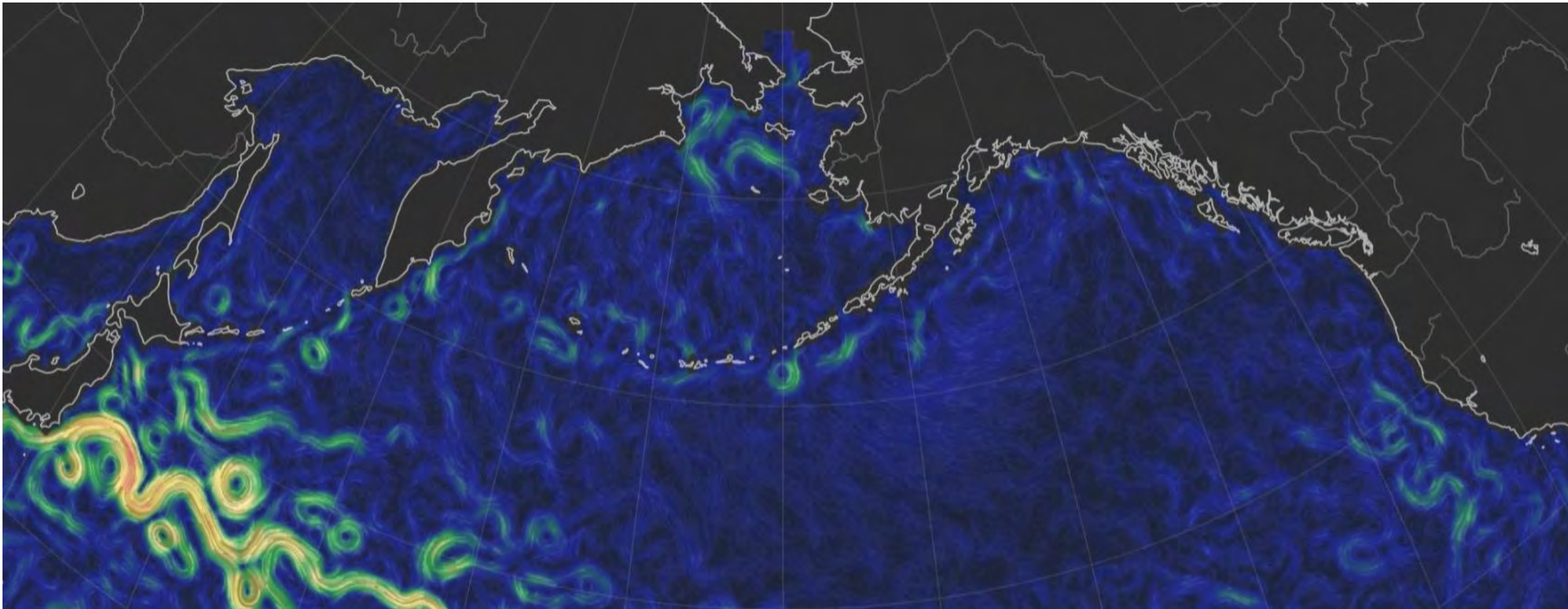


Dr. Katie Howard,  
Fisheries Scientist

BOF Hatchery Committee  
10/14/2023

## **Overview of Scientific Understanding of Salmon Competition at Sea and an Update on Research**

# 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.”

“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”

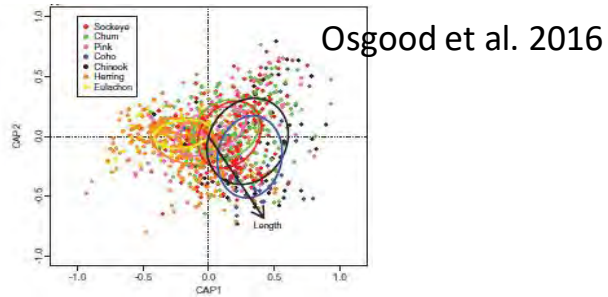
“All these data suggest that though salmon species consume a large amount of food, especially during periods of high abundance, their role in trophic chains is far from being highly important.”

“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.”

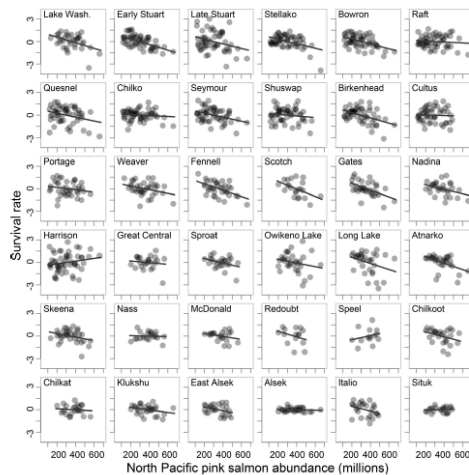
“Unfortunately, it is difficult to argue and refute fantasies of this kind and sometimes its impossible because of their absurdity.” – Shuntov et al. 2017

# Scientific Literature on Interspecific Salmon Competition

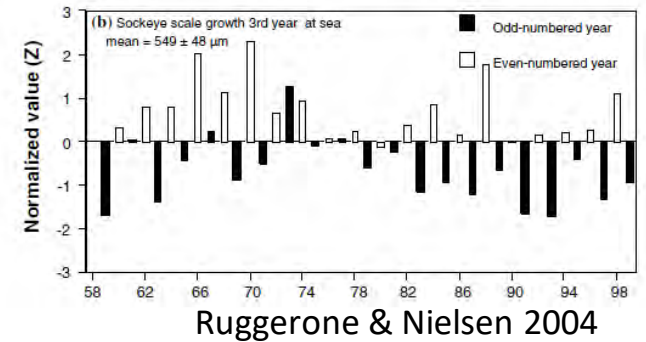
## 1. Diet overlap and diet shifts



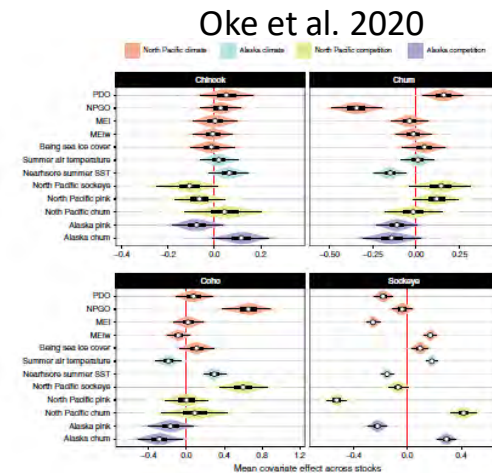
## 2. Asynchronous abundance, productivity, or survival trends (one species $\uparrow$ when the other is $\downarrow$ )



## 3. Competitor abundance associations with growth patterns (when abundance of a species is $\uparrow$ , growth of another species is $\downarrow$ )



## 4. Competitor abundance associations with age at maturity patterns (when abundance of a species is $\uparrow$ age at maturity of another species is $\downarrow$ )



# 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,

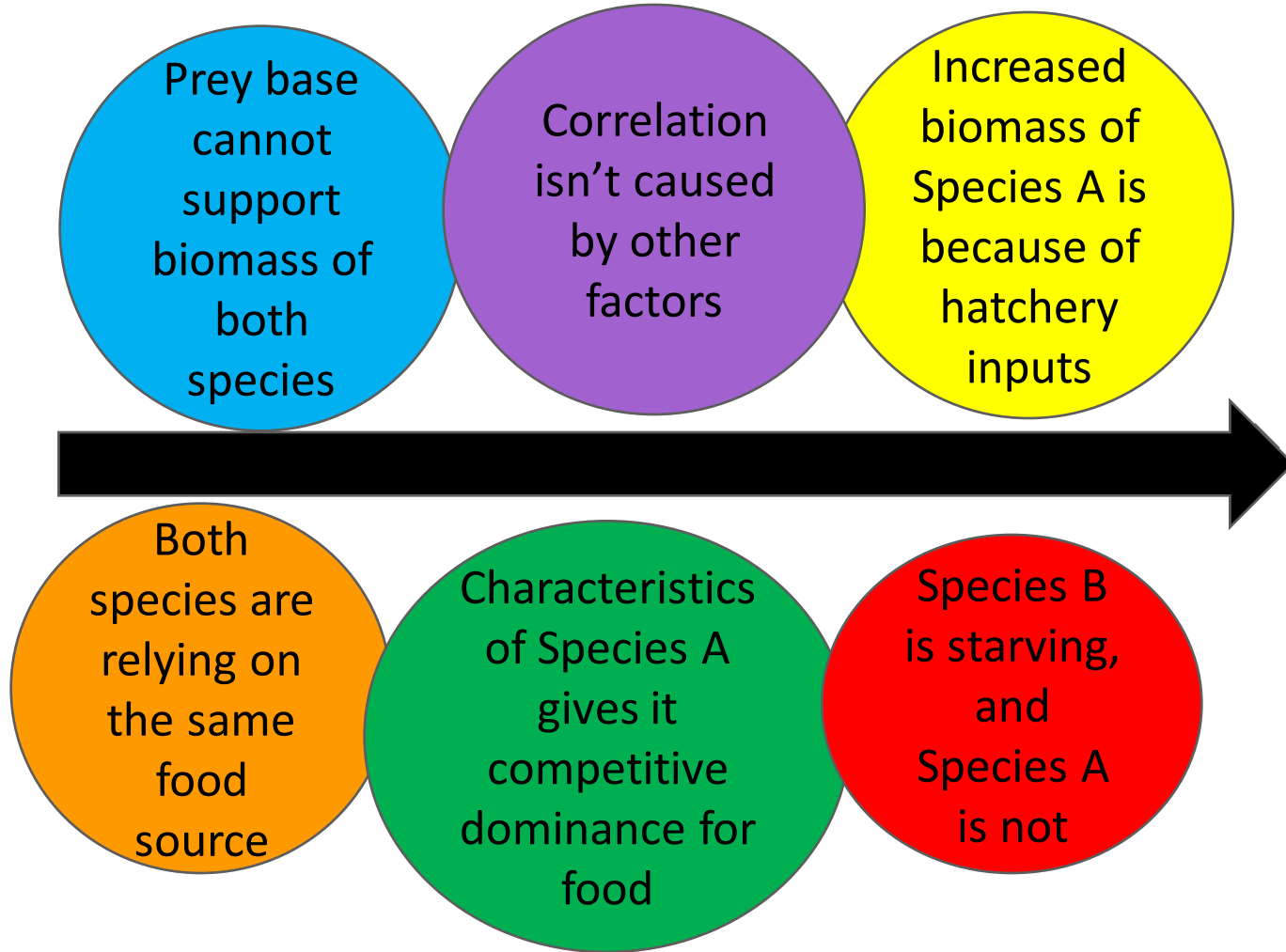
(3) there are not competing explanations, and

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

(Hilborn 2016)

# Observation

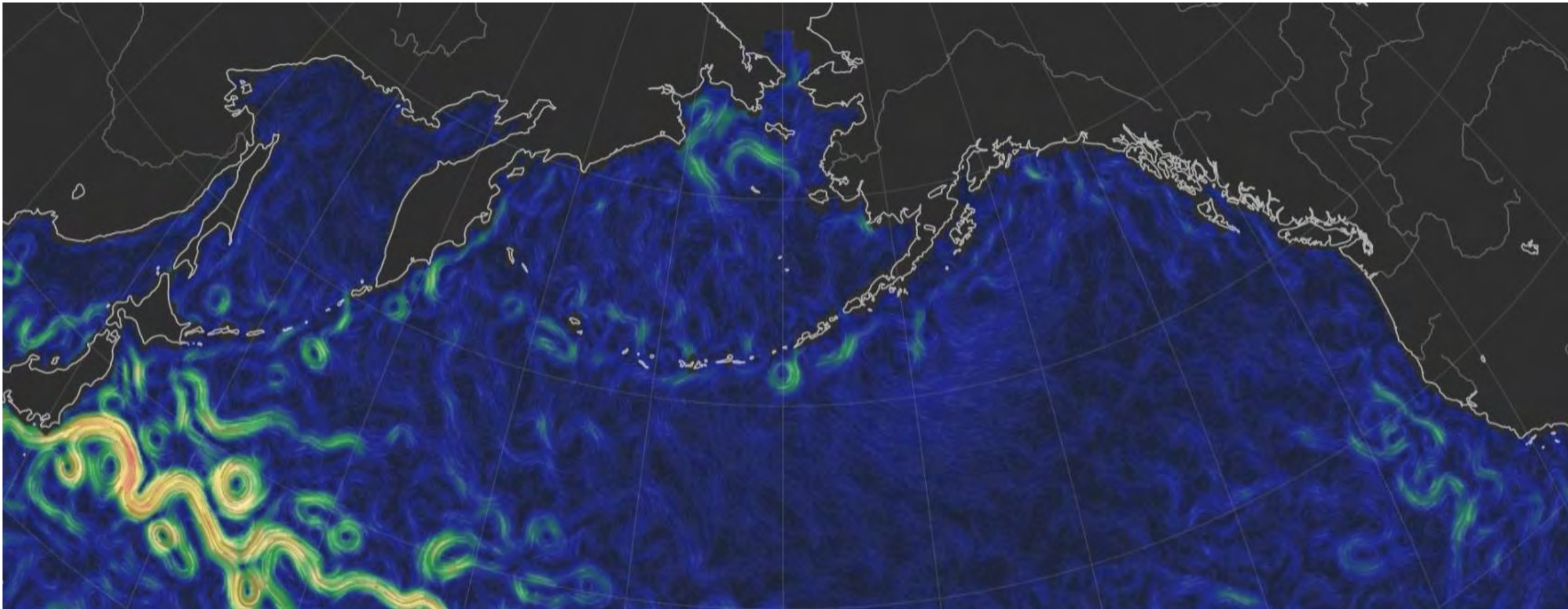
Species A  
↑ when  
Species B  
↓



# Conclusion

Hatchery  
↑ in  
Species A  
**causes** ↓  
in Species  
B

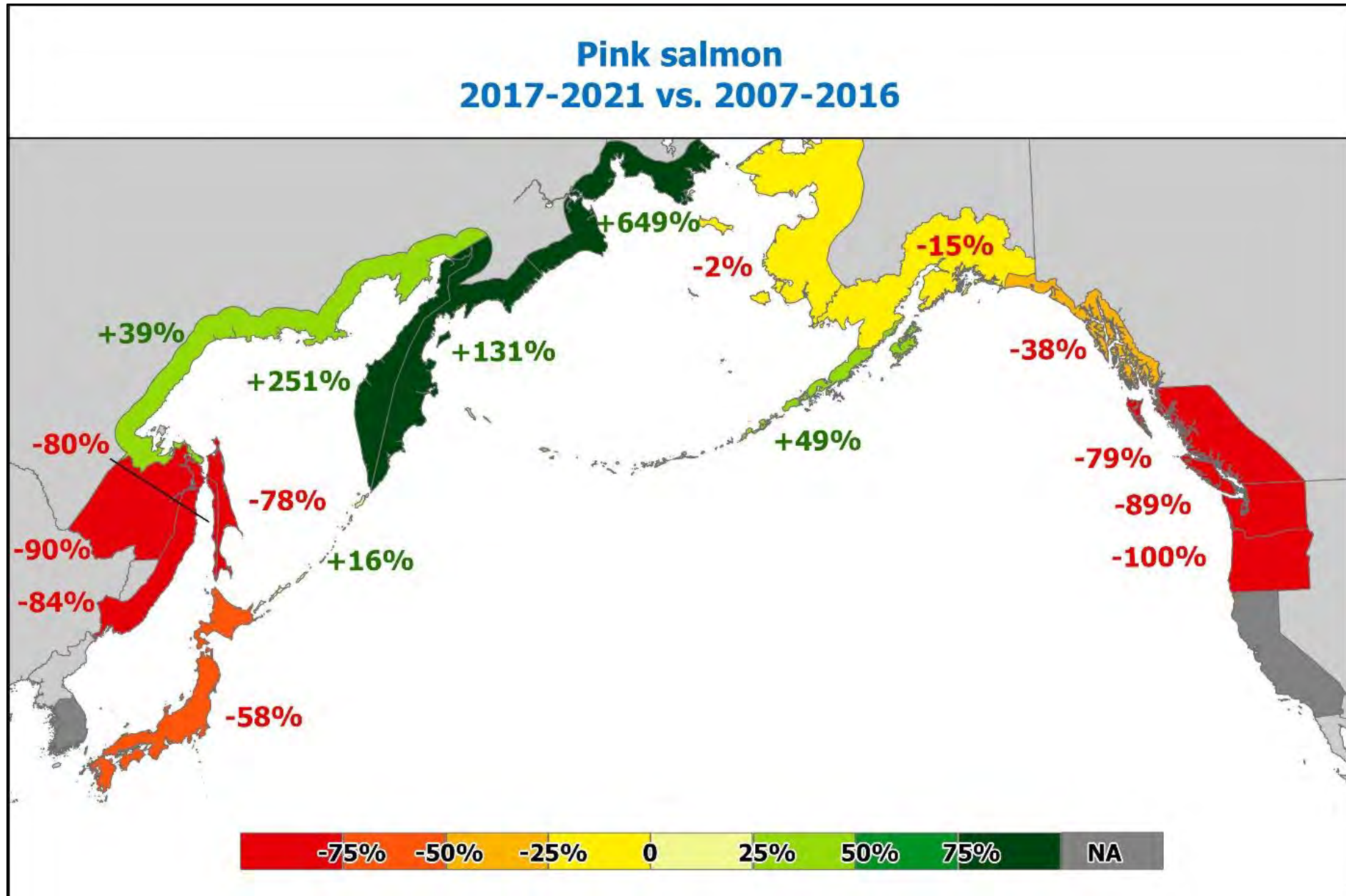
# New Efforts to Address Data Gaps



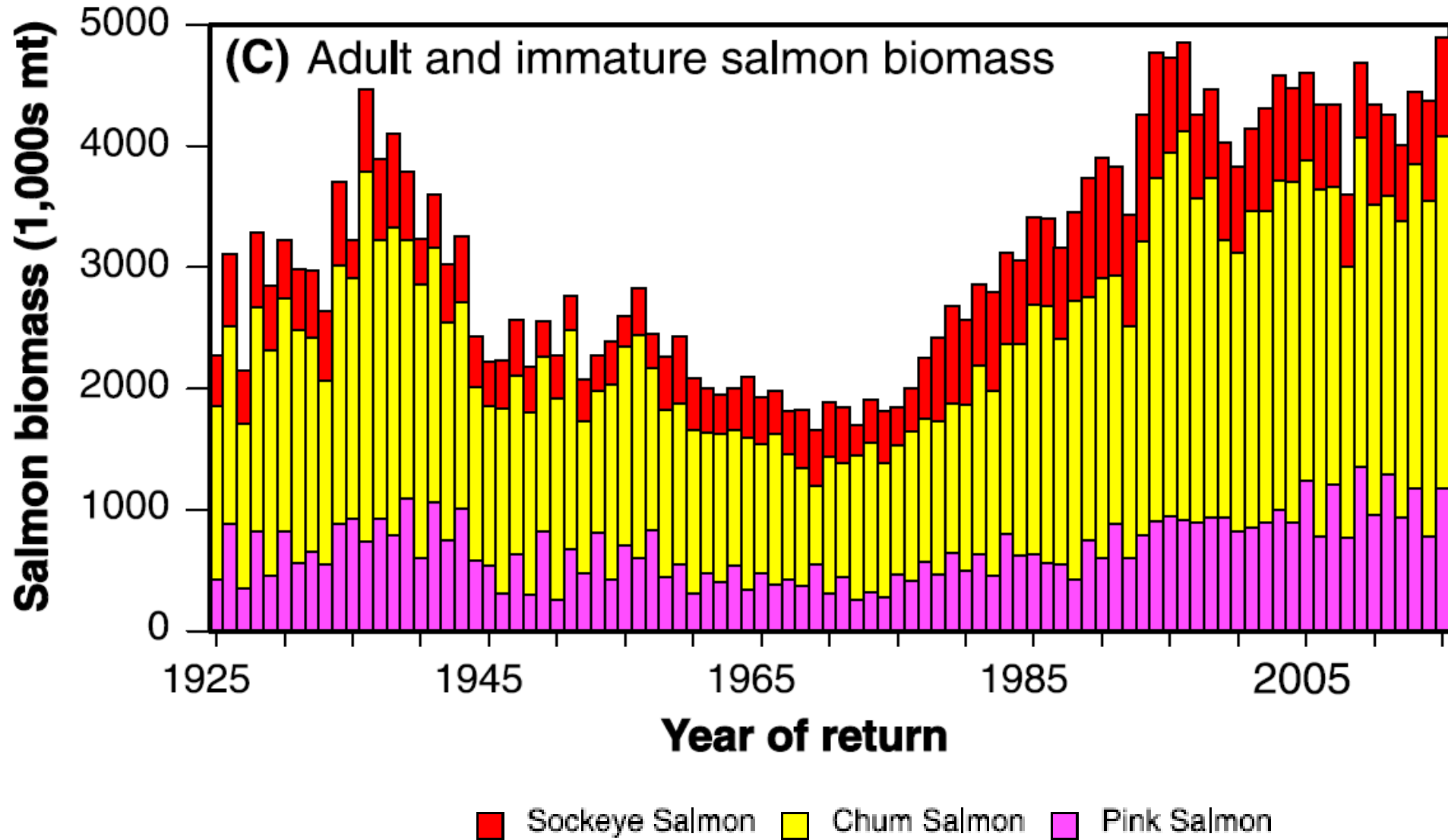


# Pacific-wide synthesis of stock assessment information

(NPAFC's Working Group on Stock Assessment)



**Improved abundance accounting for salmon across the Pacific**  
(NPAFC's Working Group on Stock Assessment)



Ruggerone & Irvine 2018



INTERNATIONAL  
YEAR OF THE SALMON

5-year initiative to support resilience for salmon and the people who depend on them by collectively generating and sharing knowledge across the international community

# Northern Hemisphere Pink Salmon Expert Group

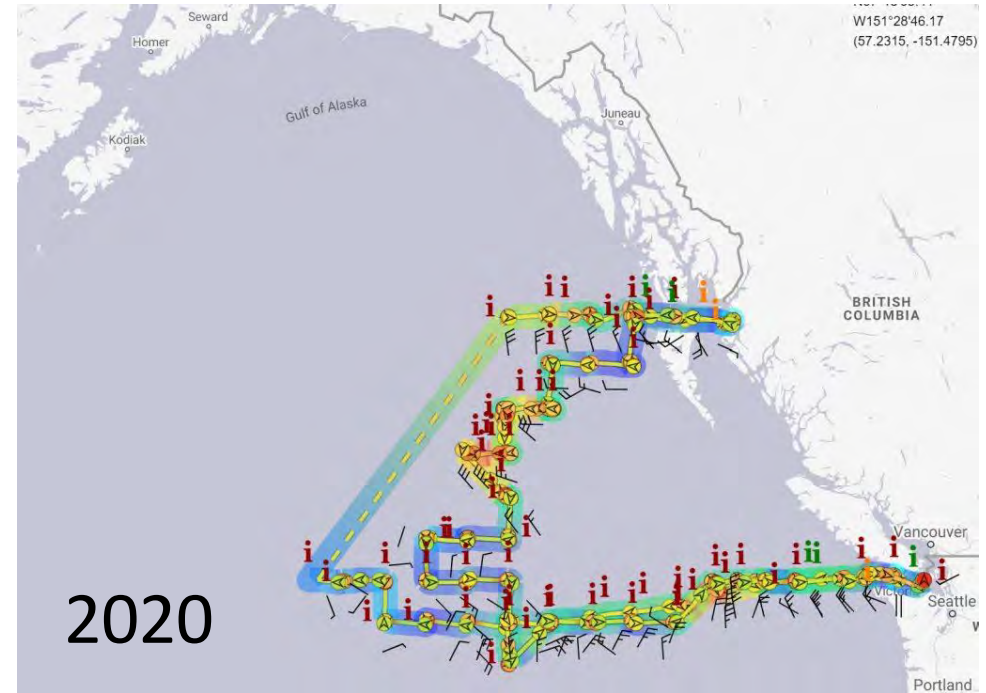


INTERNATIONAL  
YEAR OF THE SALMON





INTERNATIONAL  
YEAR OF THE SALMON

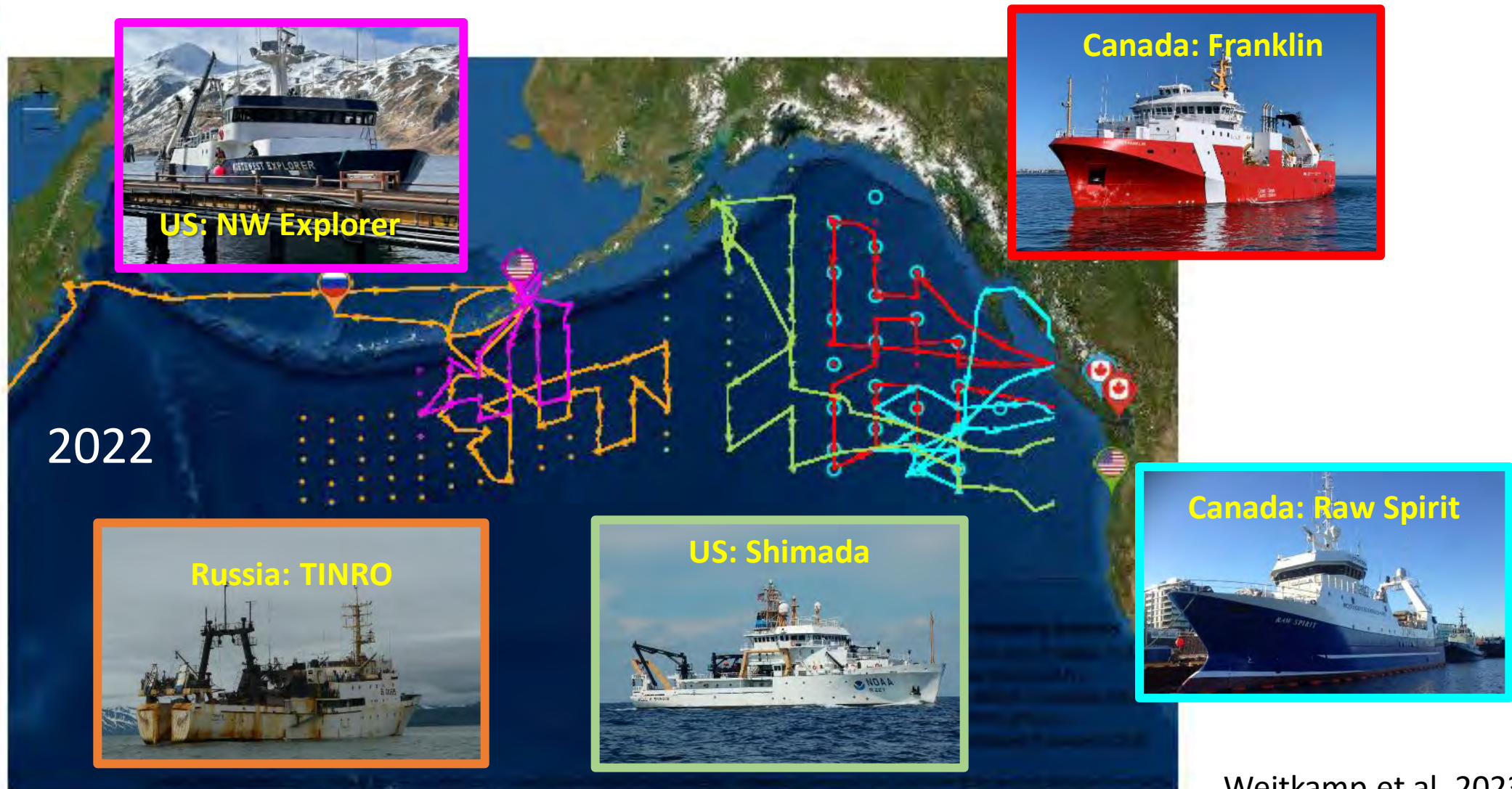


## Eastern North Pacific surveys in winter of 2019 and 2020

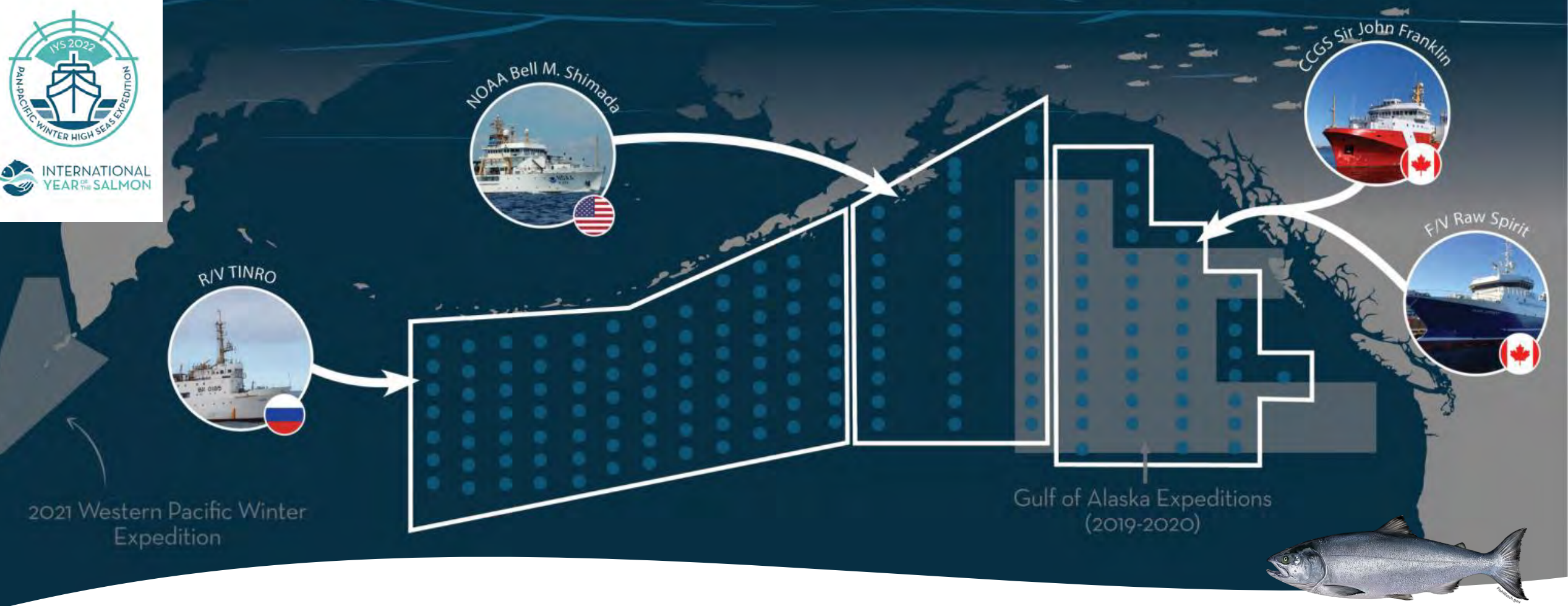


INTERNATIONAL  
YEAR OF THE SALMON

# Central and Eastern North Pacific survey in winter of 2022 (covering 2.5 million km<sup>2</sup>)



Weitkamp et al. 2023

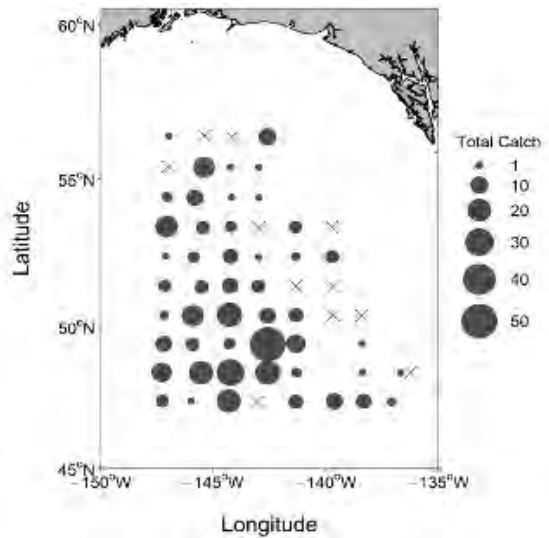
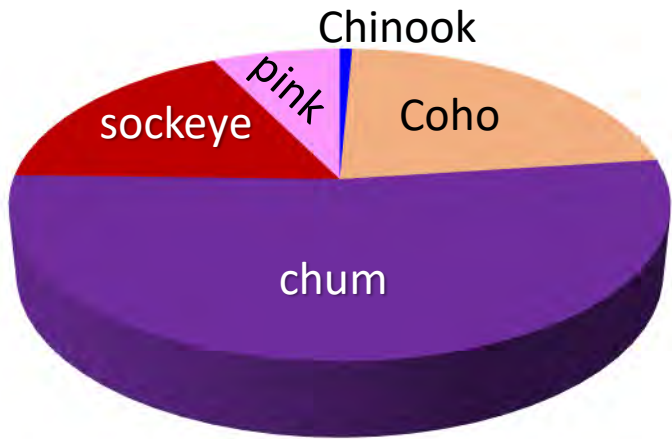


- Use IYS survey data from winter (when competition should be highest) to directly measure spatial overlap and trophic competition between AYK chum and other species/stocks

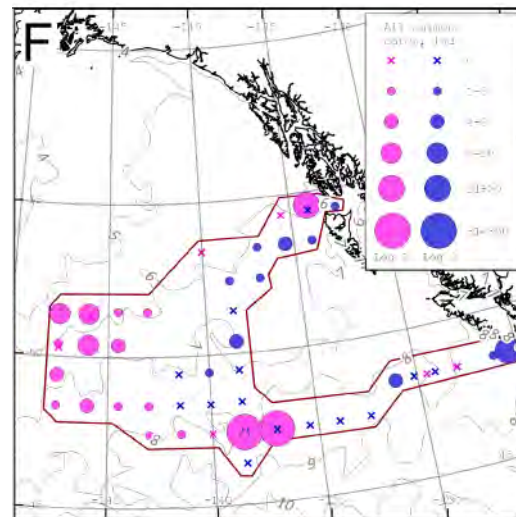
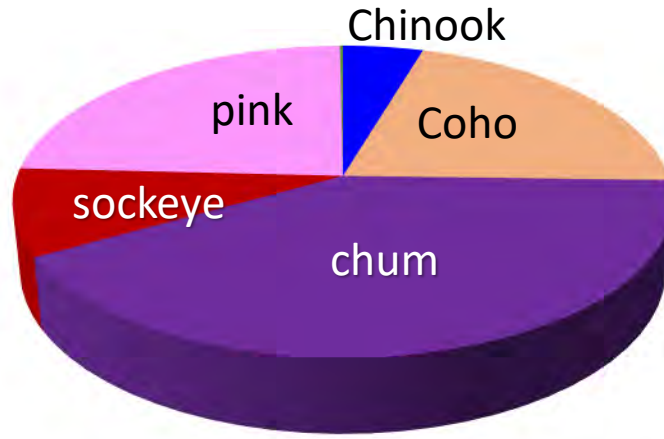




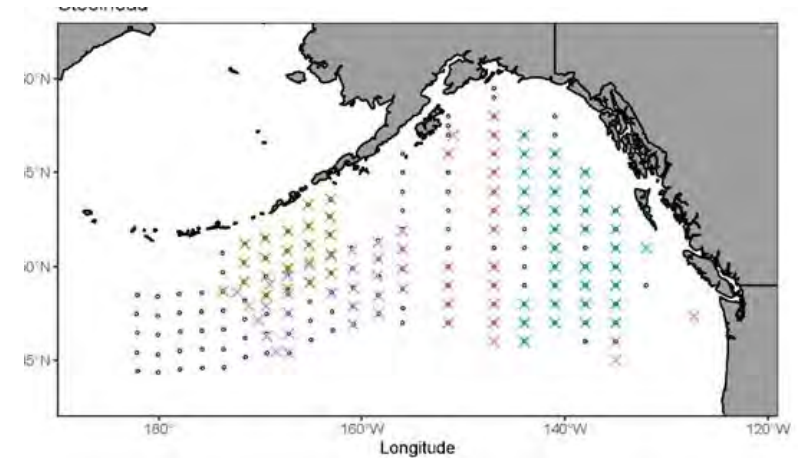
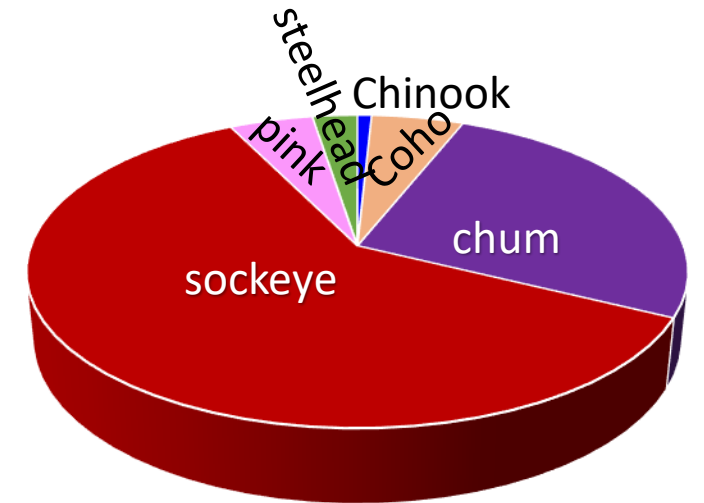
2019 (423)



2020 (566)



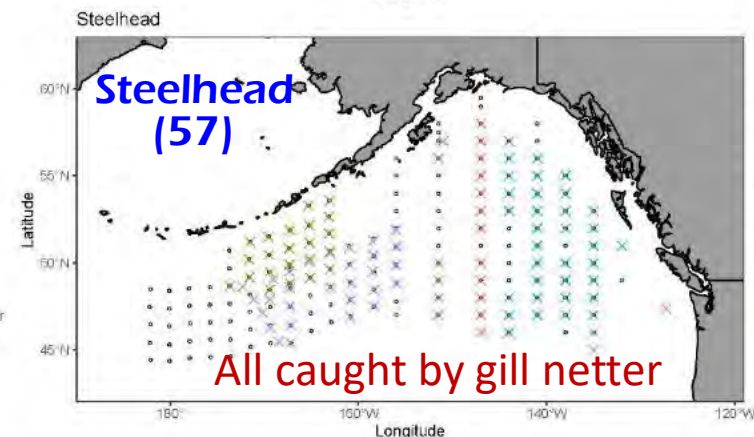
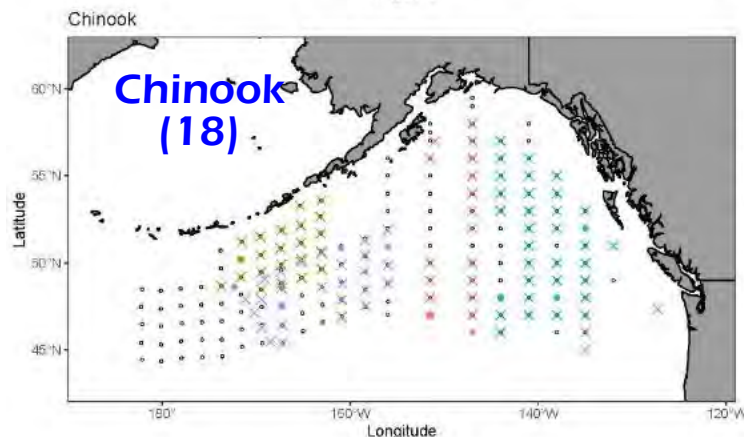
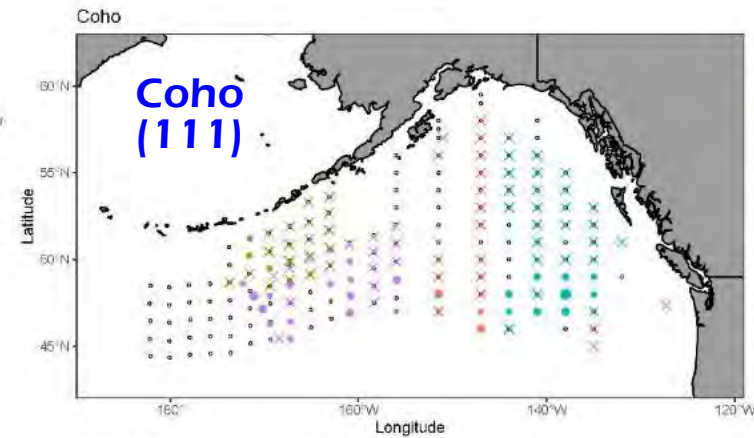
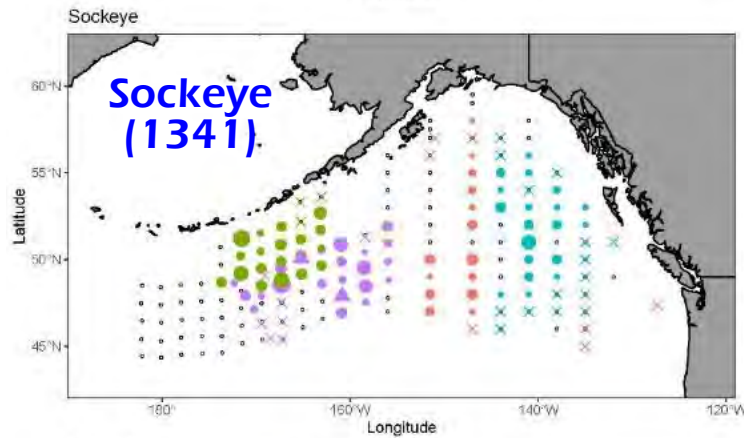
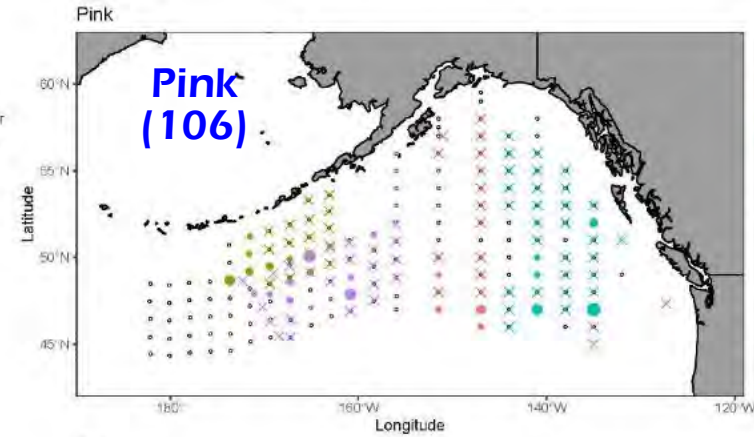
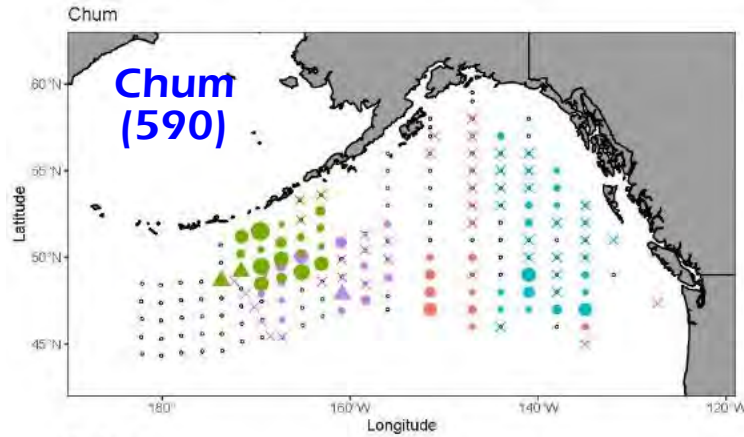
2022 (2,323)





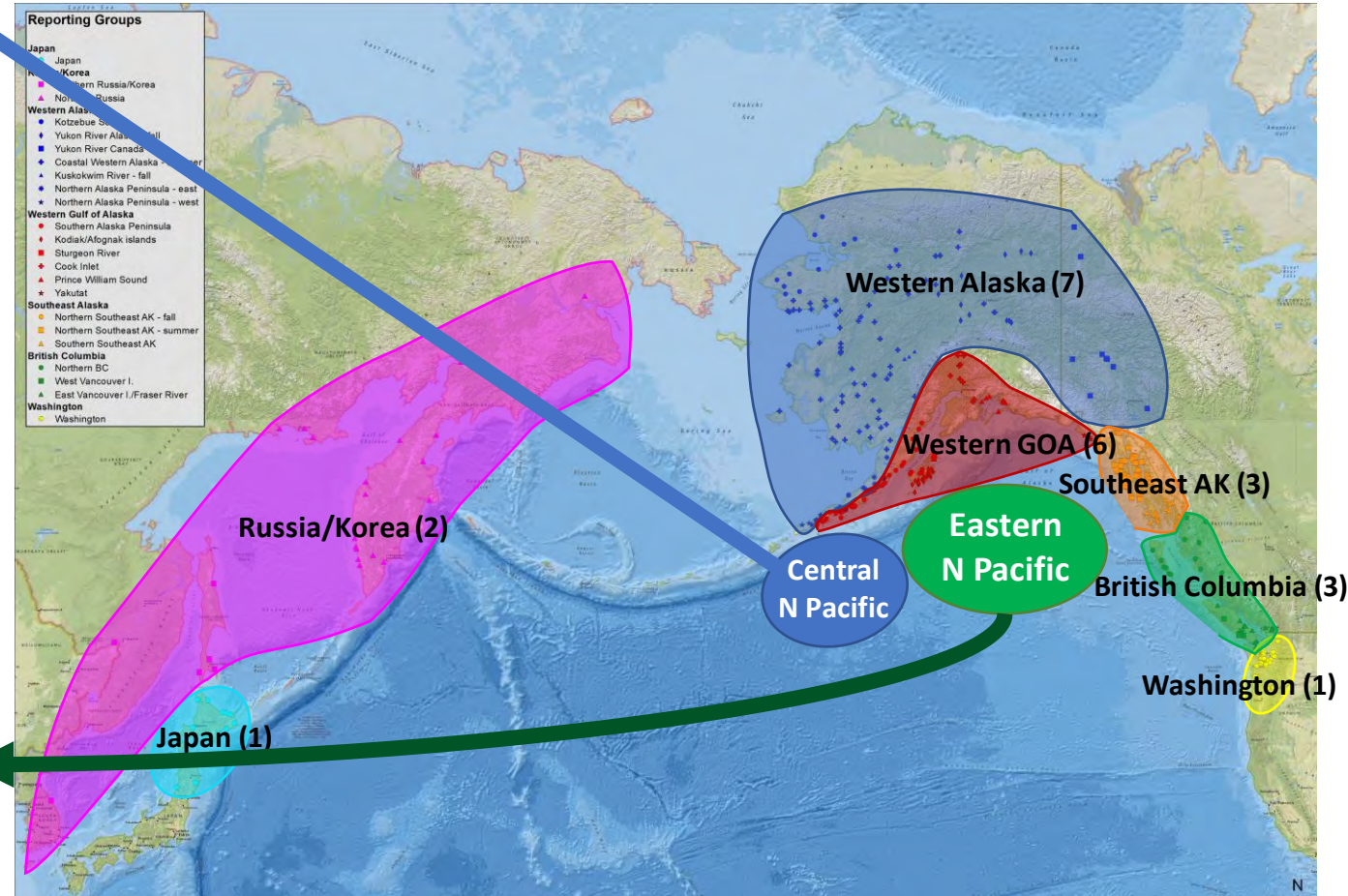
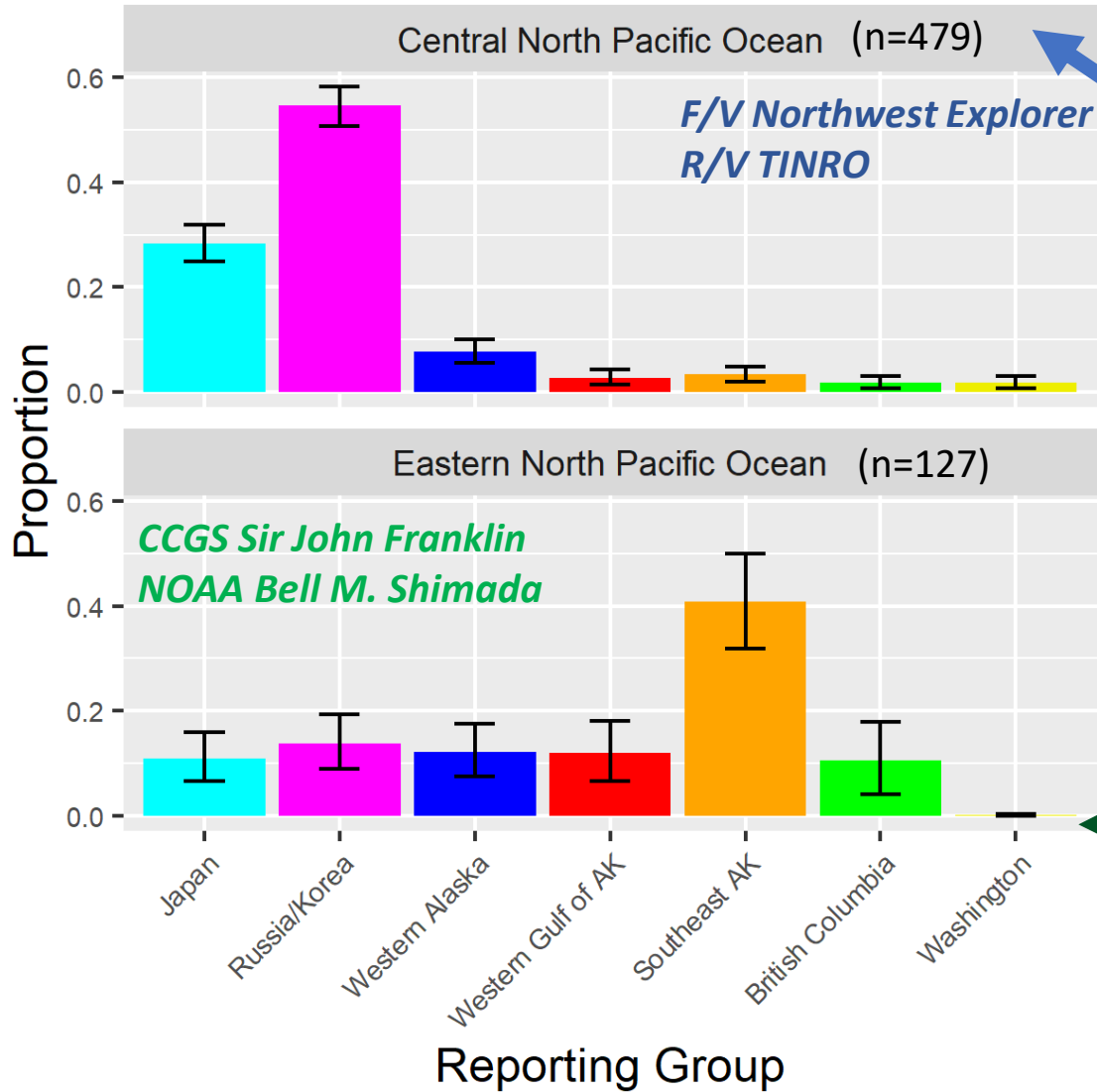


# 2022 salmon catches by species and ship (trawl only)

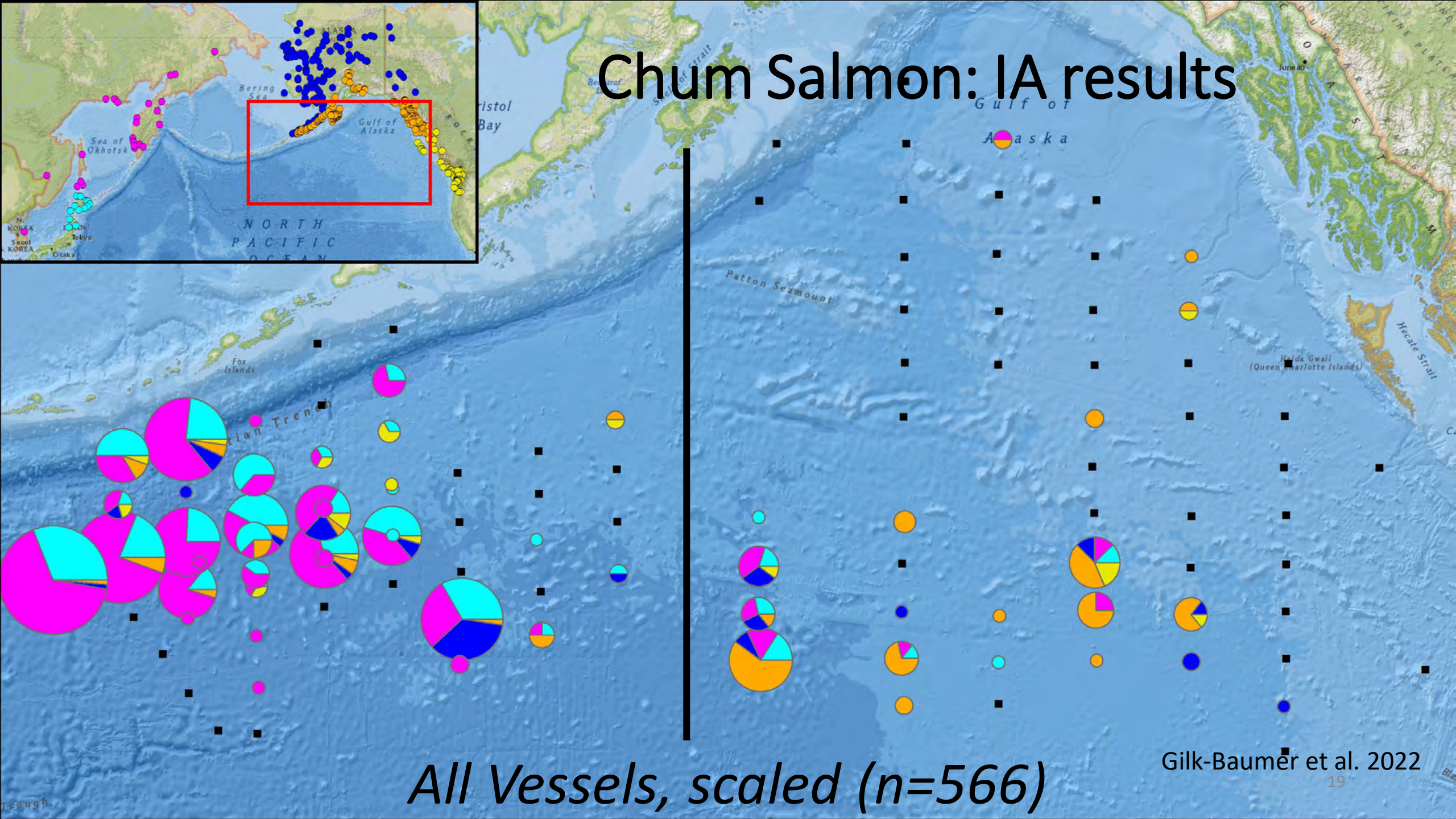




# Chum Salmon: MSA results (broad)

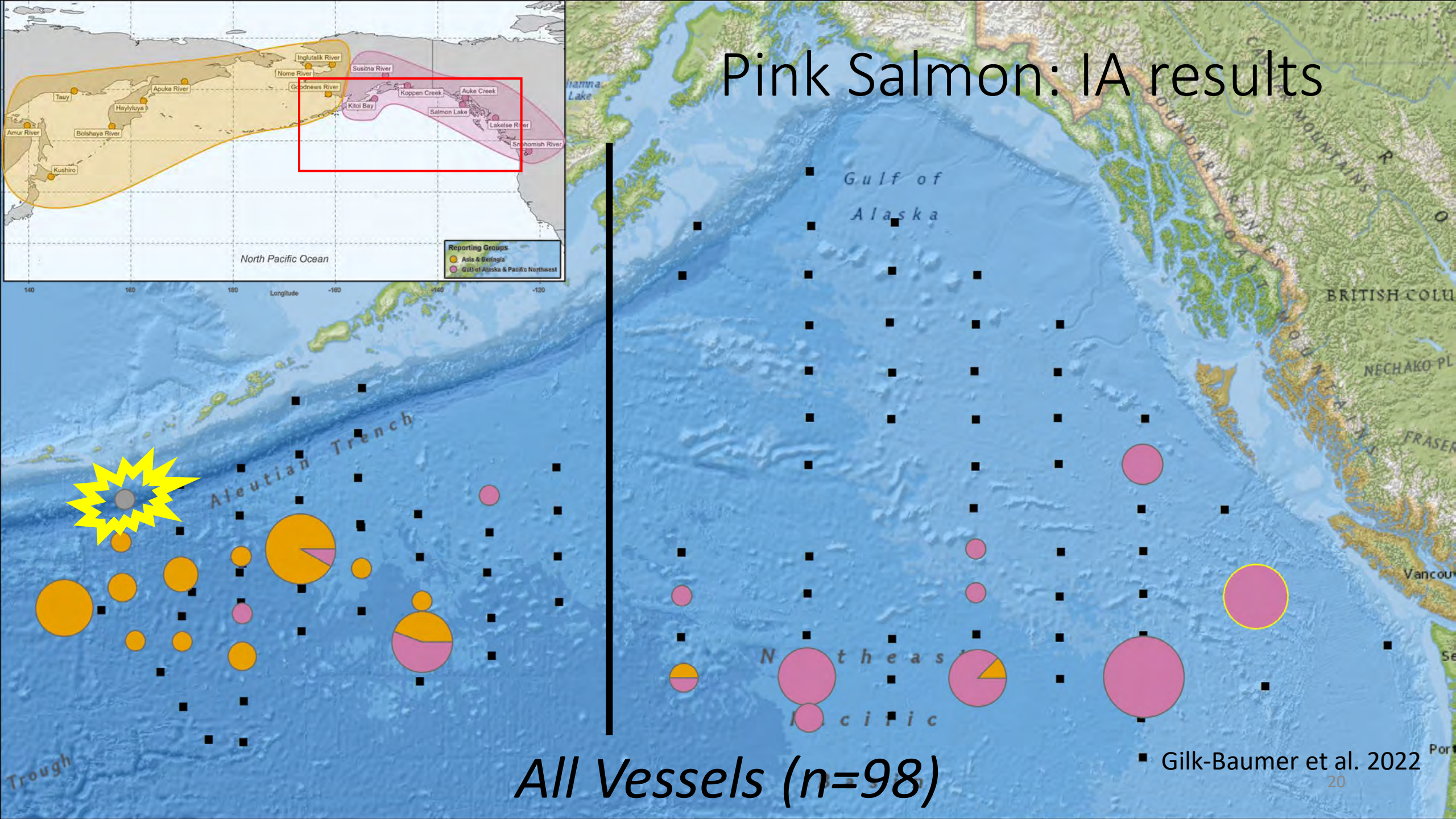
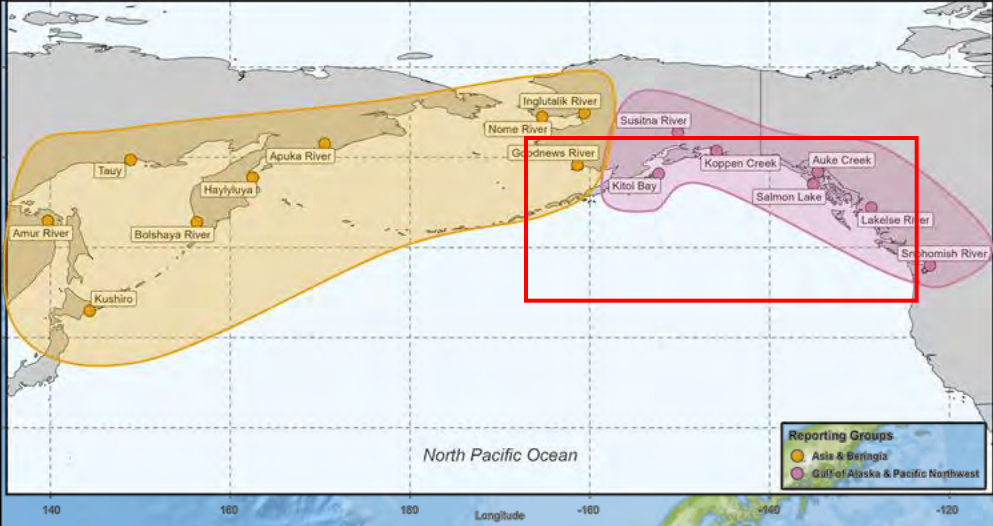


# Chum Salmon: IA results



*All Vessels, scaled (n=566)*

# Pink Salmon: IA results



Gilk-Baumer et al. 2022



**THANK YOU**

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