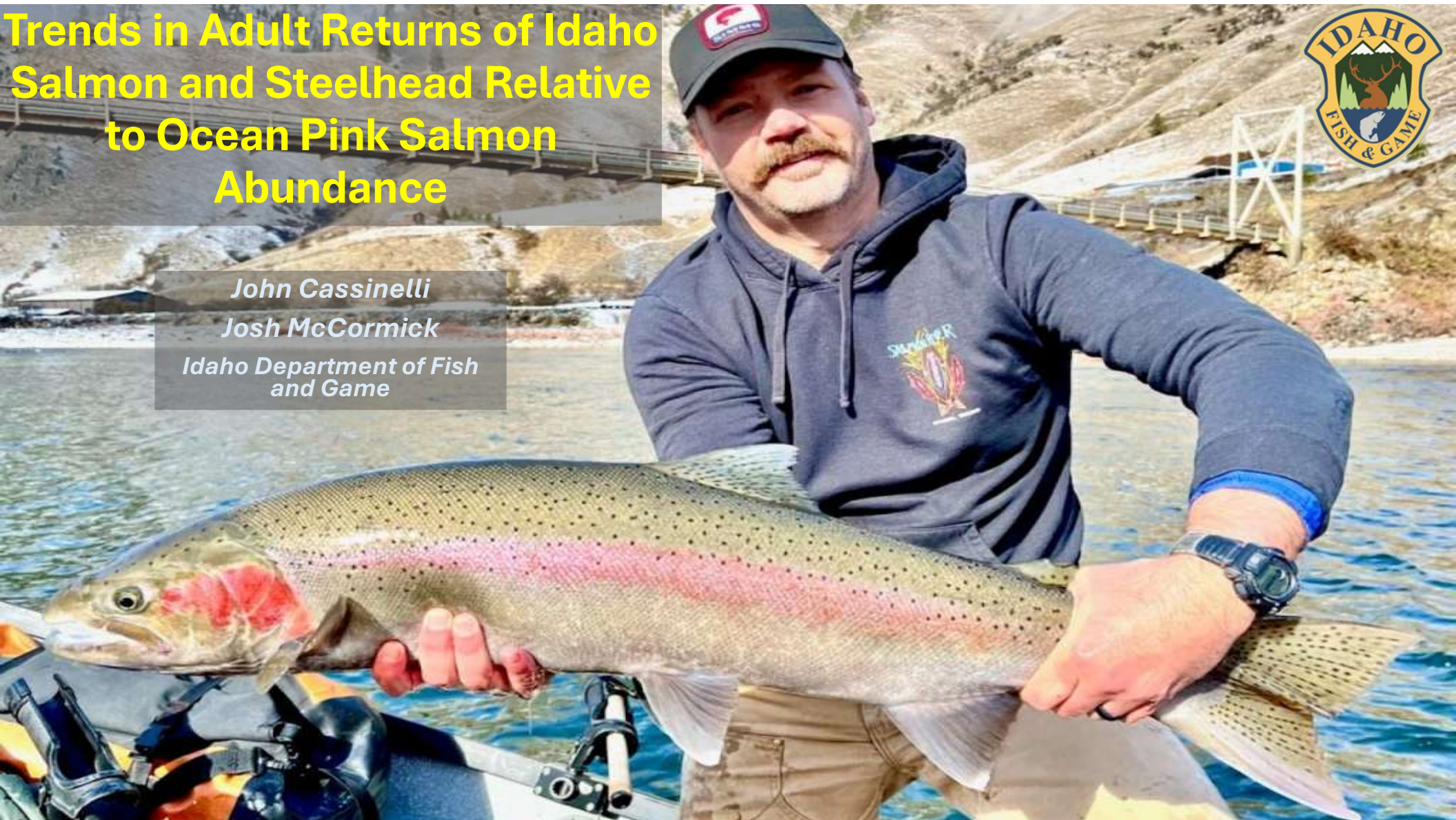


# Trends in Adult Returns of Idaho Salmon and Steelhead Relative to Ocean Pink Salmon Abundance

*John Cassinelli*

*Josh McCormick*

*Idaho Department of Fish and Game*



# Idaho Anadromous 101

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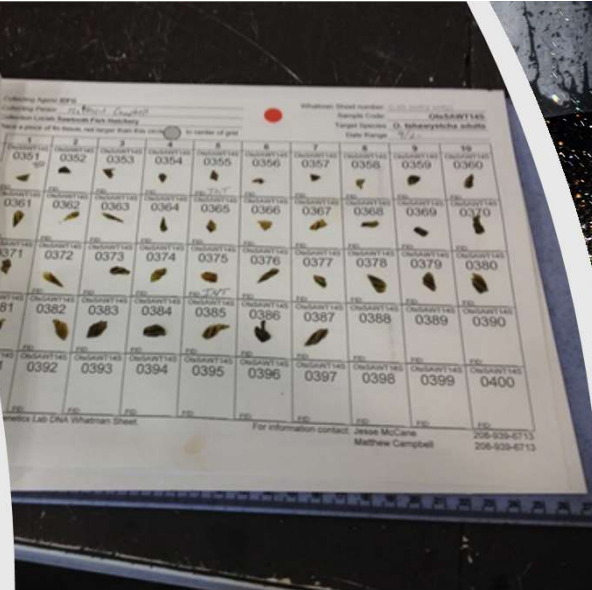
- **Chinook (spring, summer, and fall runs)**
  - > 45% of entire Columbia River run (historically, one of the world's largest)
- **Summer run steelhead**
  - > 50% of entire Columbia River run
  - 2-ocean aged NF Clearwater run considered some of largest steelhead in North America
- **Wild fish (all species except Coho, Clearwater Chinook) listed under ESA**
- **Large hatchery programs in place for all species**



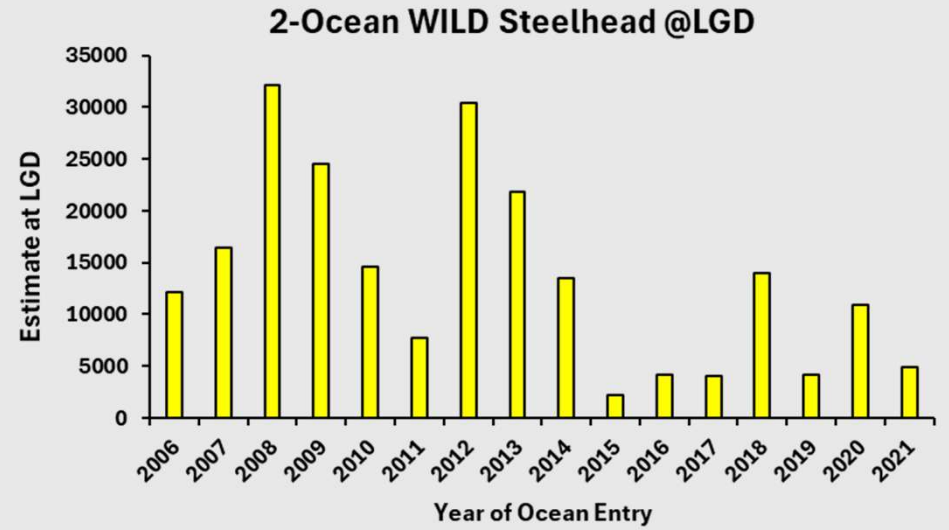
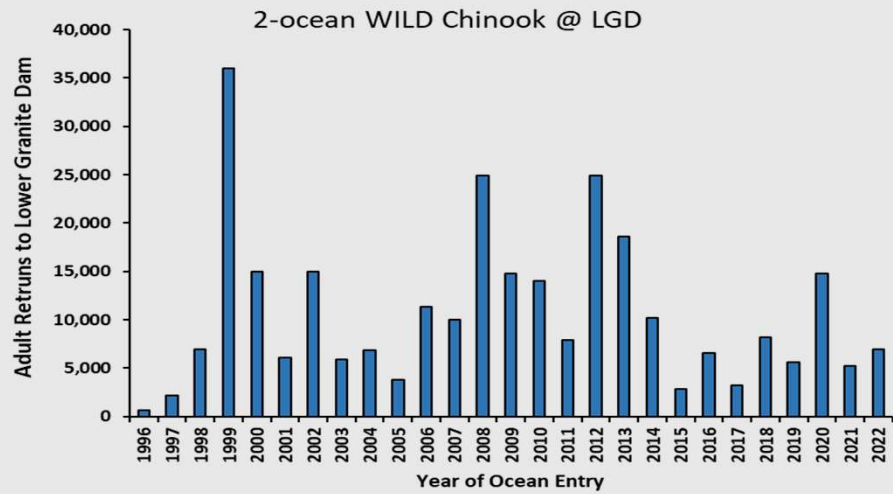
# Adult Return Monitoring

- Counts and trapping at Lower Granite Dam (estimated returns of all species by age)

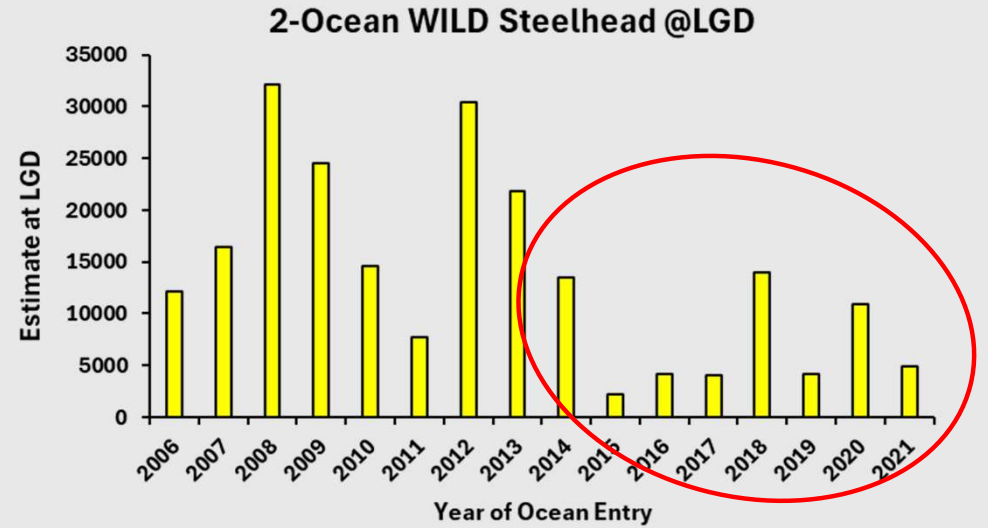
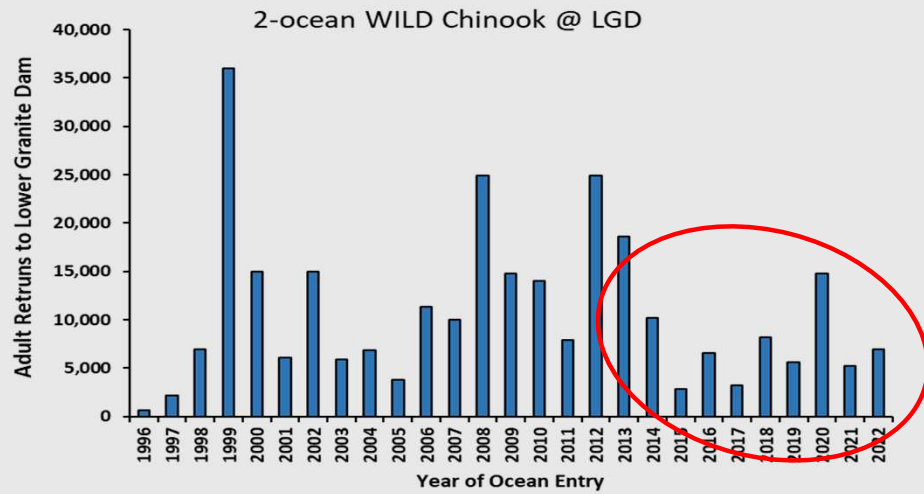
- IDFG Aging Lab
- Genetic tools since 2009
  - Genetic Stock Identification
  - Parental Based Tagging



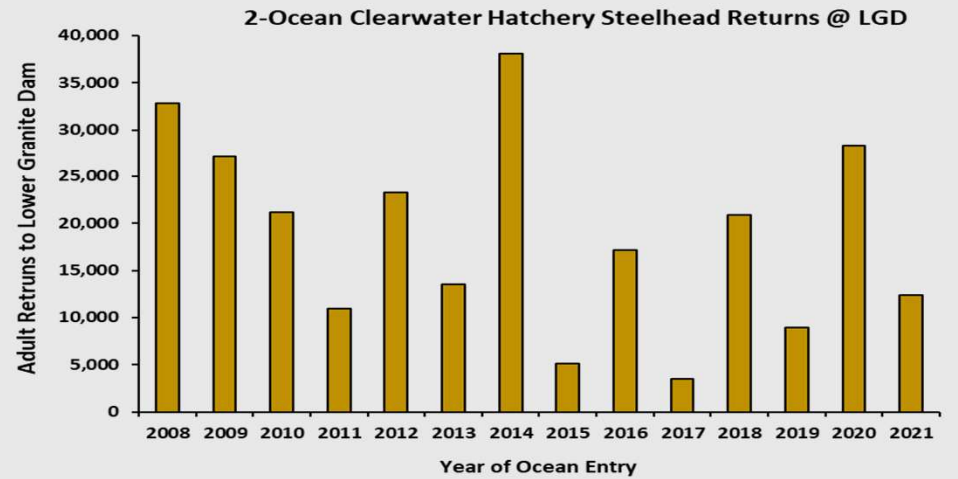
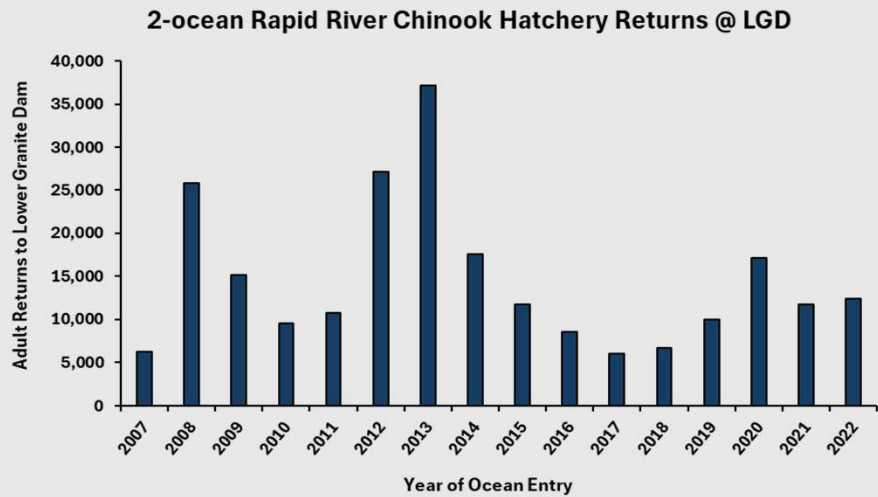
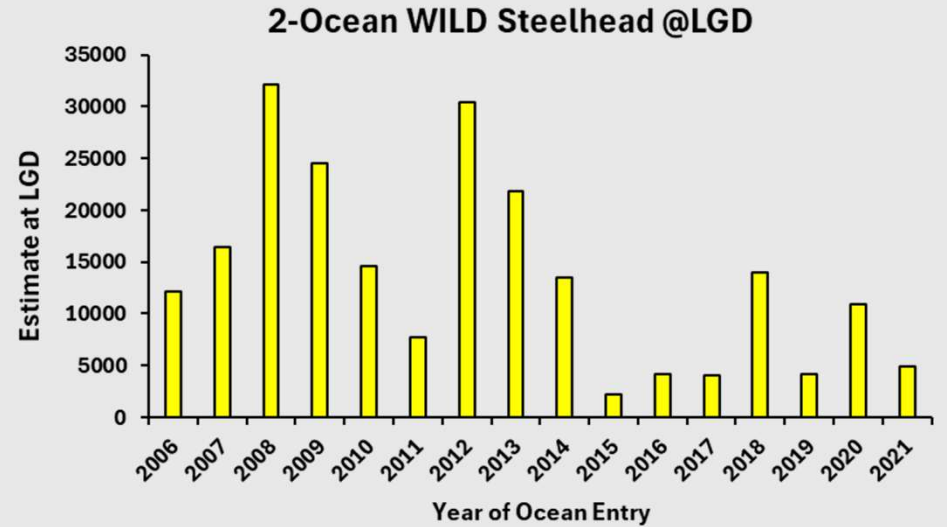
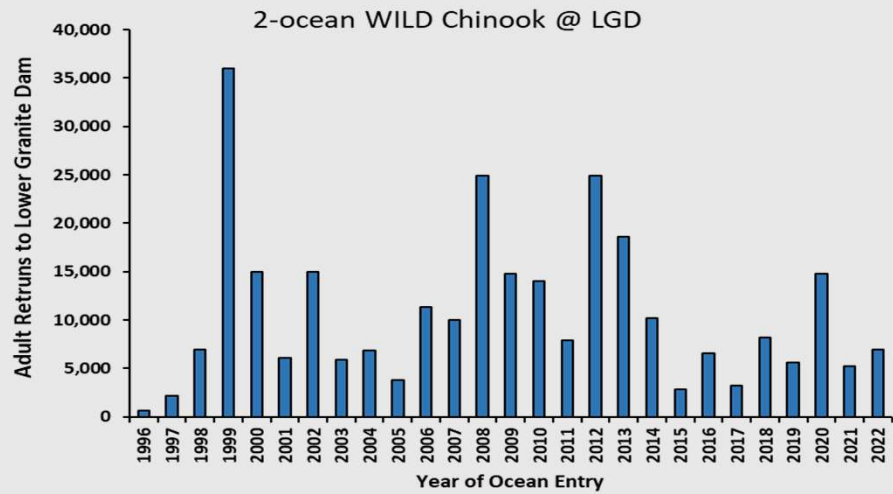
# Adult Return Trends



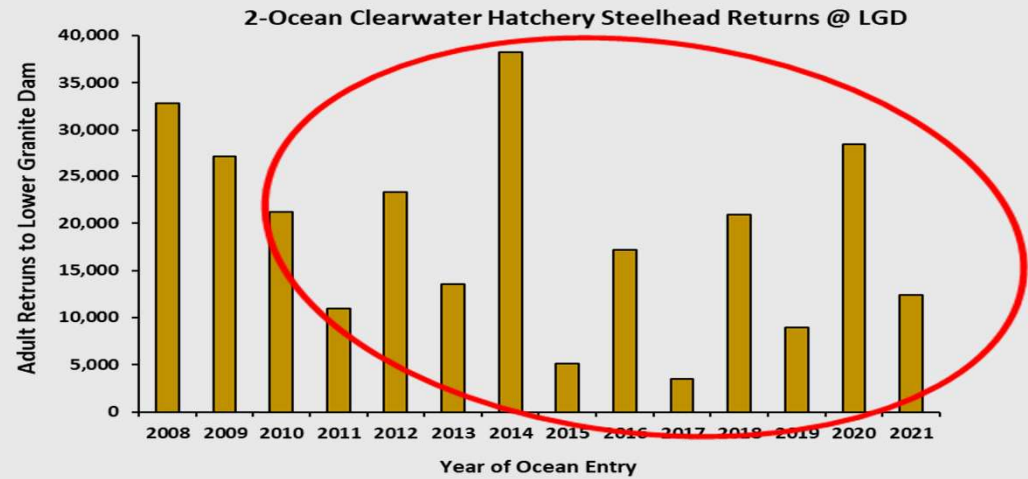
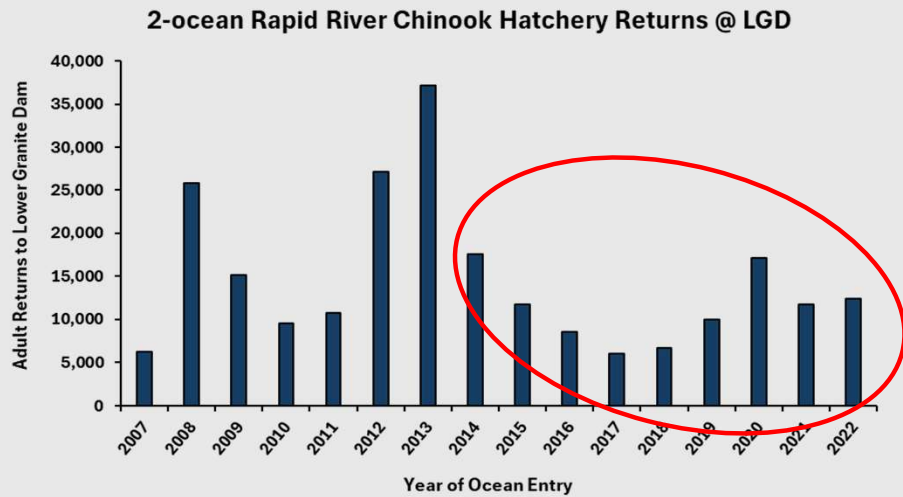
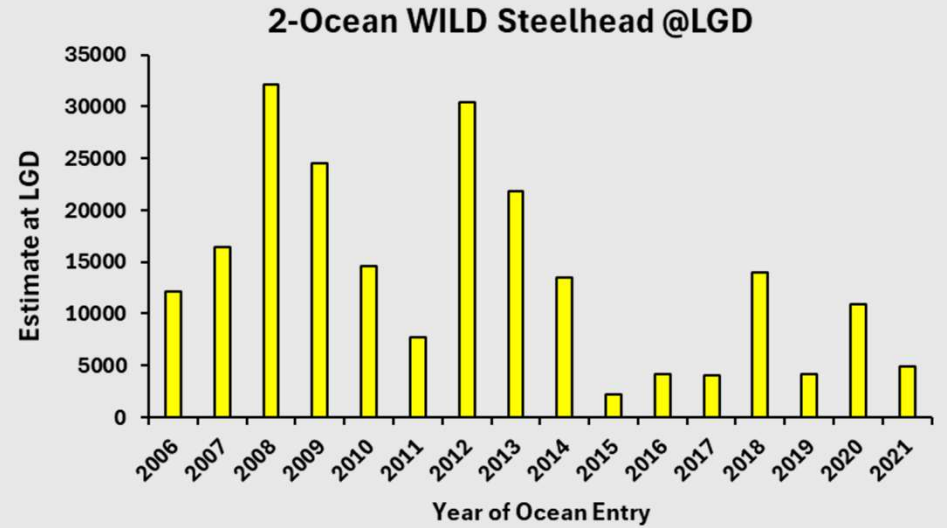
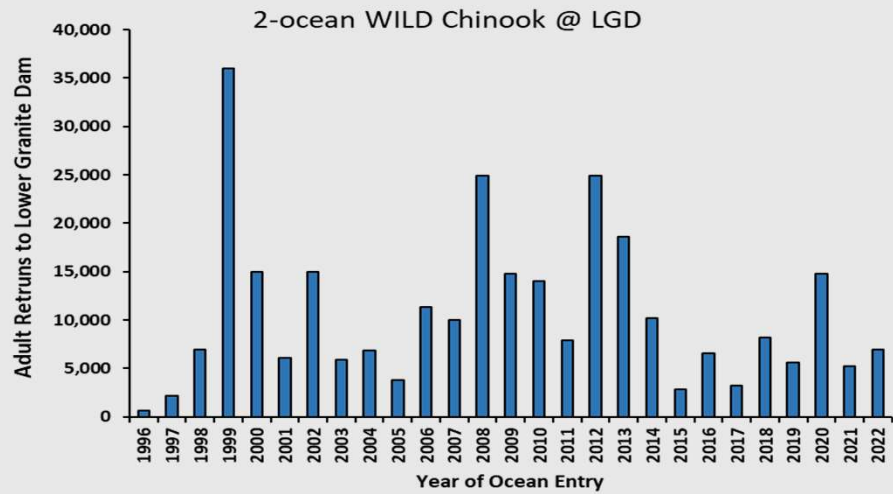
# Adult Return Trends



# Adult Return Trends



# Adult Return Trends



# Relevant Research

Odd year Pink Salmon abundance in N. Pacific growing, at all-time high (*Rand and Ruggerone, 2024*)

Estimated that Pink Salmon comprise up to 80% of all Pacific Salmon



Odd year Pink Salmon abundance found to have negative impacts on combination of abundance, growth, and reproductive success of numerous species (*Litz et al. 2021; Buckner et al. 2023; Ruggerone et al. 2023 & 2025, Vosbigian et al. 2024, Ohlberger et al. 2025*)

Squid

Forage fish

Seabirds

Whales

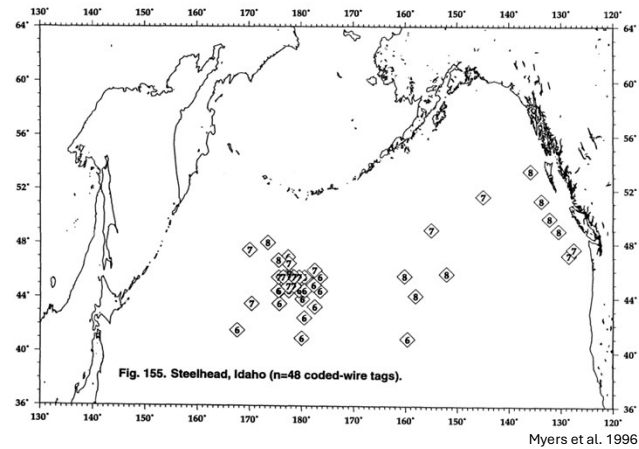
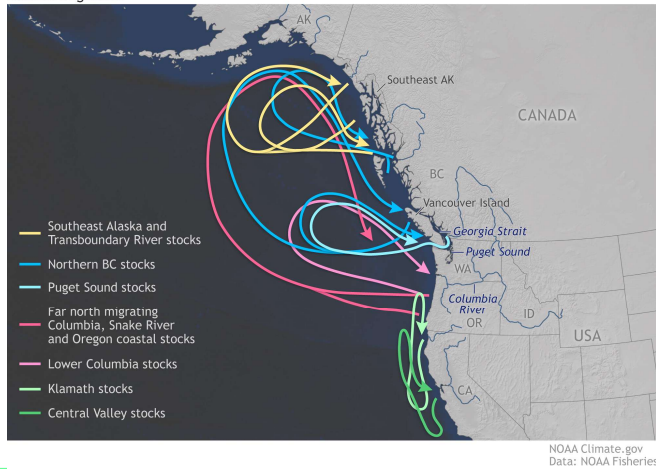
Steelhead

All other  
Pacific Salmon

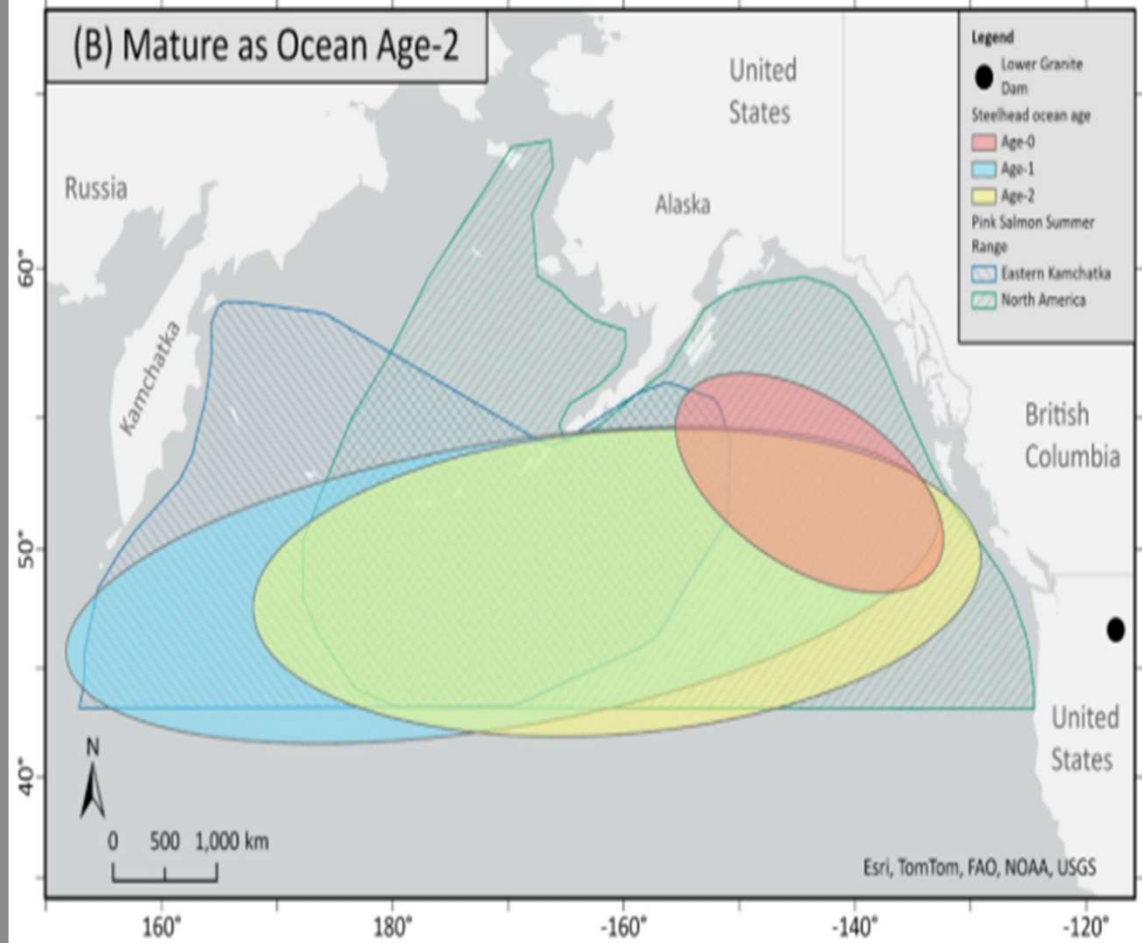


Increases in Pink Salmon abundance since mid 1950's correlated with N. Pacific heat content (*Rand and Ruggerone, 2024*)

Salmon migration

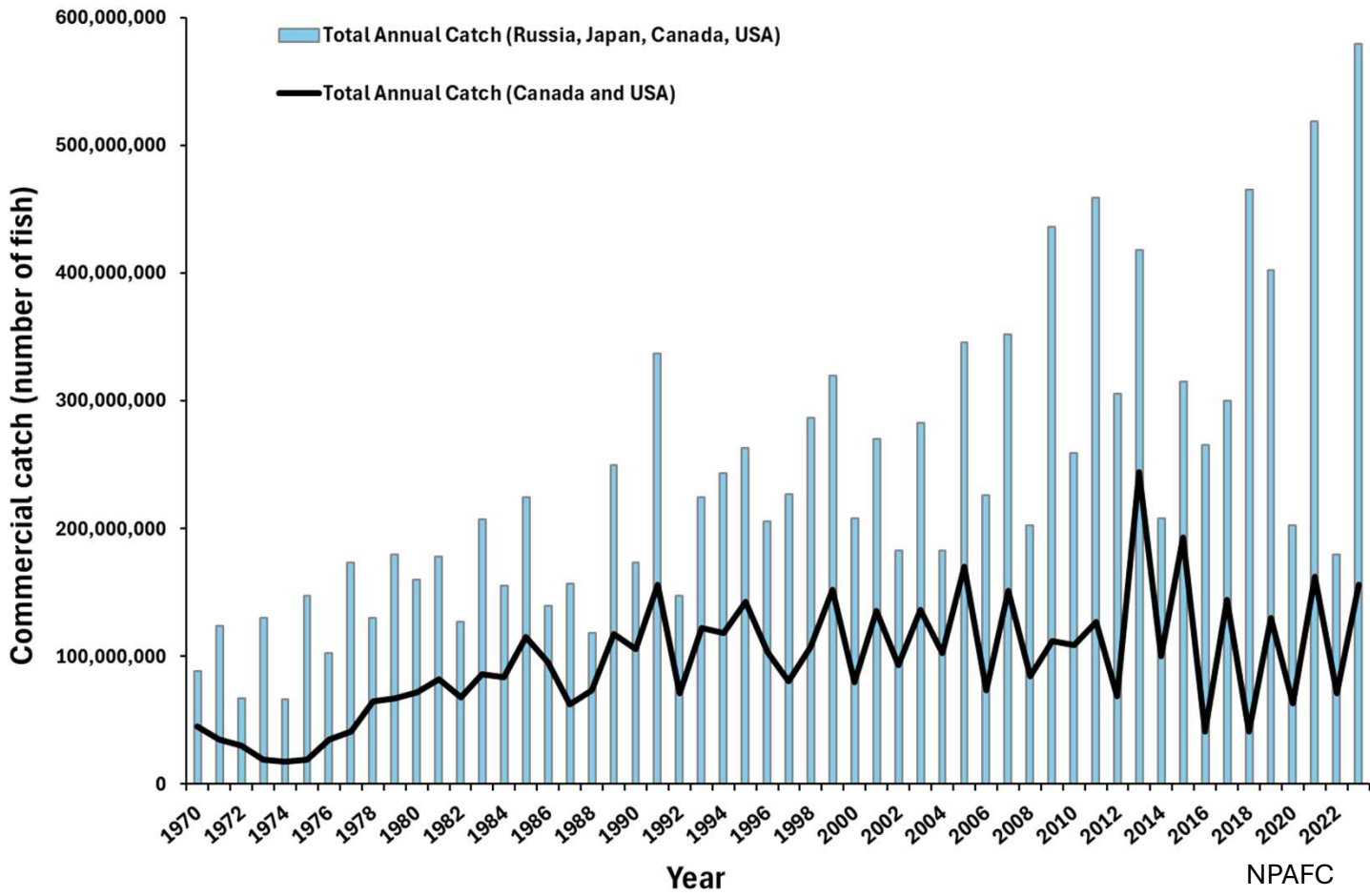


(B) Mature as Ocean Age-2



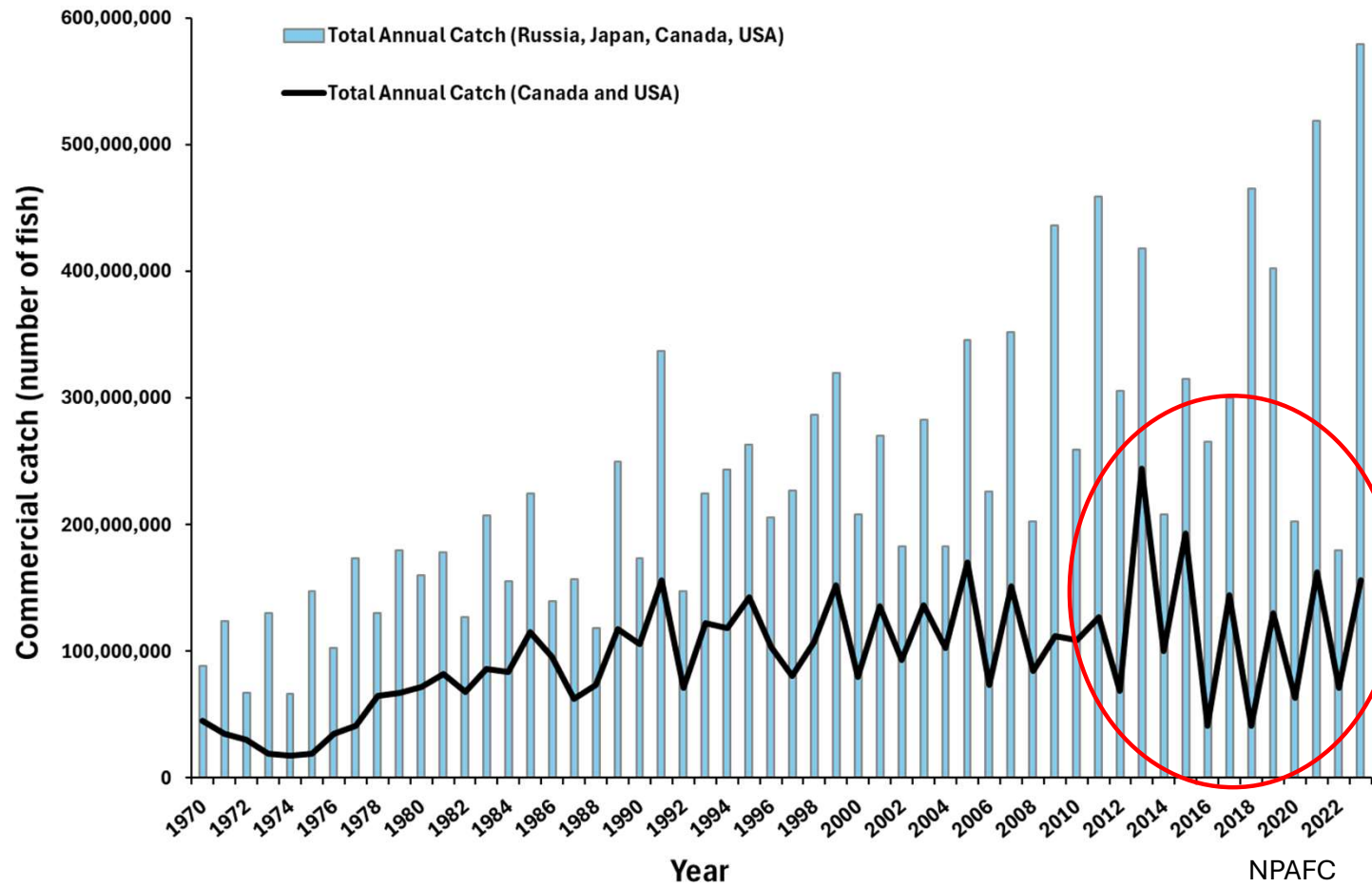
# Pink Trends

## North Pacific Commerical Catch of Pink Salmon



# Pink Trends

## North Pacific Commerical Catch of Pink Salmon



NPAFC

# Methods

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## State space model

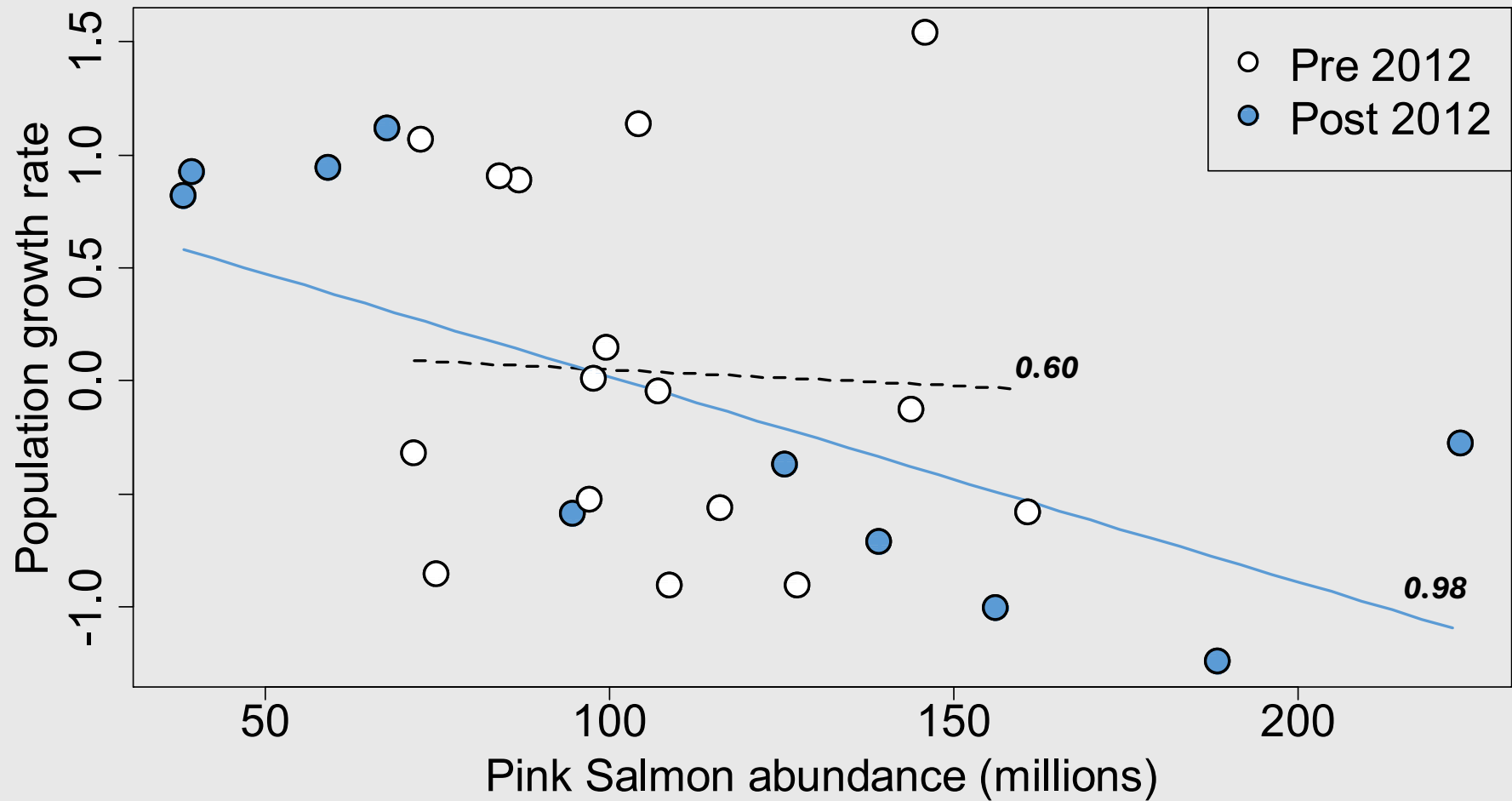
$$\log(N_t) \sim \text{normal}(\log(N_{t-1}) + r_t)$$

- $N_t$  = abundance in year  $t$
- $r$  = intrinsic rate of increase

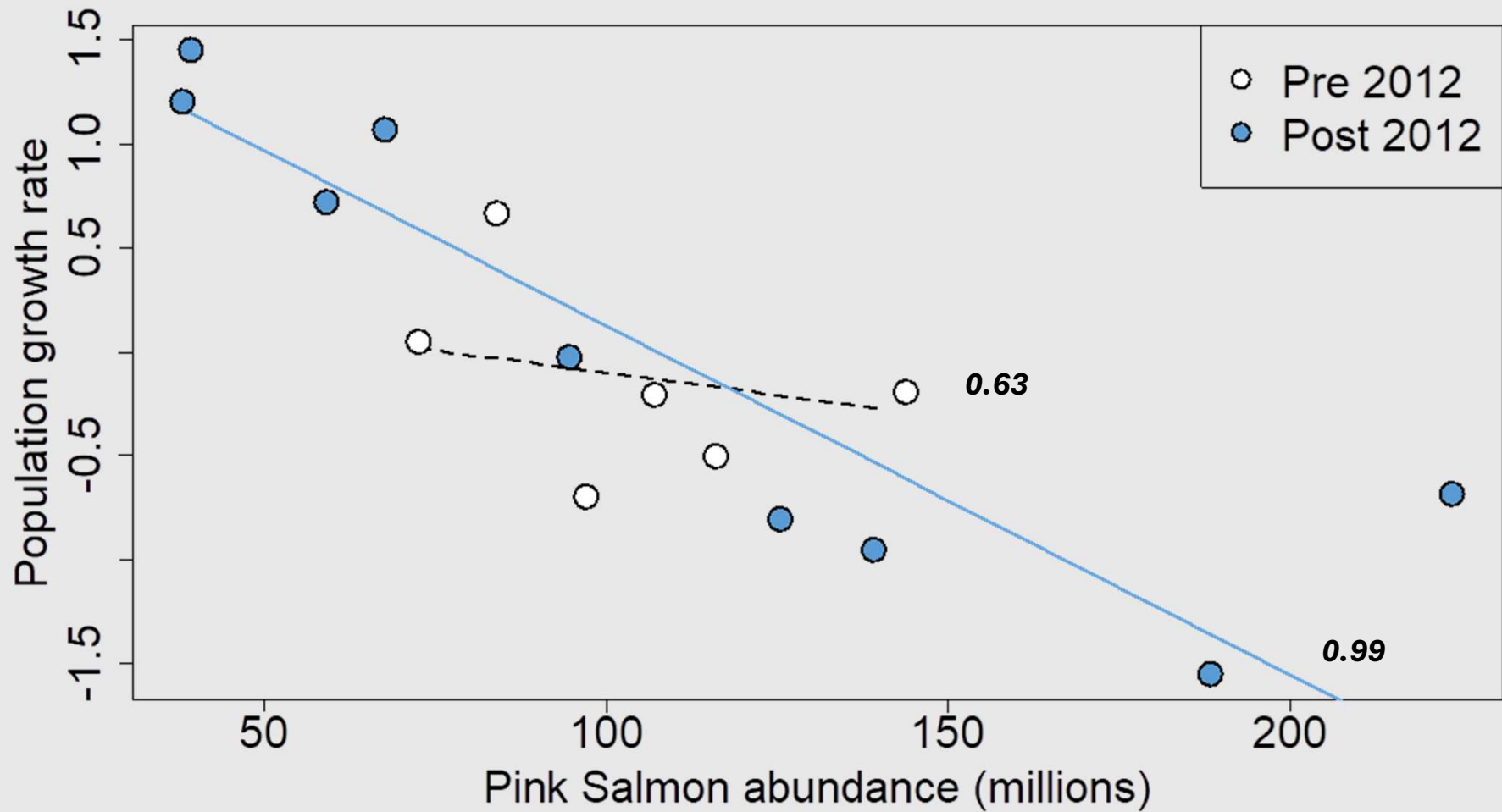
$$r_t = \beta_0 + \beta_1 x_t + \varepsilon$$

- $\beta_0$  = intercept
- $\beta_1$  = slope
- $x_t$  = Pink Salmon abundance
- $\varepsilon$  = residual error

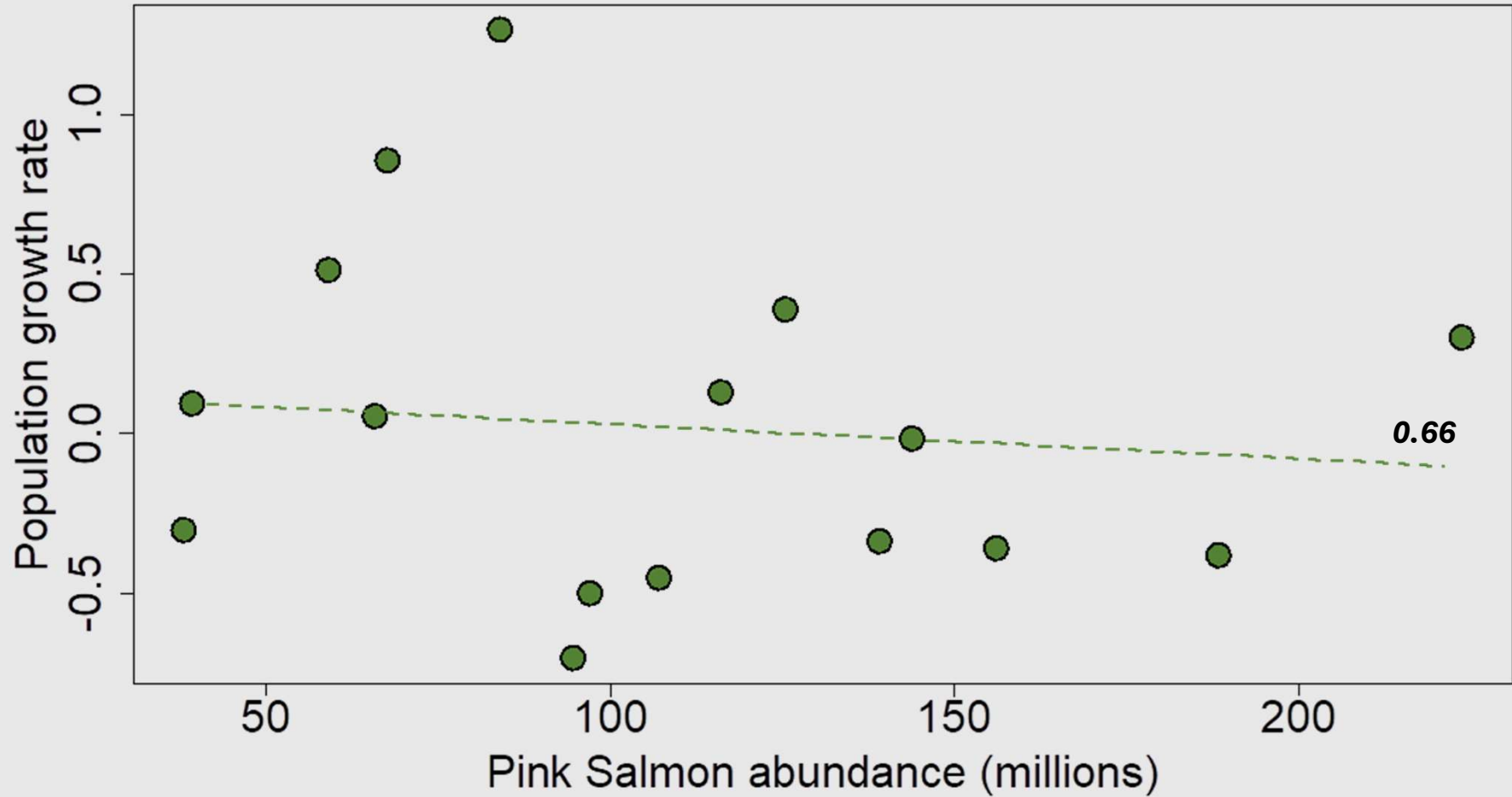
# 2-ocean WILD Chinook



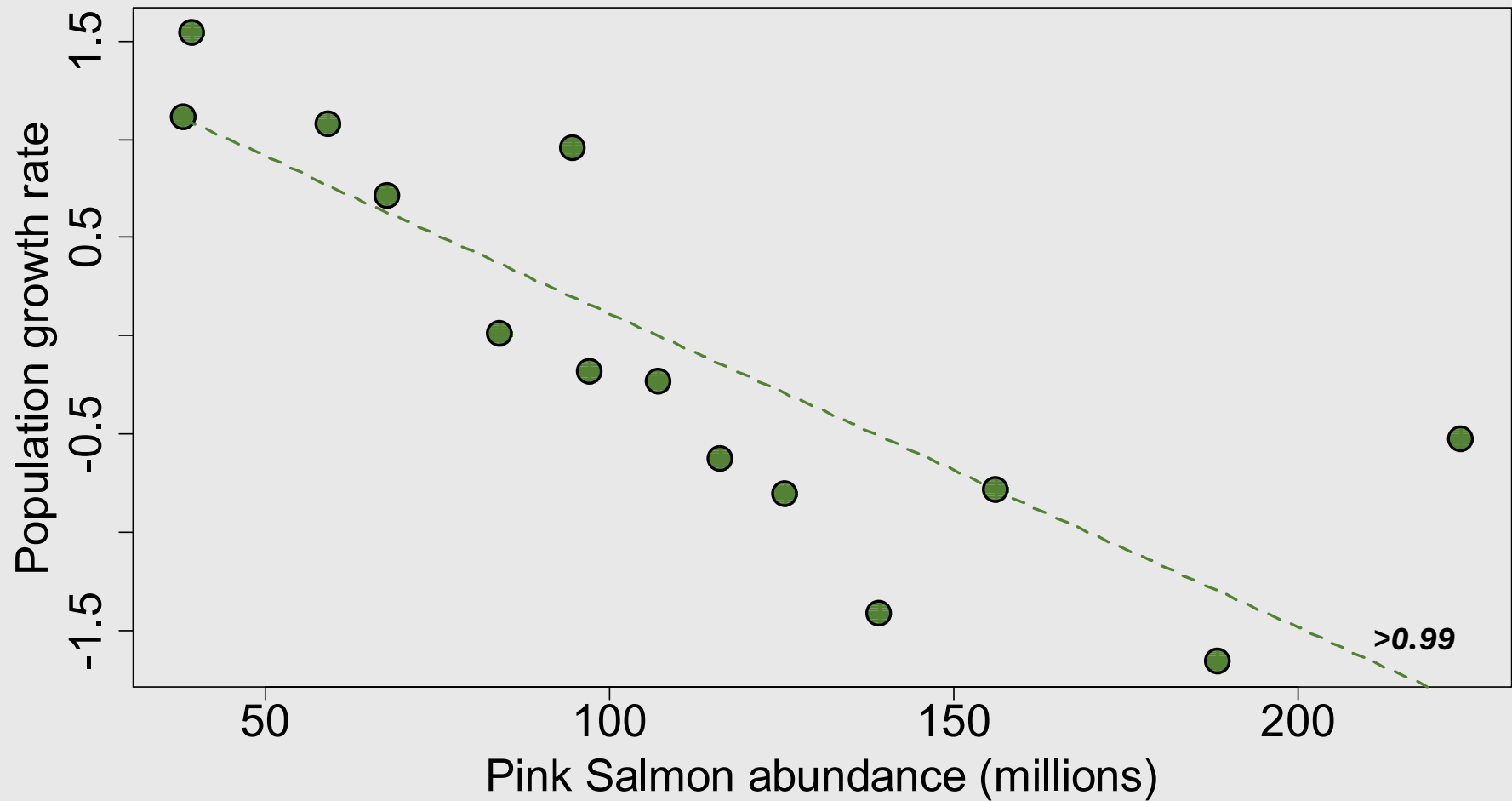
## 2-Ocean WILD Steelhead



## 2-ocean HATCHERY Chinook (Rapid River)



## 2-ocean HATCHERY steelhead (Clearwater Basin)



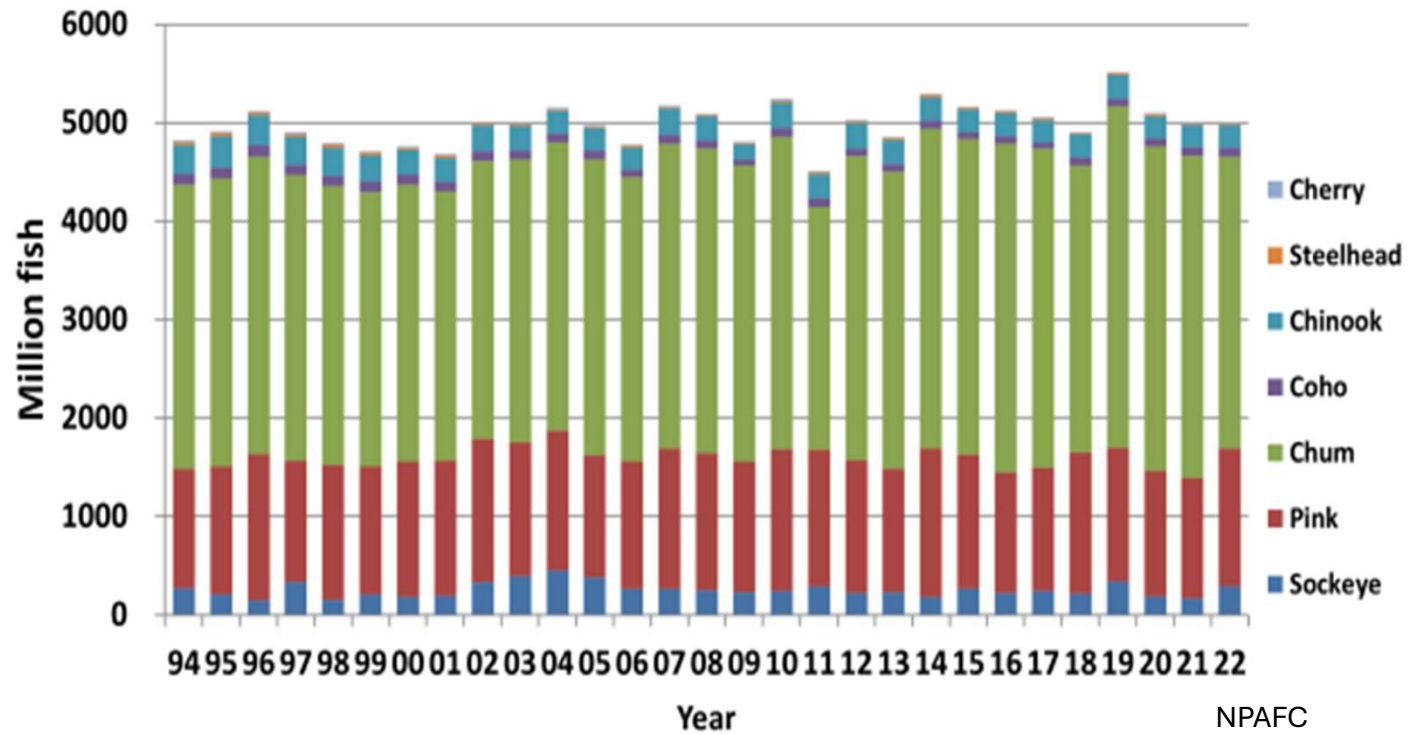
**Cycles in adult steelhead length suggest interspecific competition in the North Pacific Ocean – Vosbigian et al. 2024**

- Odd yr. 2-ocean Snake R. adult steelhead, 17 mm shorter than even-year
- Odd year returns: 54.3% age-1, 44.5% age-2
- Even year returns: 31.8% age-1, 66.9% age-2
- Gonatid squid diet overlap
- Warmer seas surface may increase dietary needs of steelhead
- Changing climate may favor pink salmon



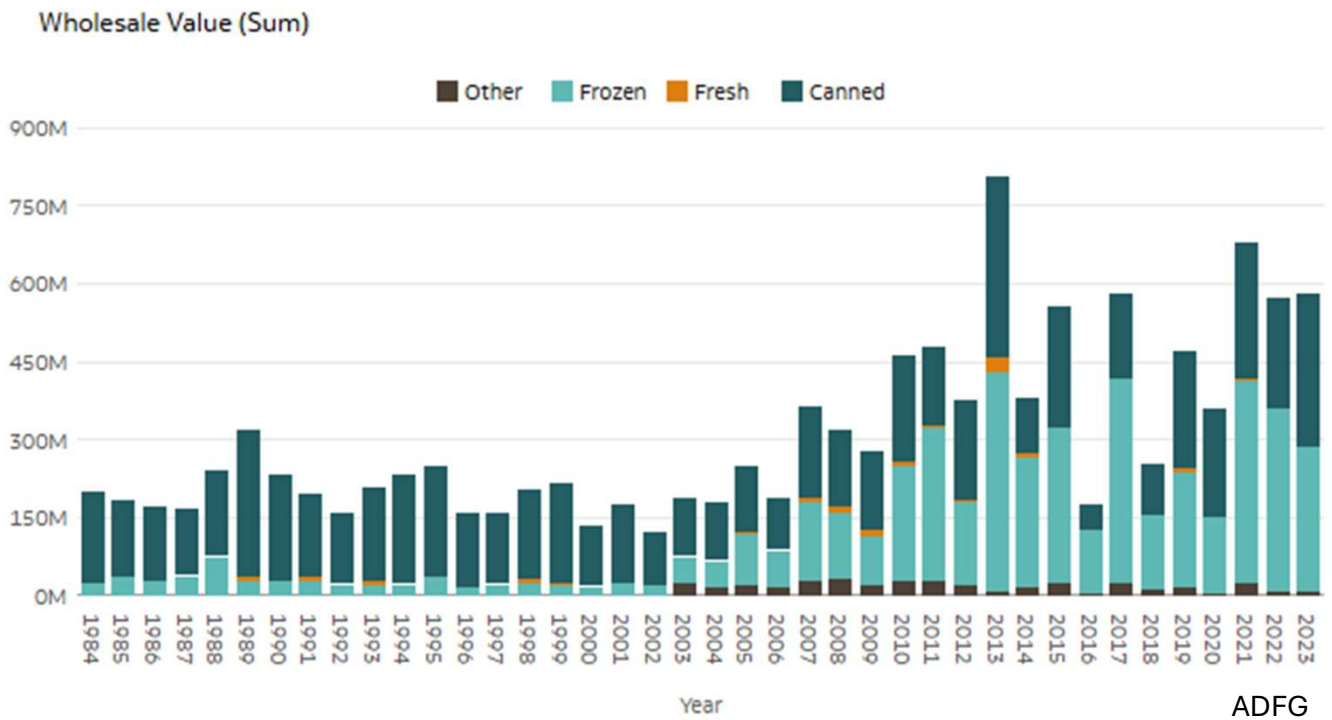
# Hatchery Releases

## North Pacific (US, Russia, Korea, Japan, Canda) Total Hatchery Releases



# Economics

## Economic Trends (AK Commercial Pink Salmon)



ADFG



# Summary

- **Pink Salmon abundance impacts multitude of species in N. Pacific Ocean**
- **High odd year Pink abundance negatively correlated with adult returns of some Snake R. runs**
  - Largest impact on steelhead
  - Relationship amplified in wild populations by decreased natural production every other year?
- **Role of changing climate have on:**
  - Pink Salmon population growth and expansion?
  - Even/Odd year dominance?
- **Highlights complexity of multijurisdictional species management and priorities**

# Acknowledgements

- IDFG anadromous research staff
- IDFG & CRITFC genetics labs
- IDFG Nampa aging lab
- IDFG anadromous hatchery program
- Nez Perce Tribe
- Shoshone Bannock Tribe
- US Army Corps of Engineers
- Bonneville Power Administration
- Lower Snake River Compensation Plan
- Idaho Power Company



Questions?

