

# Do Pink Salmon Southern Resident Killer Whales?

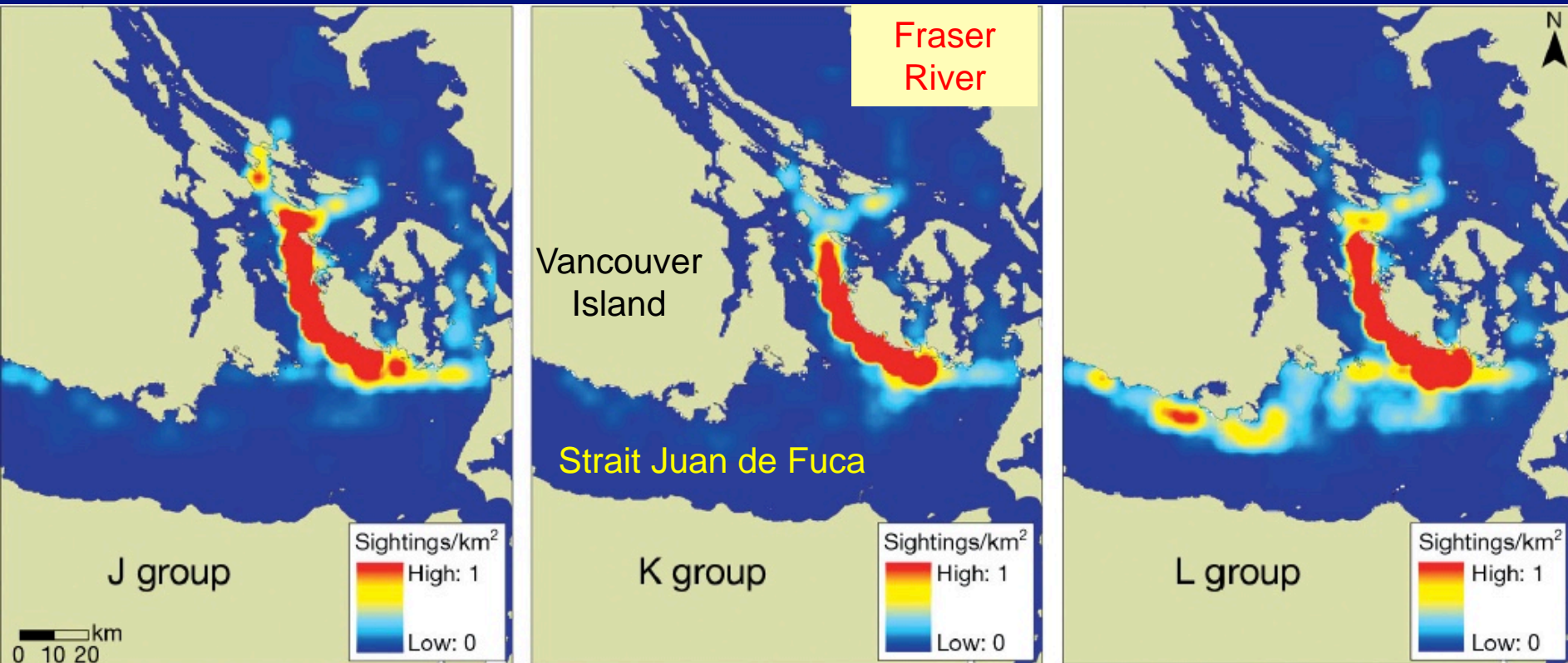
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Photo by Candice Emmons

NOAA Fisheries/NWFSC

# Southern Resident Killer Whale Core Foraging Area



May to September distribution (Hauser et al. 2007)

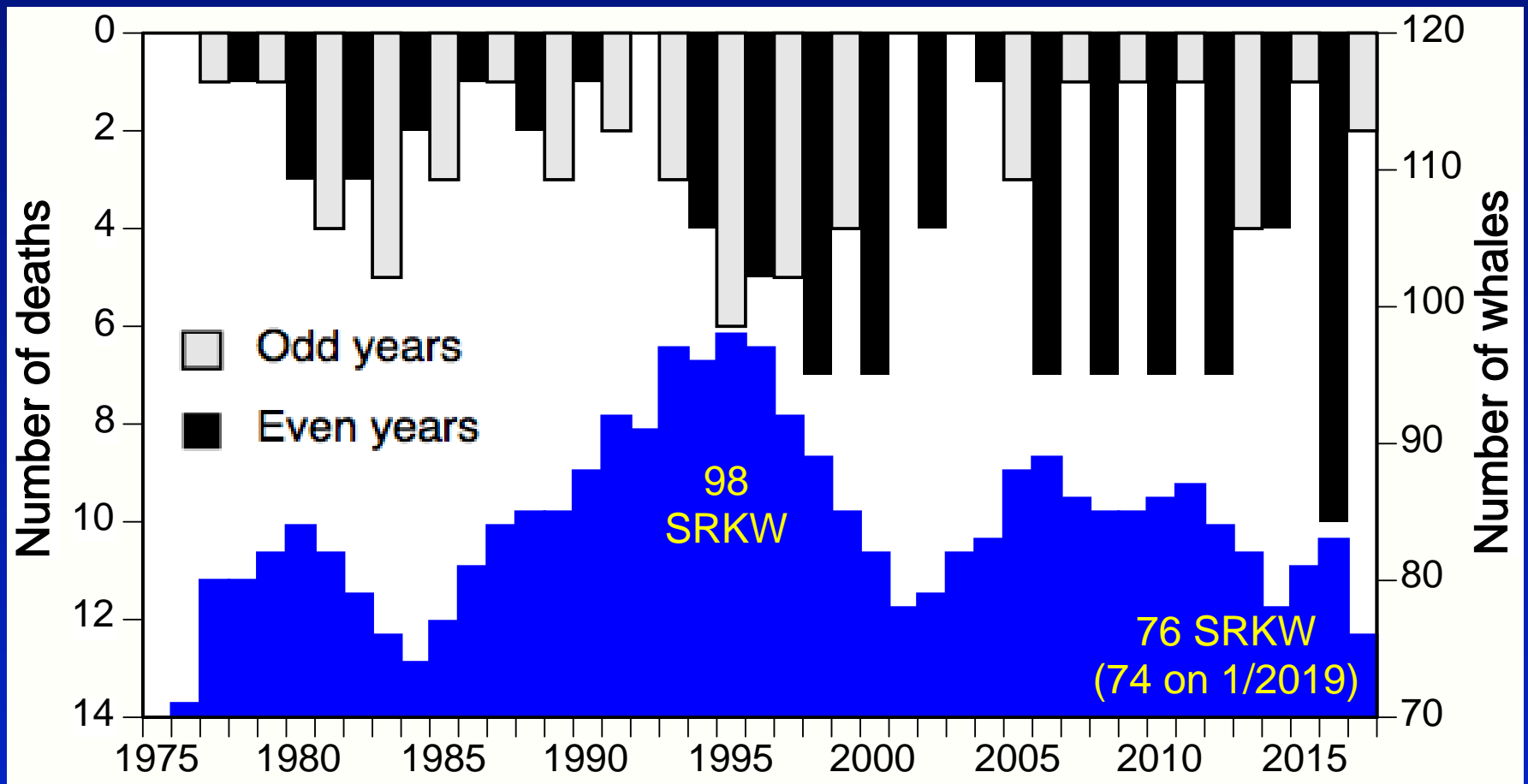
Chinook salmon: key prey

~No pink salmon eaten

Chinook/Pink salmon overlap: late July to early Sept

April-June activity declining since 2000 coincident w/ spring Chinook decline (Shields et al. 2018)

# Southern Resident Killer Whales Numbers and Mortality

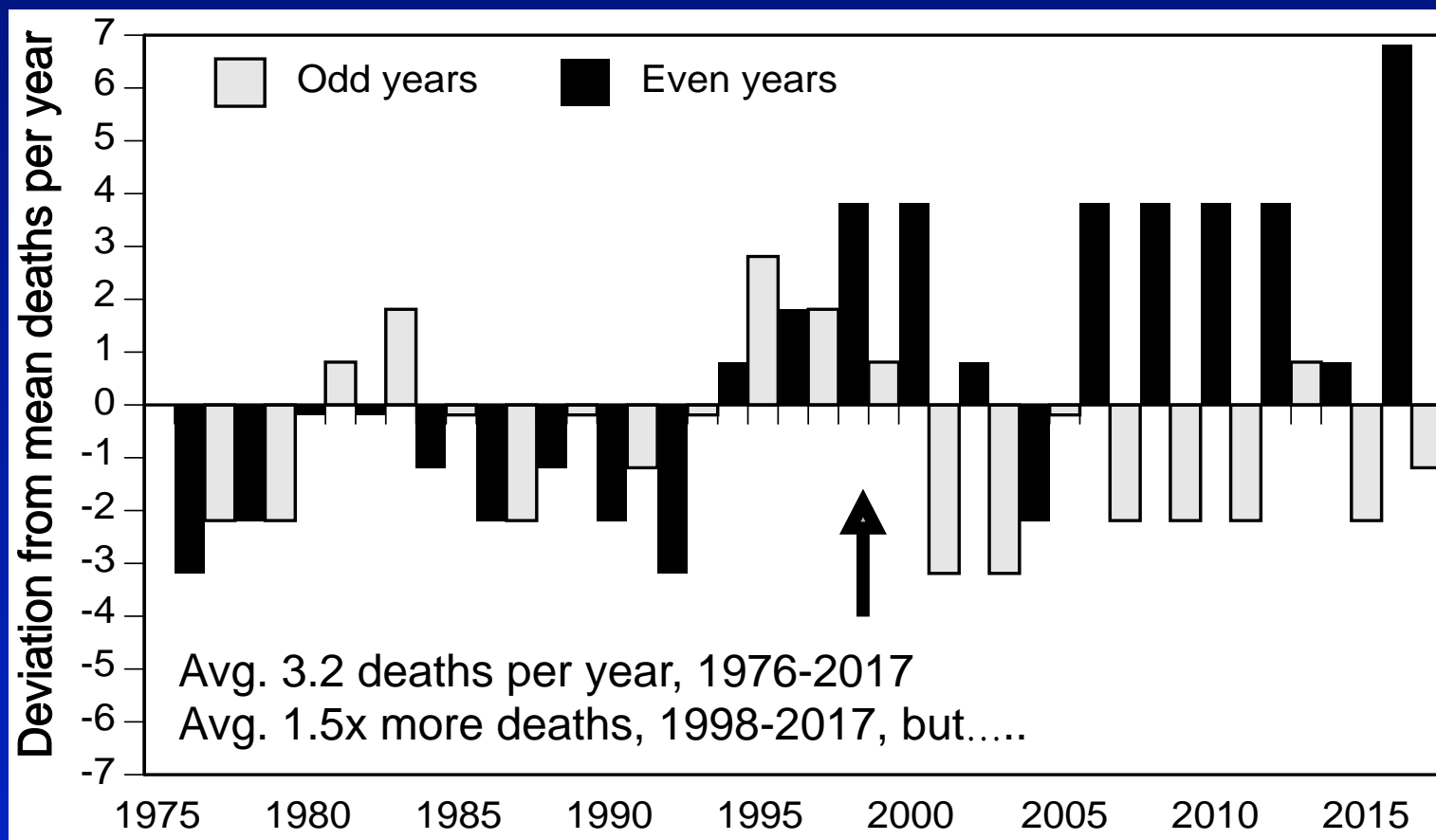


Low numbers in early 1970s related to extraction & deaths associated with aquaria trade

Biennial pattern began ~1998, coincident with 1997/98 El Nino & reduced pink harvests

# Southern Resident Killer Whales

## Deviation from Mean Annual Mortality



3.6 times more deaths in even (61 SRKW) vs odd years (17 SRKW) since 1998 as population decreased from 92 to 76 killer whales

During 1998-2017, mortality was 43% **lower** in odd years than in 1976-1997

# Southern Resident Killer Whales

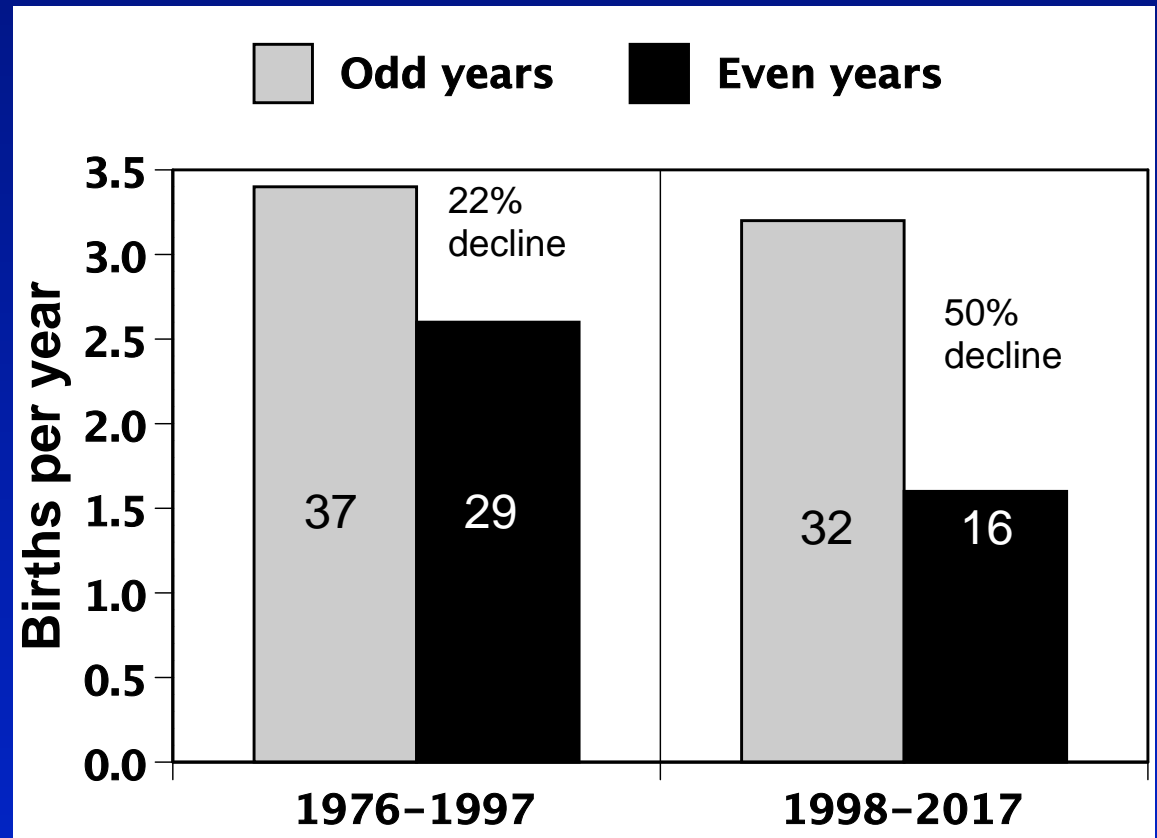
## Successful Births Declined in Even Years

### 1998-2017

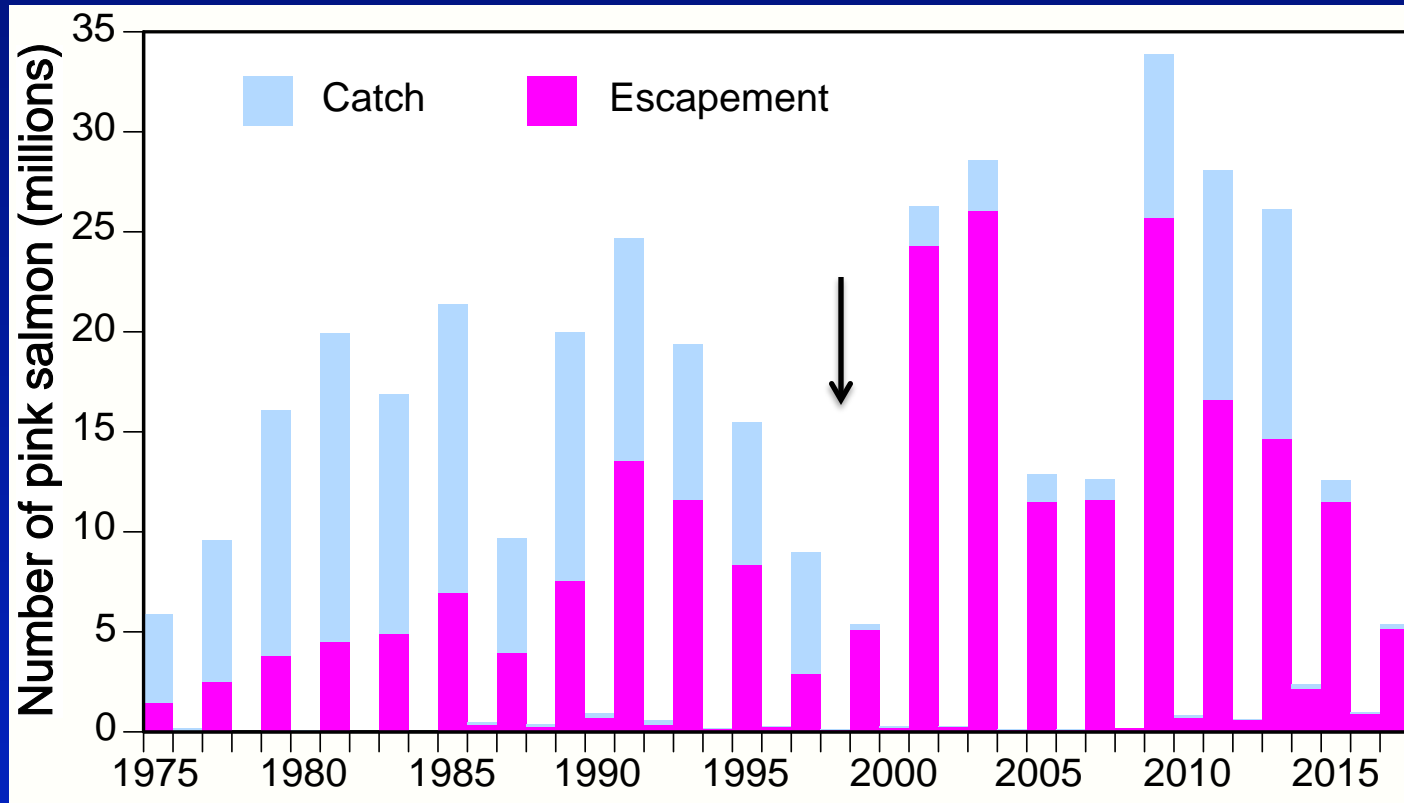
50% decline in successful births in even years; consistent with mortality pattern

### 1976-2017

Little change in birth rate in odd years over all years



# Do Pink Salmon Impact Southern Resident Killer Whales?



Pink salmon escapement increased 135% after 1997 due conservation concerns for Chinook and sockeye

18 million pink salmon in odd years; 0.4 million in even years

# Do Pink Salmon Impact Southern Resident Killer Whales?

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Mortality ~1 year after poor Chinook abundance (Ford et al. 2010)

Hypothesis: High densities of pink salmon interfere with foraging efficiency of SRKW, late July to early Sept of odd years

High mortality and low births delayed ~1 year

Pink and Chinook salmon migrate along same route

~50x more pink salmon than Chinook

Pinks migrate near surface, Chinook deeper

New evidence

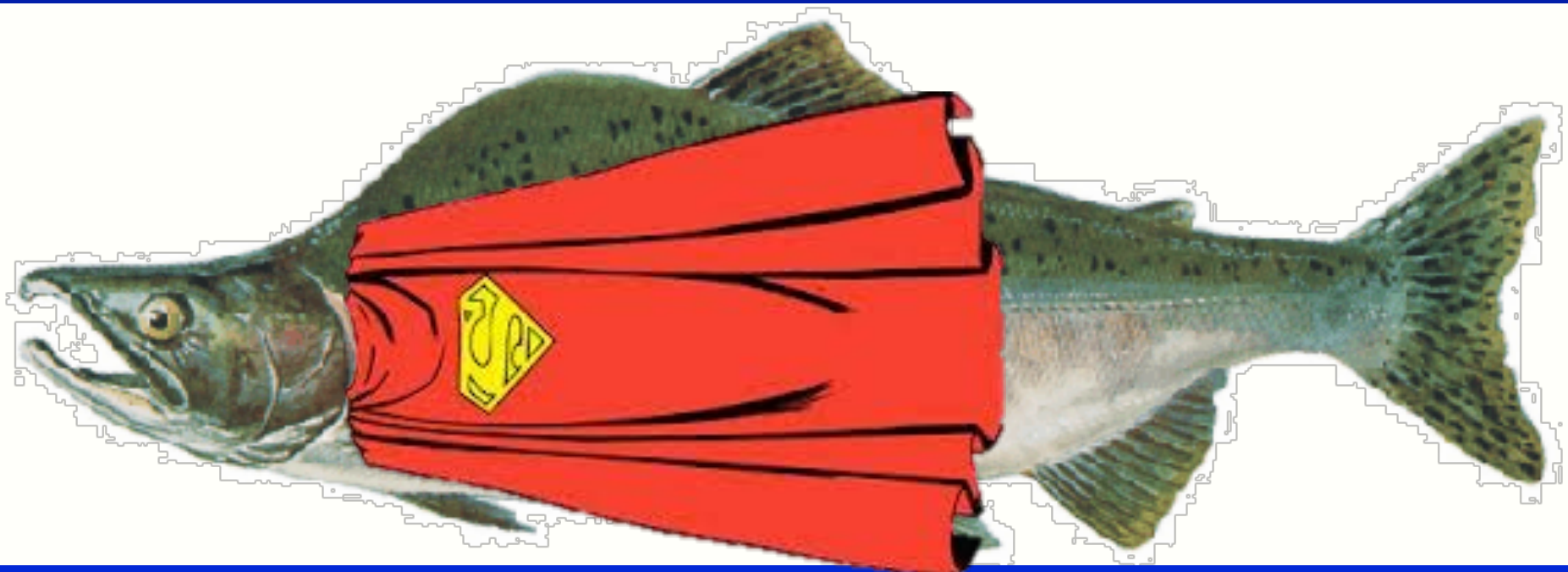
Actions: Manage pink salmon abundance

# Questions?

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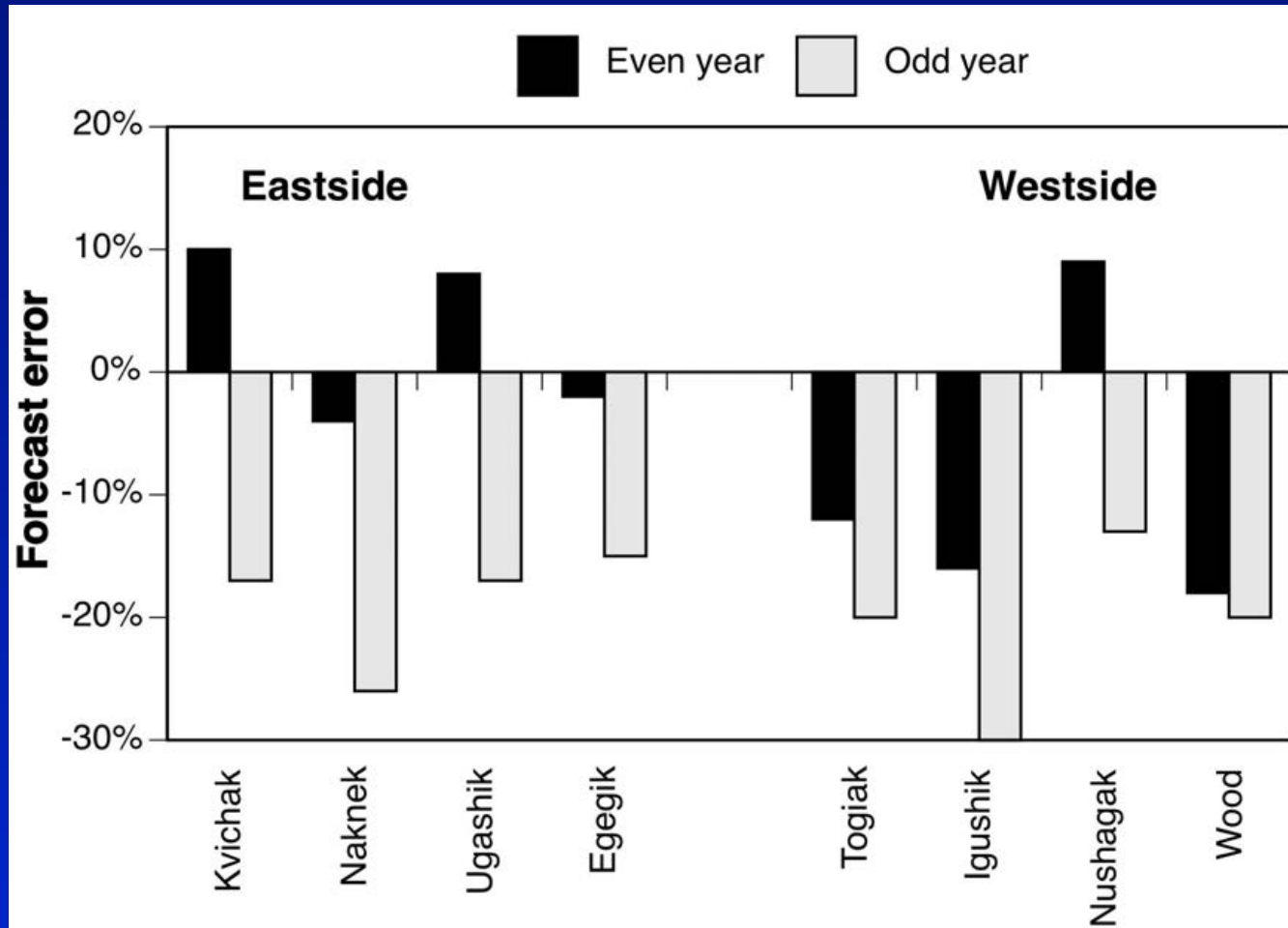
*"Nobody goes there anymore. It's too crowded."*

Y. Berra 1998



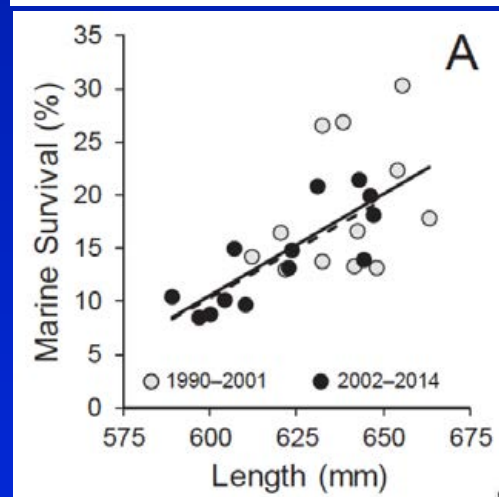
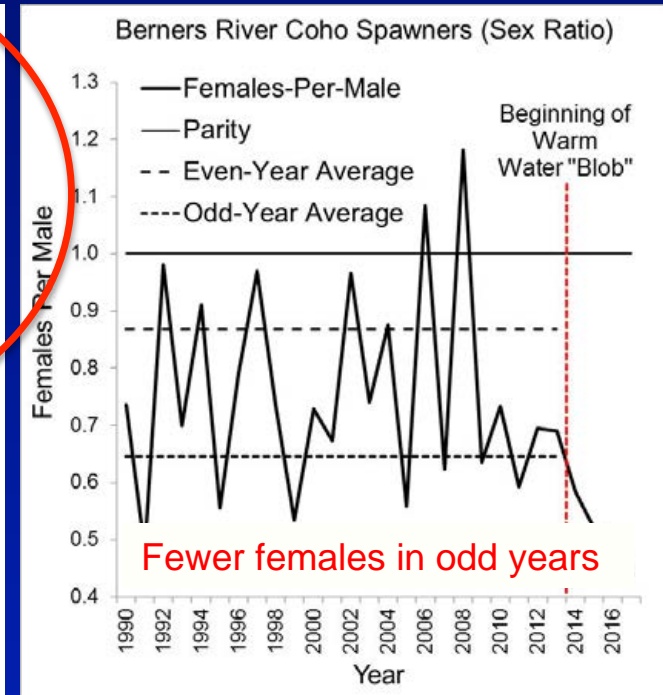
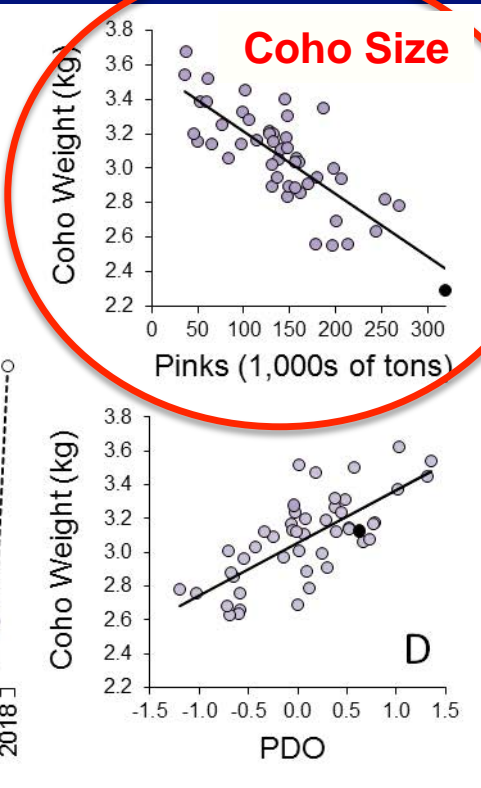
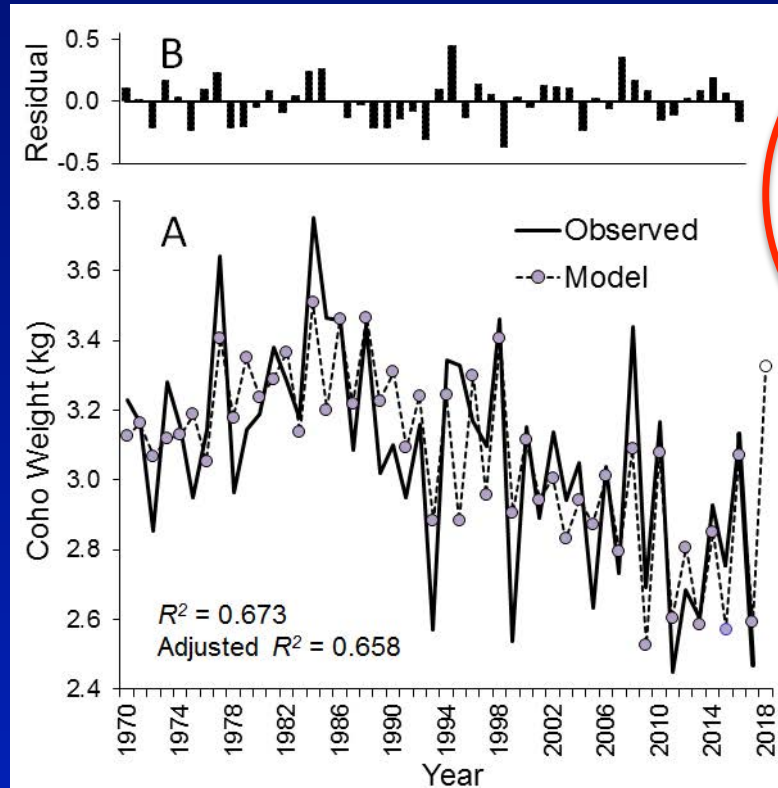


# Bristol Bay Sockeye Forecast Error 1977 to 2009

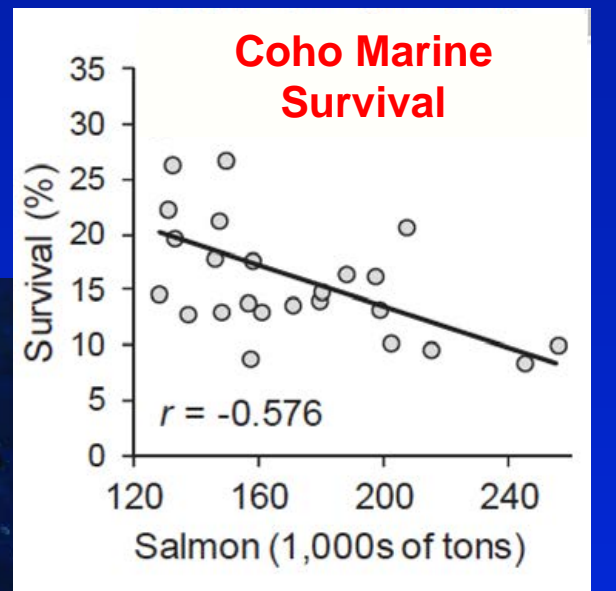


Forecast error (%) = (Forecast – Observed run) / Observed run  
Forecasts by Alaska Department of Fish and Game

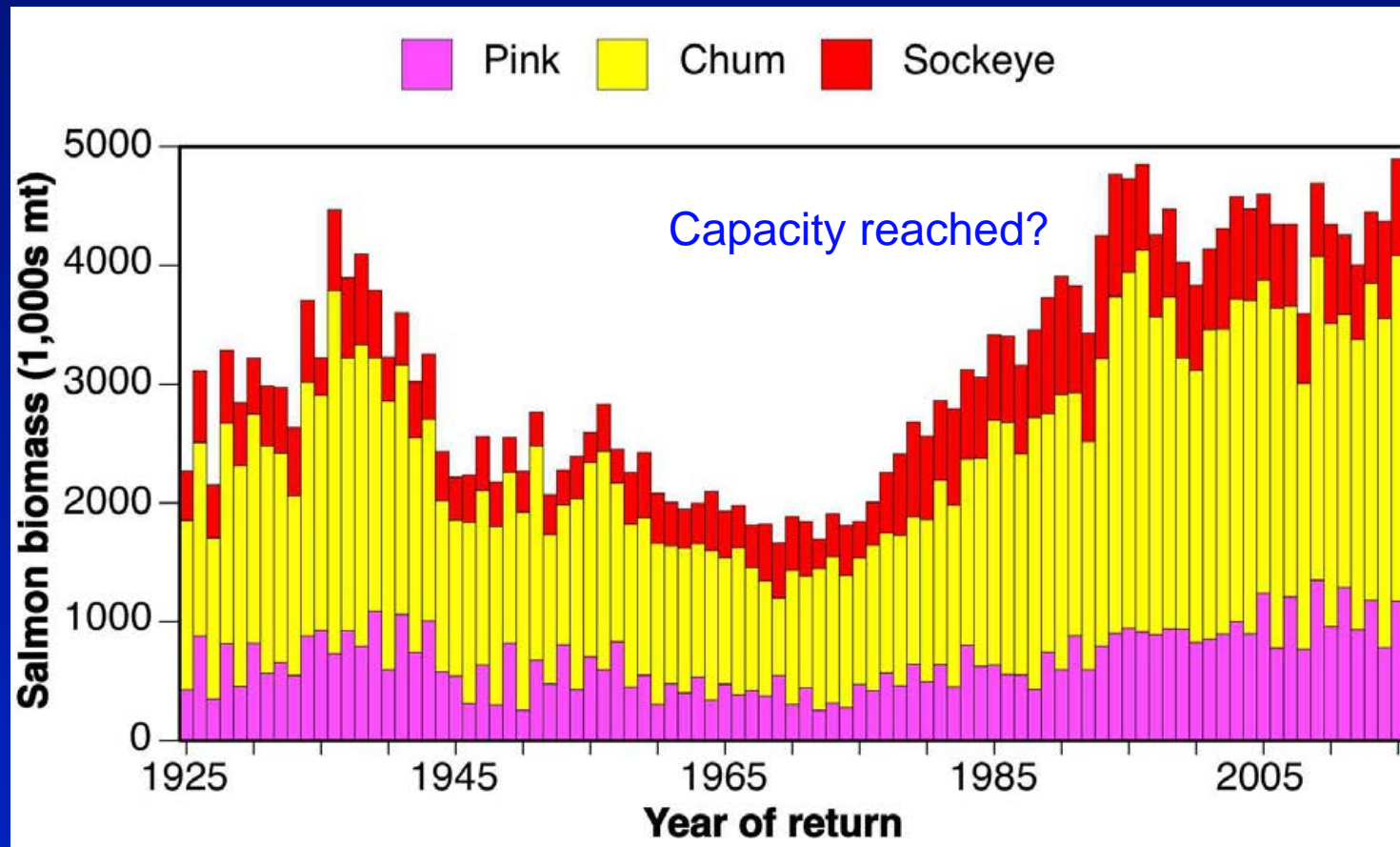
# Do Pink Salmon Impact SEAK Coho Salmon?



See supporting analyses  
Shaul and Geiger 2016



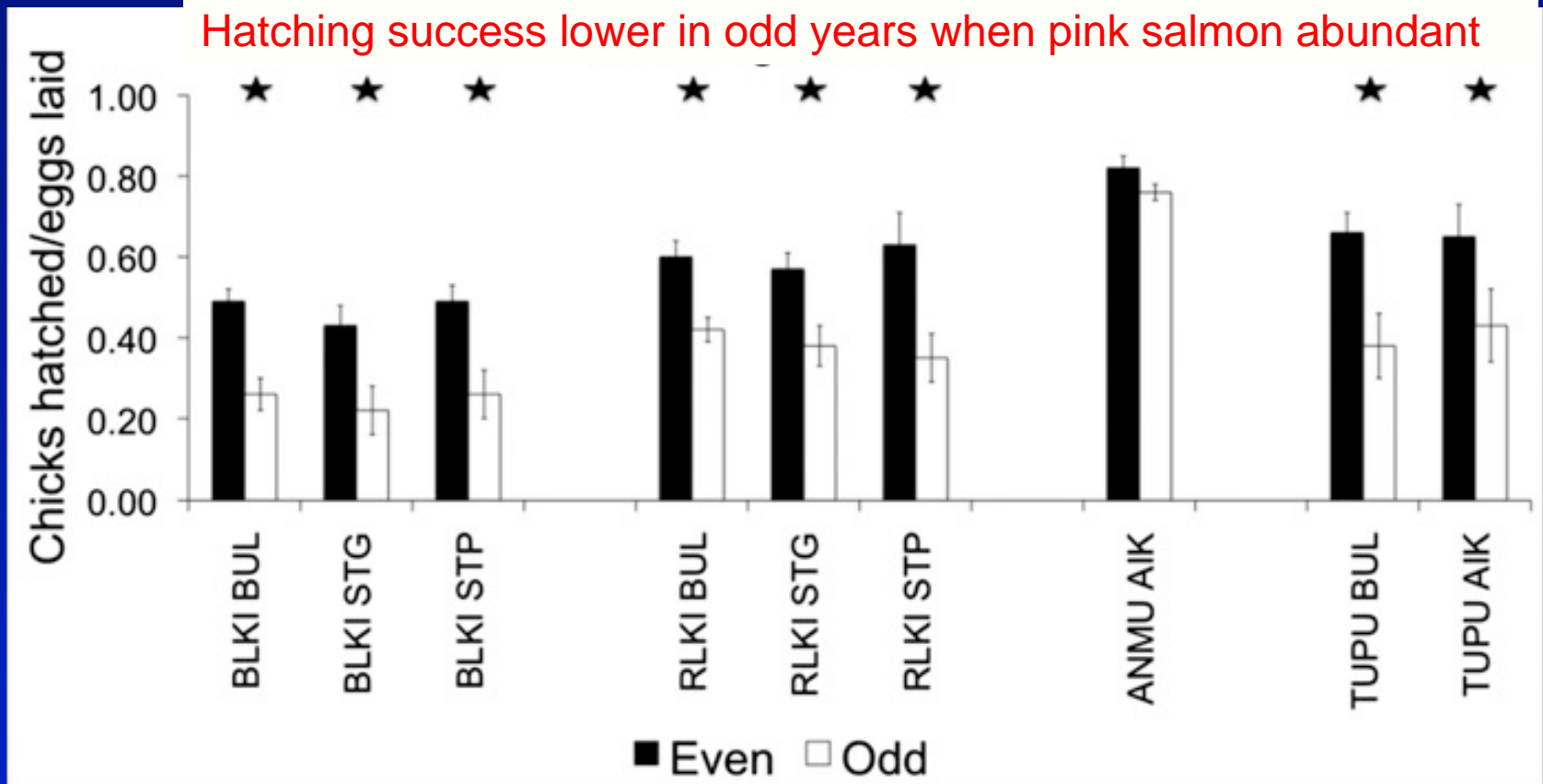
# Chum Salmon Dominate Adult & Immature Biomass



- ~40% of adult and immature salmon biomass is hatchery origin, largely due to chum (Japan, Russia, SEAK, PWS)
- Chum diet largely different from other salmon

# Do Pink Salmon Cause a Trophic Cascade?

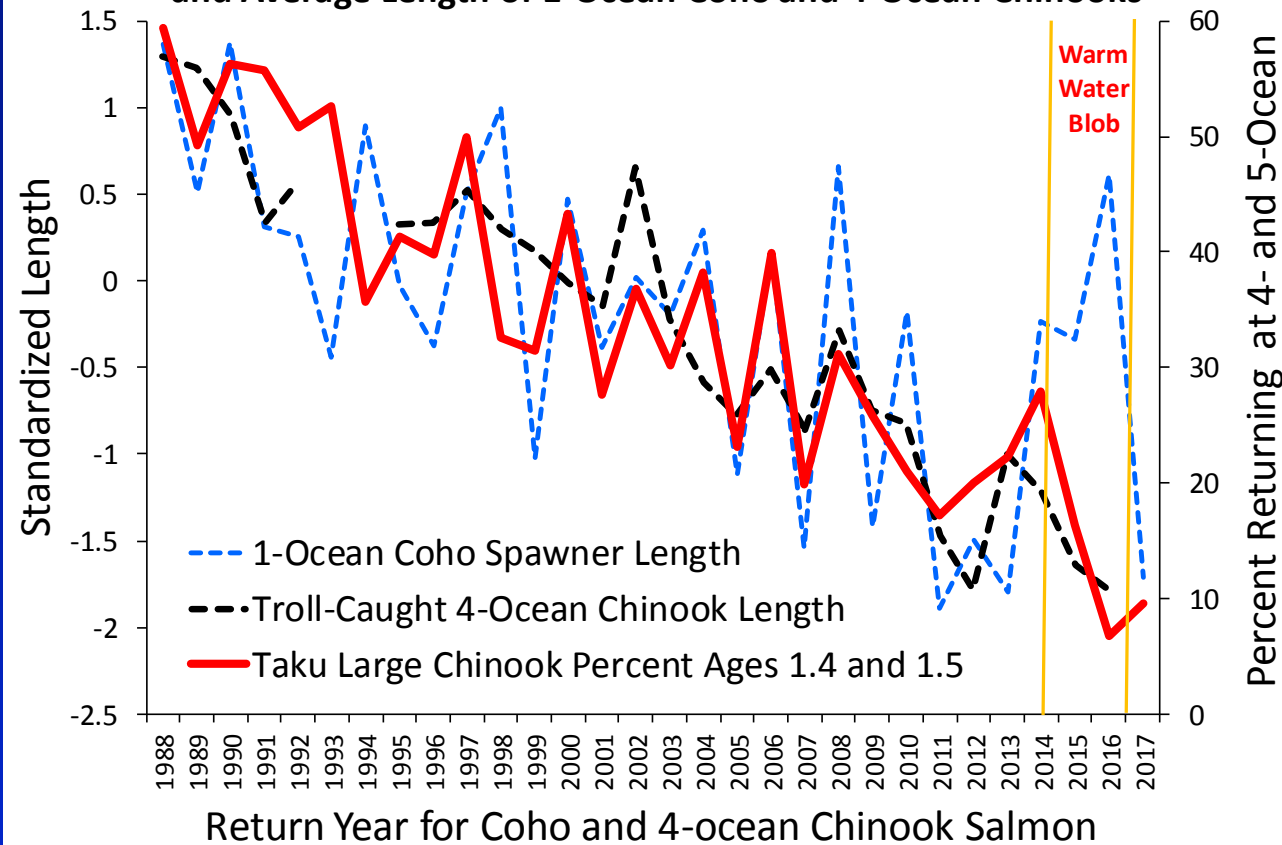
Seabird Hatching Success Declines When Pink Salmon Abundant



- Negatively correlated with E Kamchatka pink salmon abundance
- Black-legged kittiwake (BLKI), Red-legged kittiwake (RLKI), Ancient murrelet (ANMU), Tufted puffin (TUPU)
- Buldir I (BUL), St George I (STG), St Paul Island (STP)

# Are Chinook Finding Enough to Eat? Is Late Ocean Mortality Increasing?

Percent of Taku River Large Chinook Returning at >3 Ocean and Average Length of 1-Ocean Coho and 4-Ocean Chinooks



15 of 28 (54%) large tagged Chinook died via large predators (mostly salmon sharks). 71% of large salmon succumbed to natural mortality

Andy Seitz, UoA