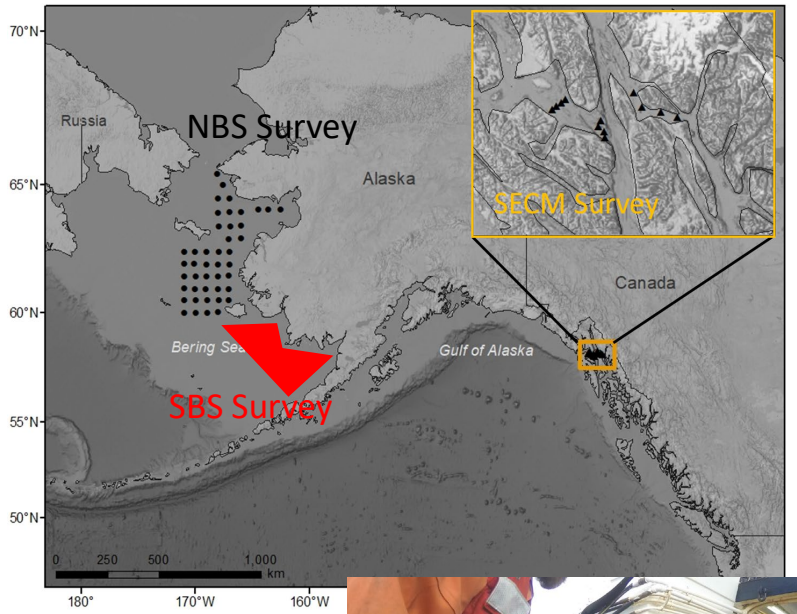


Both surveys provide new information on early marine ecology of juvenile salmon and vital ecosystem data

1. Long term monitoring of Alaskan salmon at sea
2. Identify survival bottlenecks that affect future run sizes
3. Forecast run sizes (1 to 3 years in the future)



How We Do It

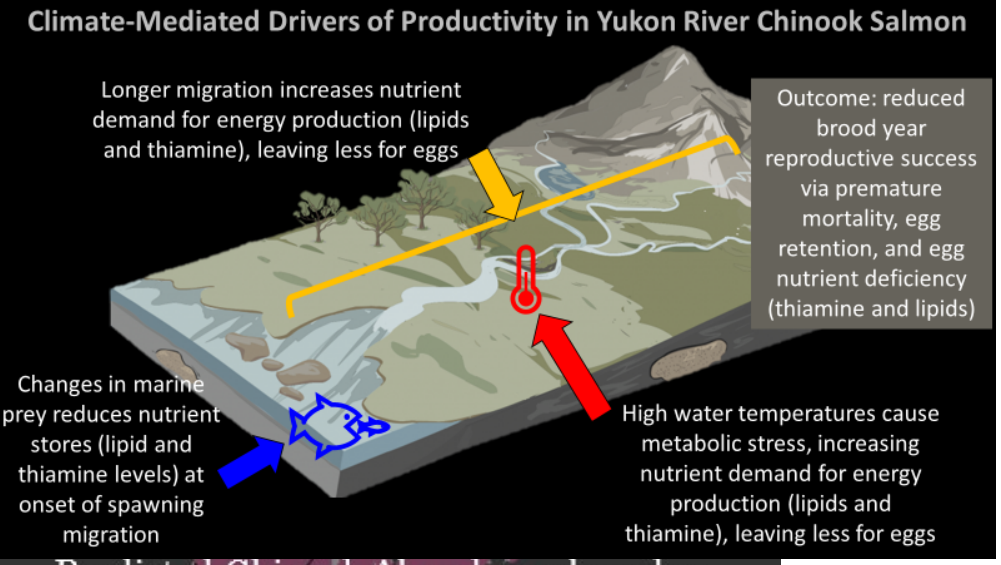


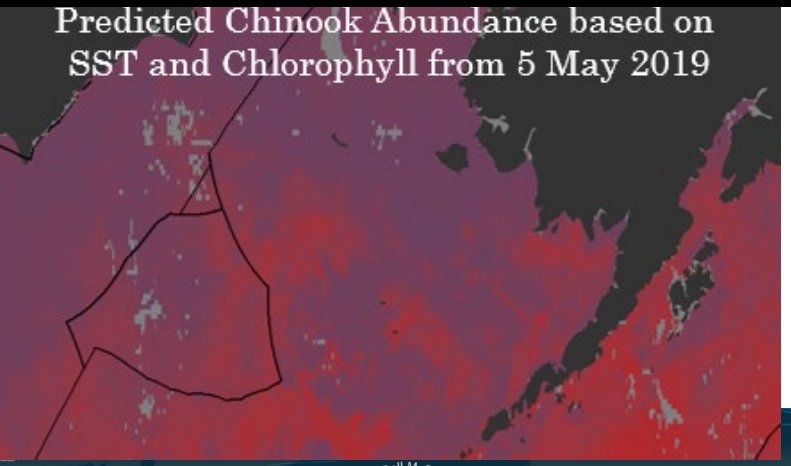
Southern Bering Sea Survey (SBS; ADF&G):

- Modeled after NBS survey
- Feasibility project to assess juvenile Chinook salmon from the Kuskokwim River and Bristol Bay.
- Looking for continued funding and larger vessel to support this work.

Salmon shark tagging (ADF&G):

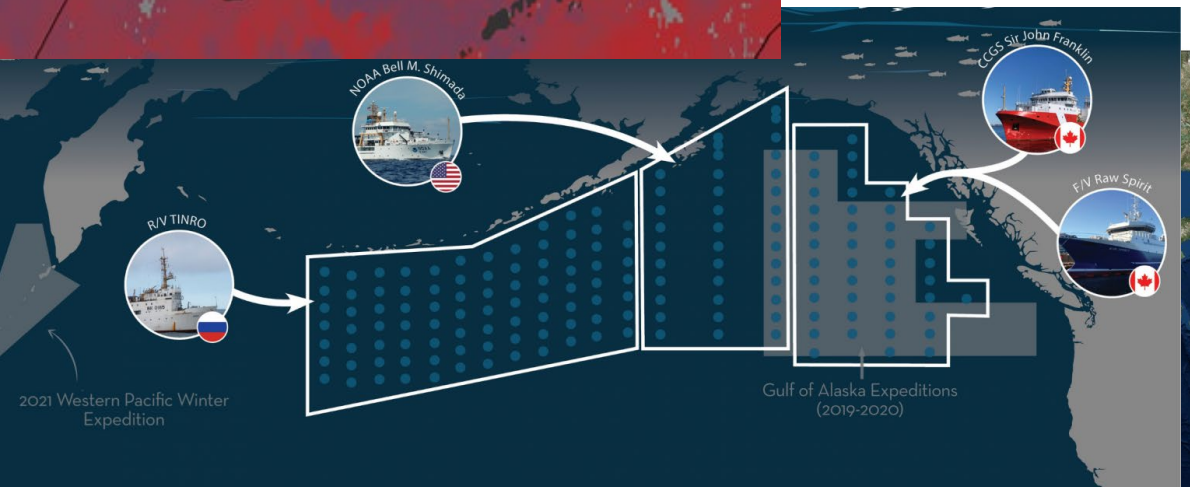
- Satellite transmitting tags used to assess behavior & migration patterns over multiple years
- Assess predator overlap with salmon

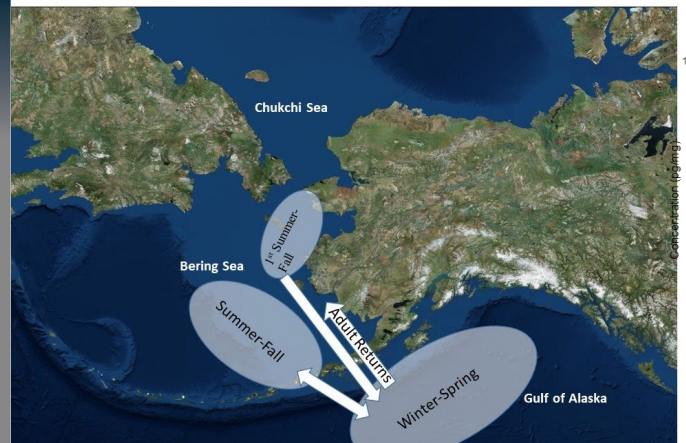


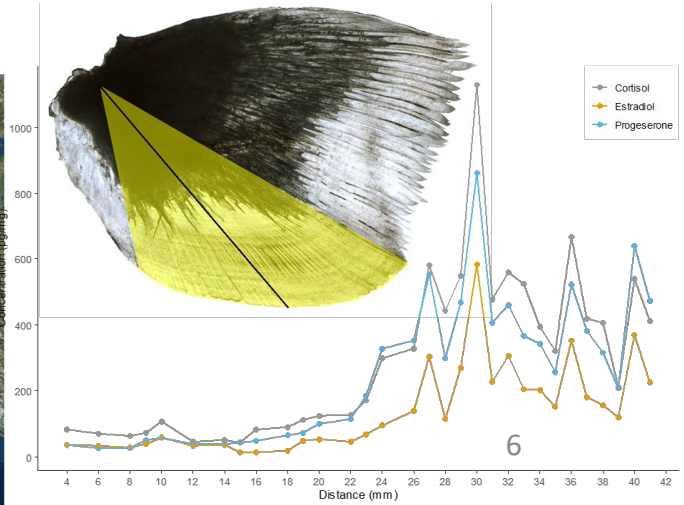


How We Do It

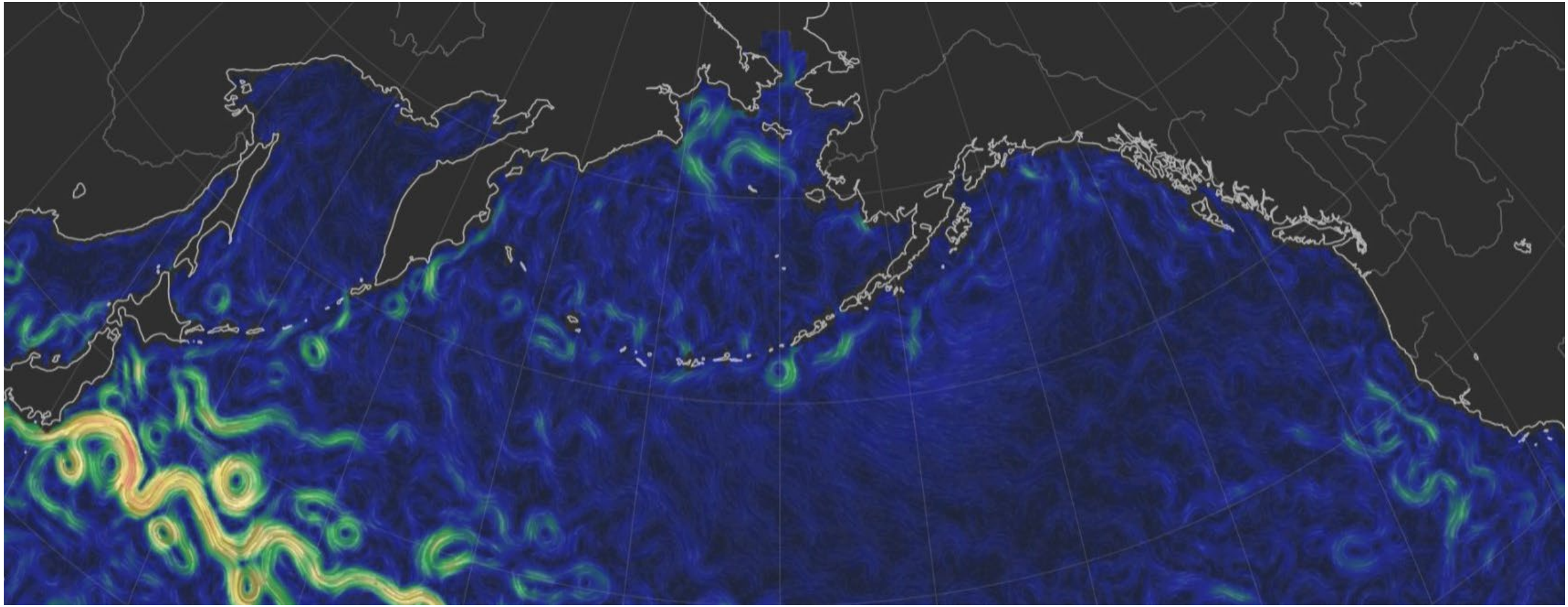
- 2022 Pan-Pacific Expedition (International Year of the Salmon – USA, Canada, Japan, Korea, Russia)
- Where have all the Chum salmon gone? An assessment of marine critical periods for Arctic Yukon Kuskokwim chum salmon in a changing environment (NOAA & ADF&G)
- Exploring Linkages Between a Changing Climate and Productivity of Yukon River Chinook Salmon (ADF&G, NOAA, USGS and YRDFA)
- Species distribution models for Chinook salmon in the Bering Sea (ADF&G, UAF, NOAA)
- Determinants of life history in Yukon River chum salmon (ADF&G and Baylor University)







A Brief Overview of Scientific Understanding of Salmon Competition at Sea



“resource vacuum and altered community composition left behind as pink salmon migrate…. suggest that they have a destabilizing effect on the ecosystem” – Springer & van Vliet 2014

“The consistent pattern of findings from multiple regions of the ocean provides evidence that interspecific competition can significantly influence salmon population dynamics and that pink salmon may be the dominant competitor among salmon in marine waters.”

“All these data suggest that though salmon species consume a large amount of food, especially during periods of high abundance, their role in trophic chains is far from being highly important.”

“the potential for food resources to limit salmon production across the North Pacific continues to be vigorously debated”

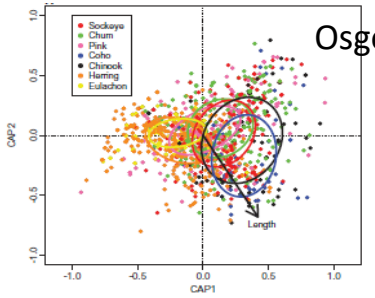
“This suggests that hatchery production has contributed to the depressed productivity of sockeye salmon in British Columbia, some of which have recently been assessed as at risk of extinction”

“Salmon input into the trophic structure of pelagic communities is generally low, and an additional several hundred thousand tons of artificially reared salmon cannot significantly change this trophic structure.”

“Unfortunately, it is difficult to argue and refute fantasies of this kind and sometimes its impossible because of their absurdity.” – Shuntov et al. 2017

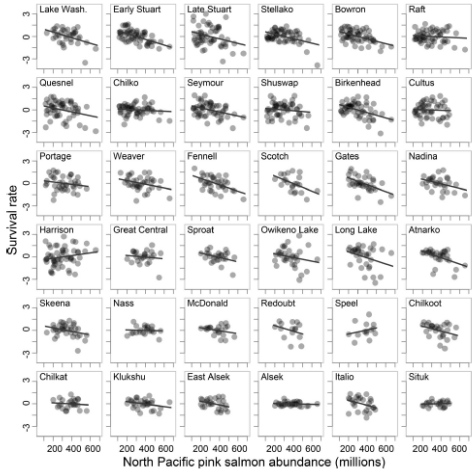
Scientific Literature on Interspecific Salmon Competition

1. Diet overlap and diet shifts



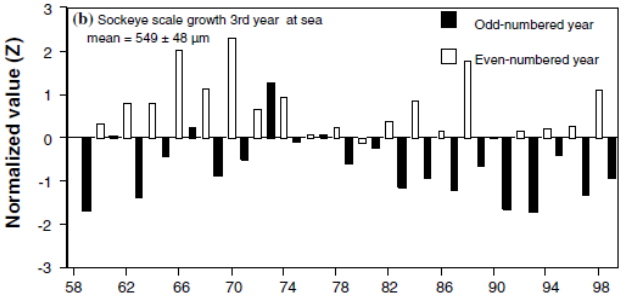
Osgood et al. 2016

2. Asynchronous abundance, productivity, or survival trends (one species ↑ when the other is ↓)



Ruggerone & Connors 2015

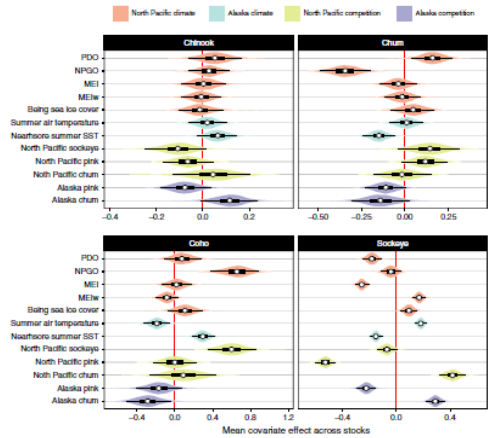
3. Competitor abundance associations with growth patterns (when abundance of a species is ↑, growth of another species is ↓)



Ruggerone & Nielsen 2004

4. Competitor abundance associations with age at maturity patterns (when abundance of a species is ↑ age at maturity of another species is ↓)

Oke et al. 2020



Opposing Perspectives

Convinced

- Evidence generally based on correlations; direct assessment not required/possible
- Evidence found consistently across multiple situations
- Salmon-centric
- Odd/even lifecycle pattern (pink salmon) viewed as natural experiment
- Largely draws from English-written journals

Not Convinced

- Assessing cause should include direct evidence for/against causal links
- Evidence of no relationships are often ignored or not published
- Pelagic ecosystem-centric
- Alternative 2-year patterns should be considered (e.g., other species like squid)
- Draws from English and non-English language journals

“Correlative evidence is strongest when

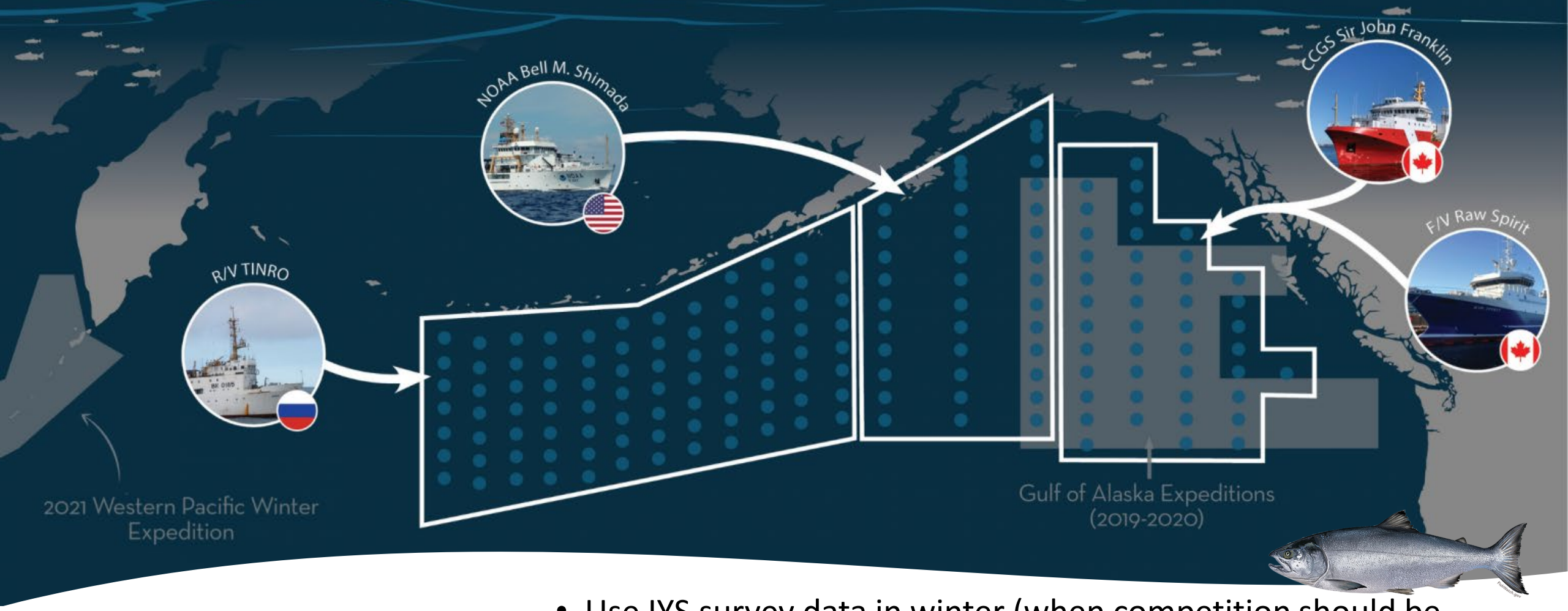
(1) correlation is high,

(2) it is found consistently across multiple situations,

(3) there are not competing explanations, and

(4) the correlation is consistent with mechanistic explanations that can be supported by experimental evidence”

(Hilborn 2016)

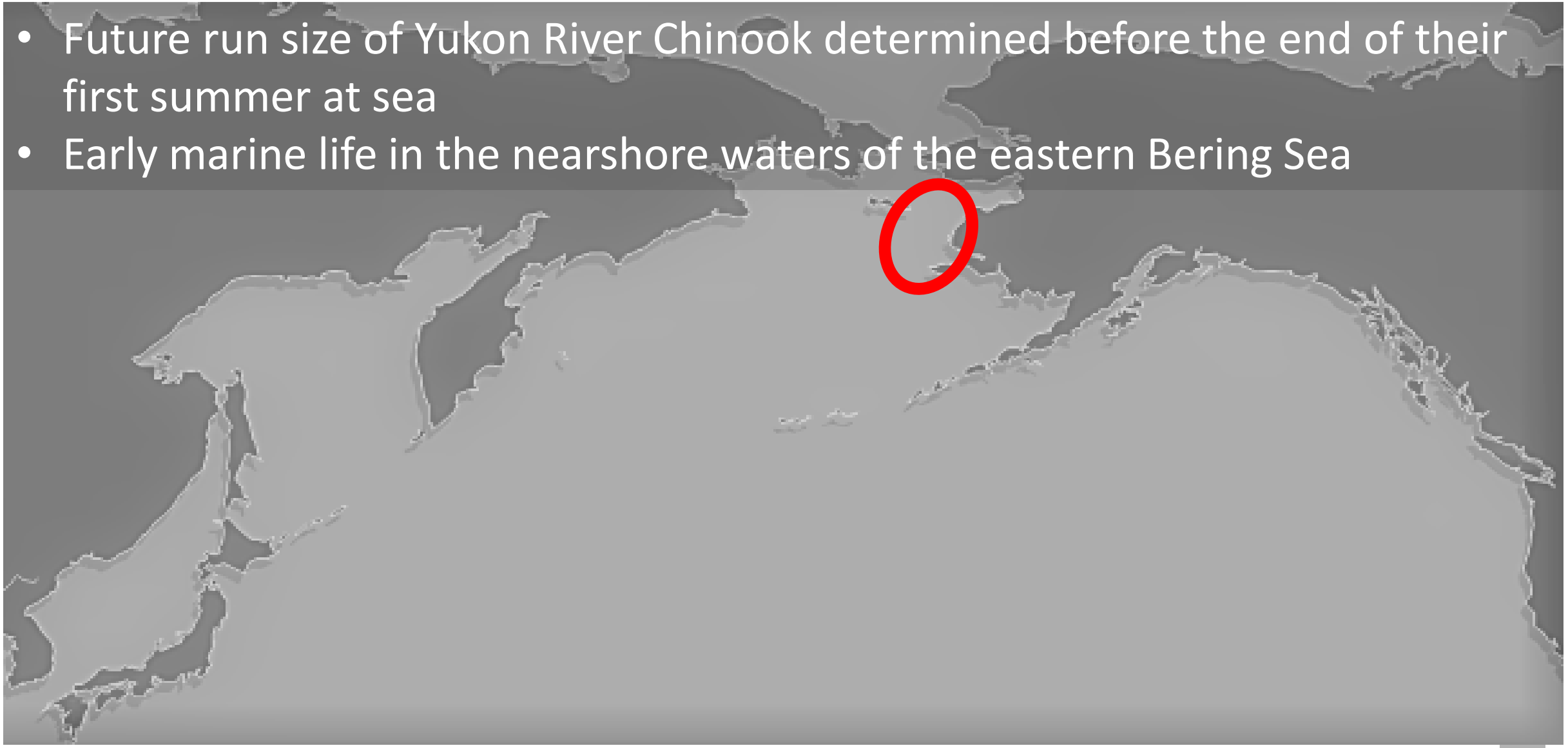


New Research/Analyses to Address Data Gaps

- Use IYS survey data in winter (when competition should be highest) to directly measure spatial overlap and trophic competition between AYK chum and other species/stocks (pending funding)
- Improve statewide abundance estimates for AK salmon (ADF&G delegation to NPAFC)

Complementary Data to Evaluate Key Drivers of Abundance

- Future run size of Yukon River Chinook determined before the end of their first summer at sea
- Early marine life in the nearshore waters of the eastern Bering Sea



Complementary Data to Evaluate Key Drivers of Abundance

- Future run size of Yukon River Chinook determined before the end of 1st summer at sea
- Early marine life in the nearshore waters of the eastern Bering Sea
- Hatcheries ▲

Because adult abundance determined before end of juvenile stage & because hatchery interactions in this location very unlikely ➡ Hatchery fish impacts on Yukon Chinook abundance is also unlikely

THANK YOU

kathrine.howard@alaska.gov

https://www.facebook.com/ADFGUnderseaWorldOfSalmonAndSharks