Northwest **Power** and **Conservation** Council

March 5, 2024

MEMORANDUM

TO: **Council Members**

FROM: **Kris Homel**

SUBJECT: **Update on Ocean Conditions for Salmon and Steelhead**

BACKGROUND:

Presenter: Brian Burke (Supervisory Research Fish Biologist, National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center)

Summary: Brian will present research findings and outlooks associated with Chinook and Steelhead returns to the Columbia River based on indicators of ocean conditions.

Relevance: The monitoring efforts associated with Brian's presentation have been consistently supported by the Council and were also highlighted as critical in both the 2014 Fish and Wildlife Program and the 2020 addendum. The monitoring efforts are implemented through Project #1998-014-00, *Ocean Survival Of Salmonids*. This work addresses several measures in the Fish and Wildlife Program by providing an overview of ocean ecological indicators as they relate to salmon survival. This information is also used in one of the Strategy Performance Indicators in Program Tracker. In addition to this presentation today, critical ocean research and monitoring topics will be further discussed at the next Ocean and Plume Science and Management Forum scheduled next month on April 4th.

Workplan: Fish and Wildlife Division work plan 2024; Program planning & Coordination.

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Bill Edmonds
Executive Director

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Background: The Council's research and monitoring efforts related to the marine environment for anadromous fish began in 1998 in response to the 1996 amendment to the Northwest Power Act, which calls on the Council to consider ocean conditions when making project funding recommendations.

The Council's Fish and Wildlife Program recognizes the ocean environment as an integral component of the Columbia River ecosystem. Measures in the Program support monitoring the ocean conditions and in-river restoration actions to determine those actions of greatest benefit, to separate the effects of ocean-related mortality from that caused in the freshwater part of the life cycle, and to assess salmonid survival and evaluate restoration potential given variable ocean conditions.

Gaps remain in the implementation of the Fish and Wildlife Program measures and the recommendations of the Council as part of the Mainstem and Program Support Project review on August 14, 2019 (please see *Project-Specific Recommendations (page 13)*. In 2012, Bonneville reduced funding for this project by approximately fifty percent.

Recently, there has been additional focus on the ocean through the "U.S. Government Commitments in Support of the Columbia Basin Restoration Initiative and in Partnership with the Six Sovereigns", which were released in December 2023. These commitments are the result of settlement discussions on Columbia River System litigation related to the Endangered Species Act and the National Environmental Policy Act. Within these commitments, the federal government specifically identifies the critical importance of the ocean to salmon and steelhead and the necessity for meaningful actions.

More Info:

- Ocean and Plume Science and Management Forum website

Update on Ocean Conditions for Salmon and Steelhead

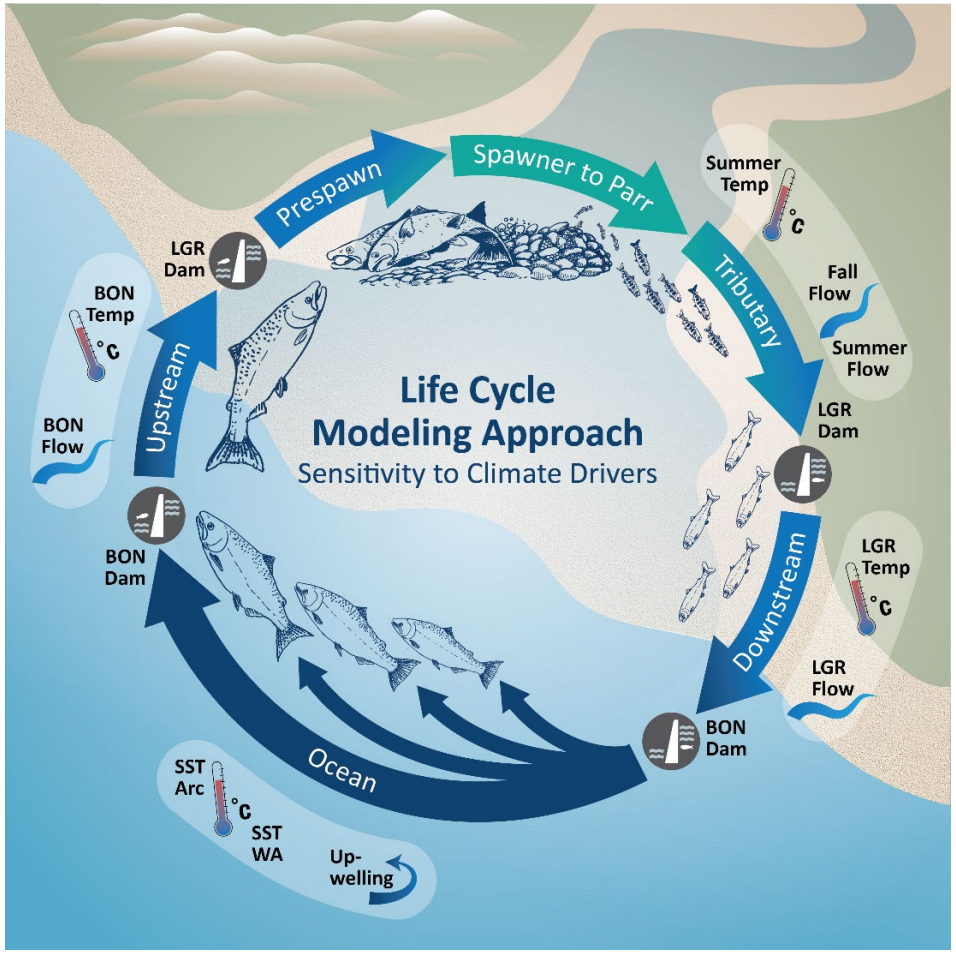
Northwest Power and Conservation Council
March 13th, 2024

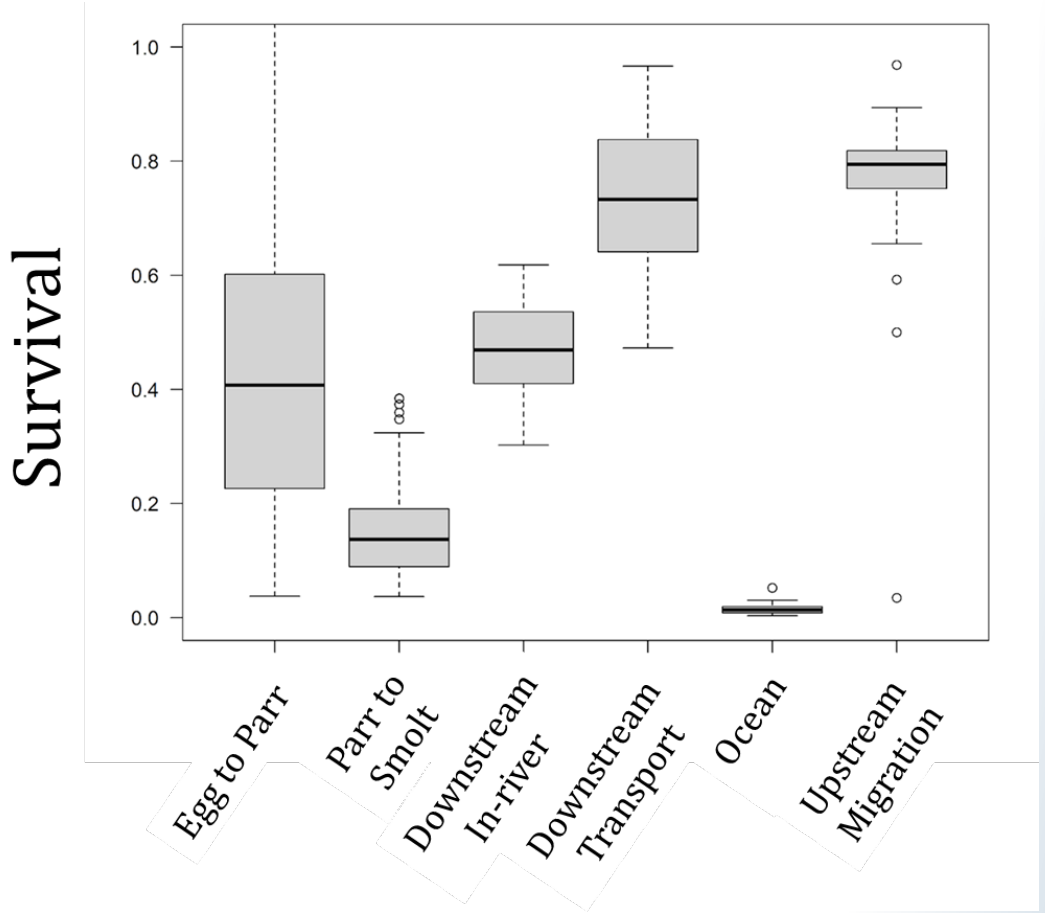
Presenter: Brian Burke
NOAA Fisheries, NWFSC

Team: Brian Beckman, Cindy Bucher, Elizabeth Daly, Susan Hinton, David Huff, Mary Hunsicker, Kym Jacobson, Jessica Miller, Cheryl Morgan, Krista Nichols, Joe Smith, Don Van Doornik, Laurie Weitkamp, Amy Wallace, Brian Wells, Jen Zamon

Also supported by:

Life Cycle Models, Survival, and the Ocean

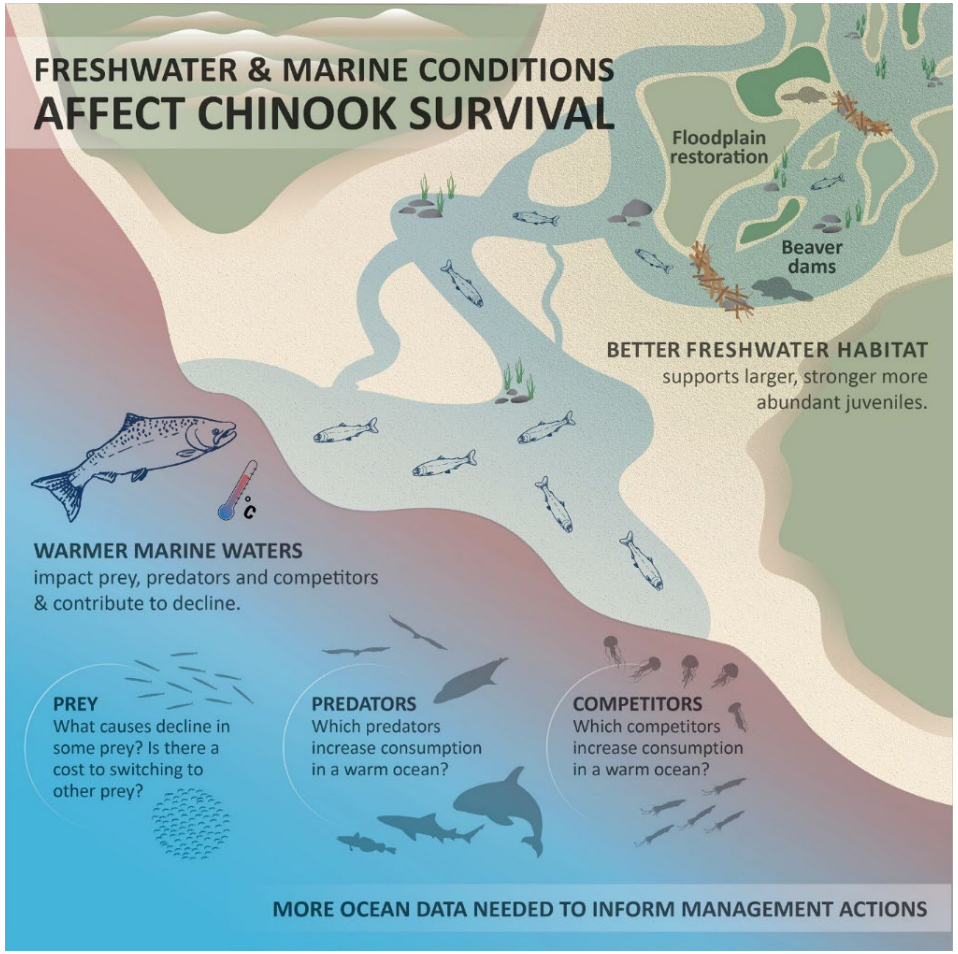


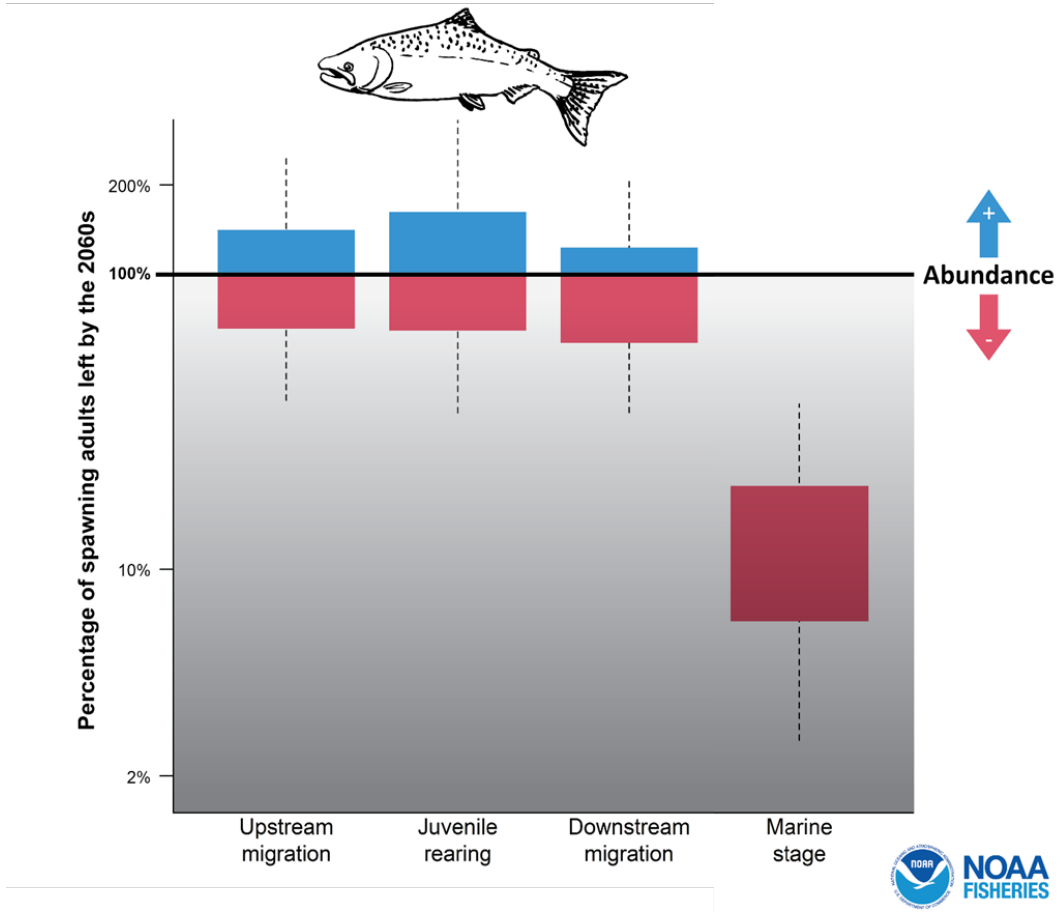


Crozier et al. 2021. Communications Biology
https://doi.org/10.1038/s42003-021-01734-w

NOAA FISHERIES

Climate Affects Habitats Differently





Crozier et al. 2021. Communications Biology
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NOAA FISHERIES

Outline

- Who we are and what we do
- Where do salmon go in the ocean?
- Ocean conditions in 2023
- Carryover effects
- CMISST and forecasts

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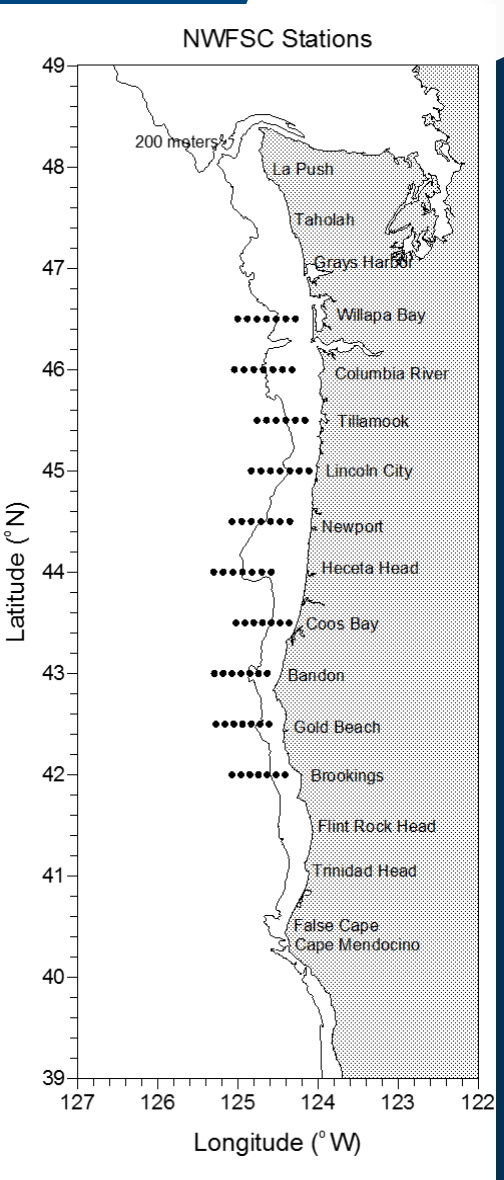
Newport Hydrographic Line and Northern California Current Survey



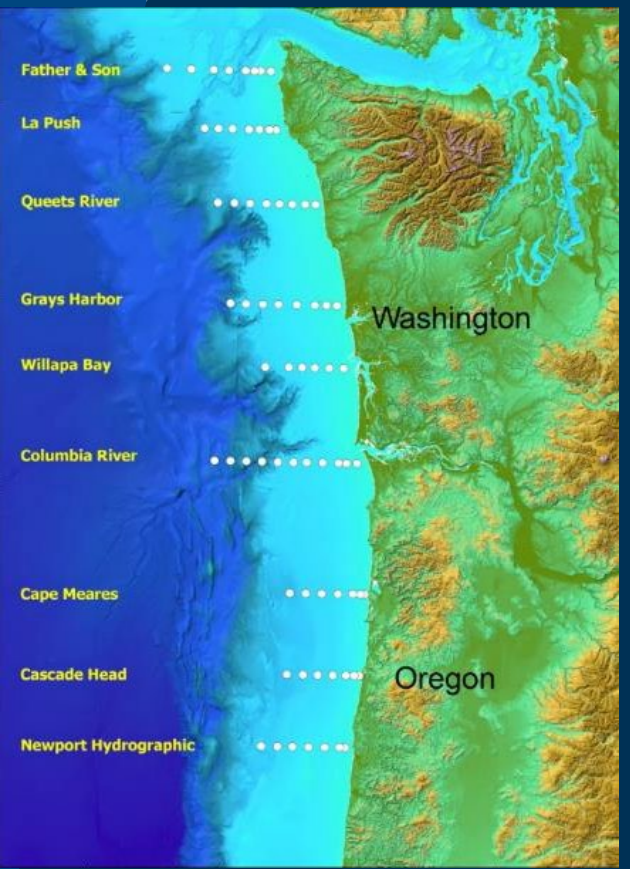
Newport Line: Sampled biweekly for 29 years

Pre-recruit: May-June (2011, 2013-2019)

NCC Survey: Seasonal (2-4 times per year)

Juvenile Salmon and Ocean Ecosystem Survey (JSOES)

- May (2006 – 2012, 2015 - present)
- June (1998 – present)
- September (1998 – 2012)



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First summer in the ocean: 3 general patterns for Columbia River salmon

Pattern 1: Rapid north-wards movement on shelf to Gulf of Alaska

- Spring Chinook, chum, sockeye, some coho

Pattern 2: Remain in local waters

- Fall Chinook, some coho

Pattern 3: Move rapidly offshore

- Steelhead

Plots by Laurie Weitkamp, NOAA Fisheries

NOAA FISHERIES

Adults returning to the Columbia: 3 general migration patterns

Pattern 1: Southwards movement along shelf

Which: Fall Chinook, Chum (?), sockeye (?)

Pattern 2: Northwards along California & Oregon Coasts

Which: Coho

Pattern 3: Move rapidly onshore (or unknown)

Which: Steelhead, Spring Chinook

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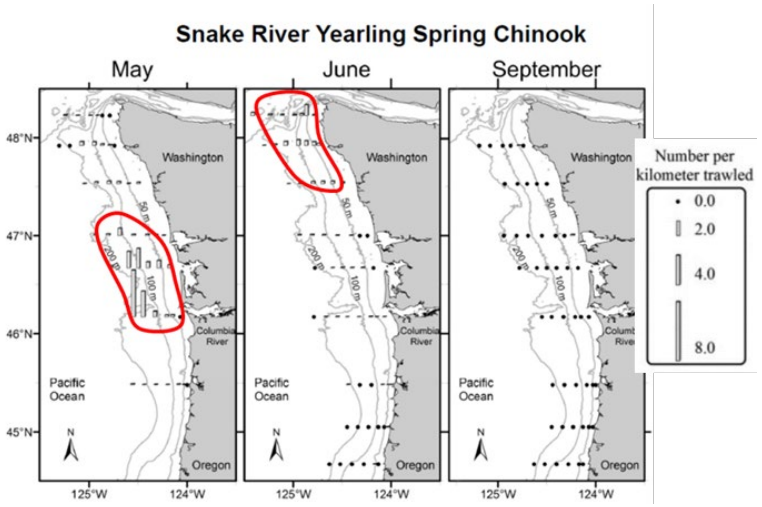
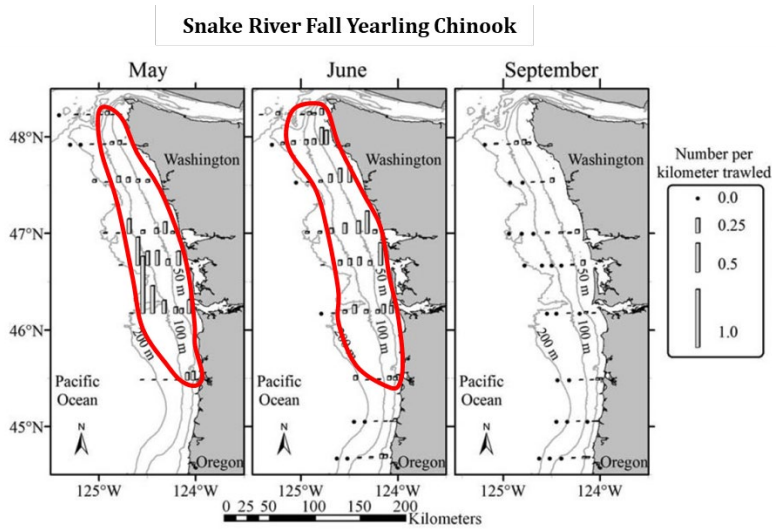
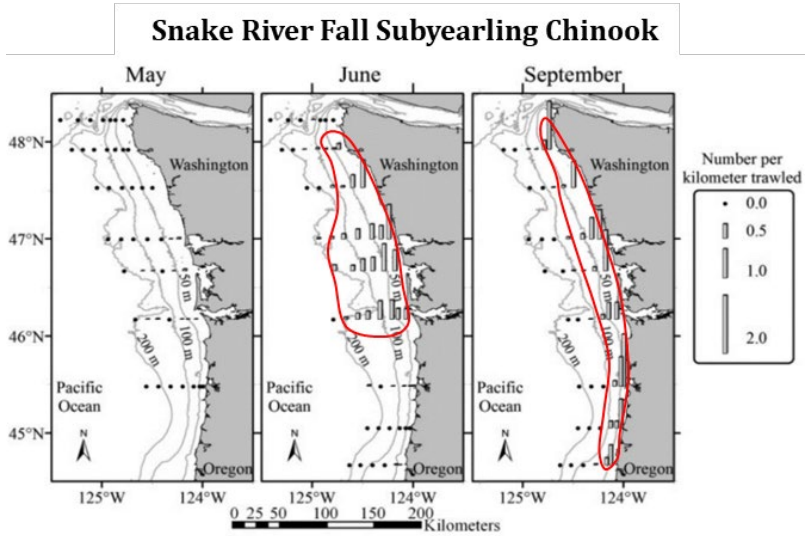
Spatial distribution is stock-specific

Snake River Chinook Salmon







Teel, et al. 2015. Marine and Coastal Fisheries 7:274-300.

NOAA FISHERIES

Take Home Messages

1. The Ocean is not homogenous – where and when salmon migrate will determine their ocean experience, growth, and survival

Outline

- Who we are and what we do
- Where do salmon go in the ocean?
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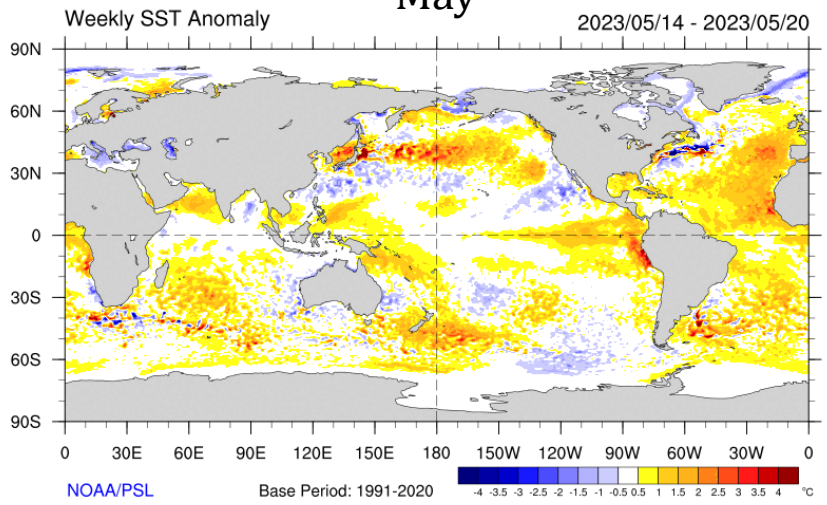
NOAA FISHERIES

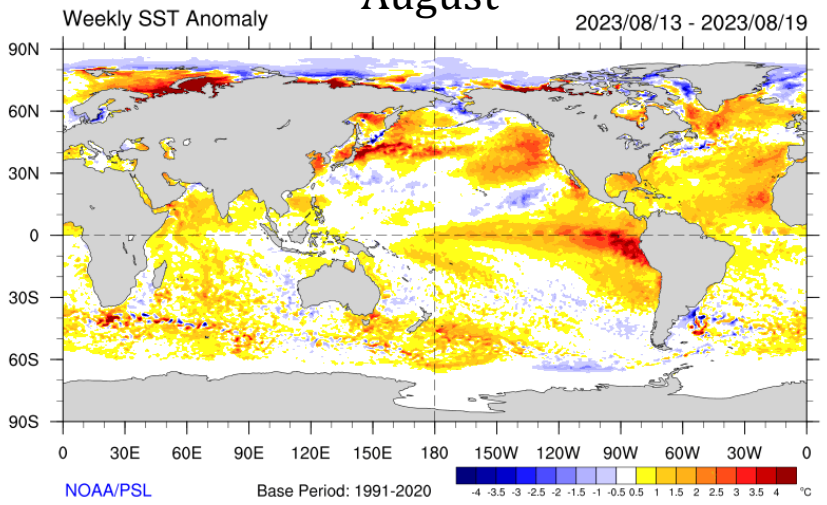
The Sea Surface is warm

May 2023 - February 2024

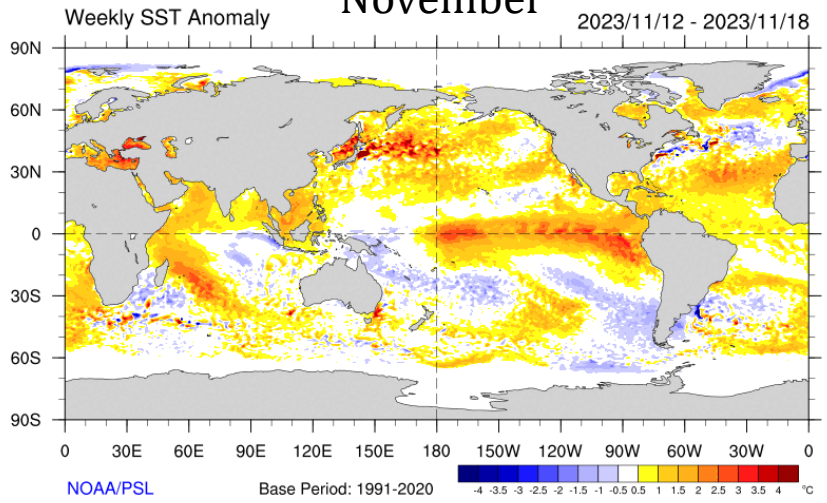
May



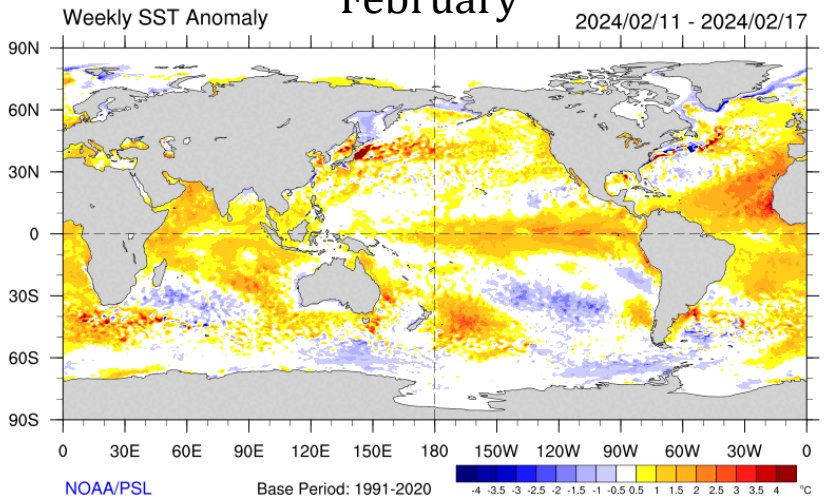
August



November



February



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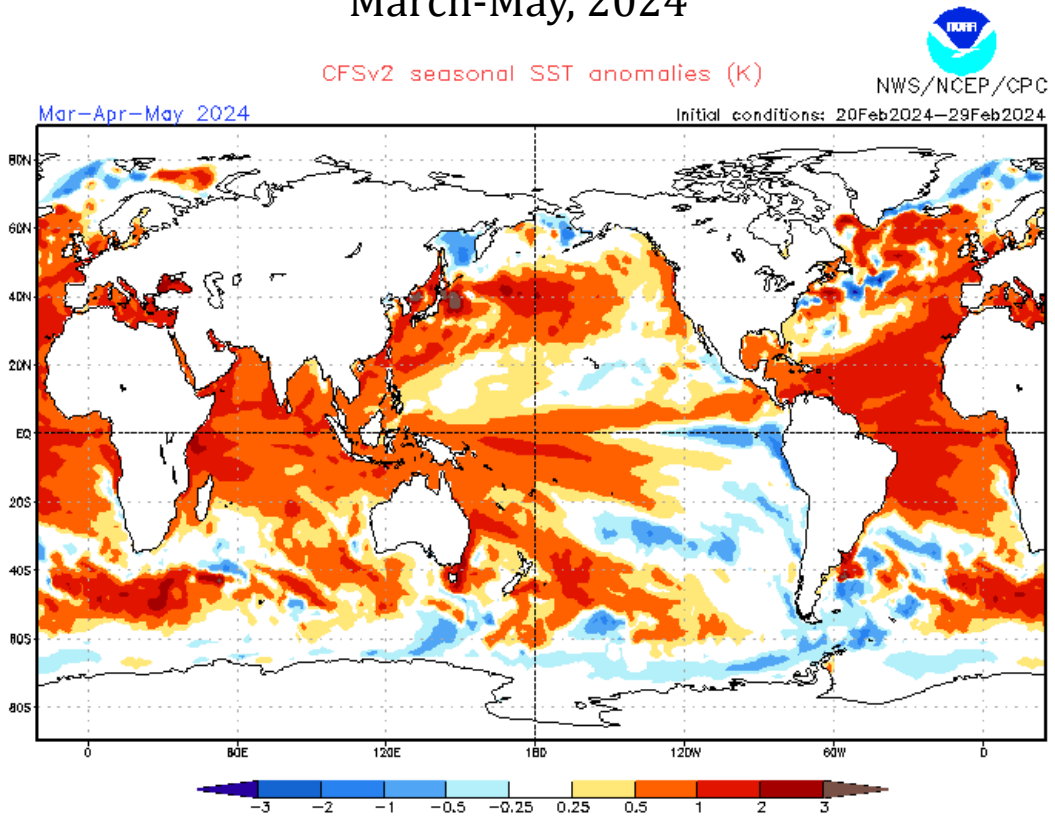
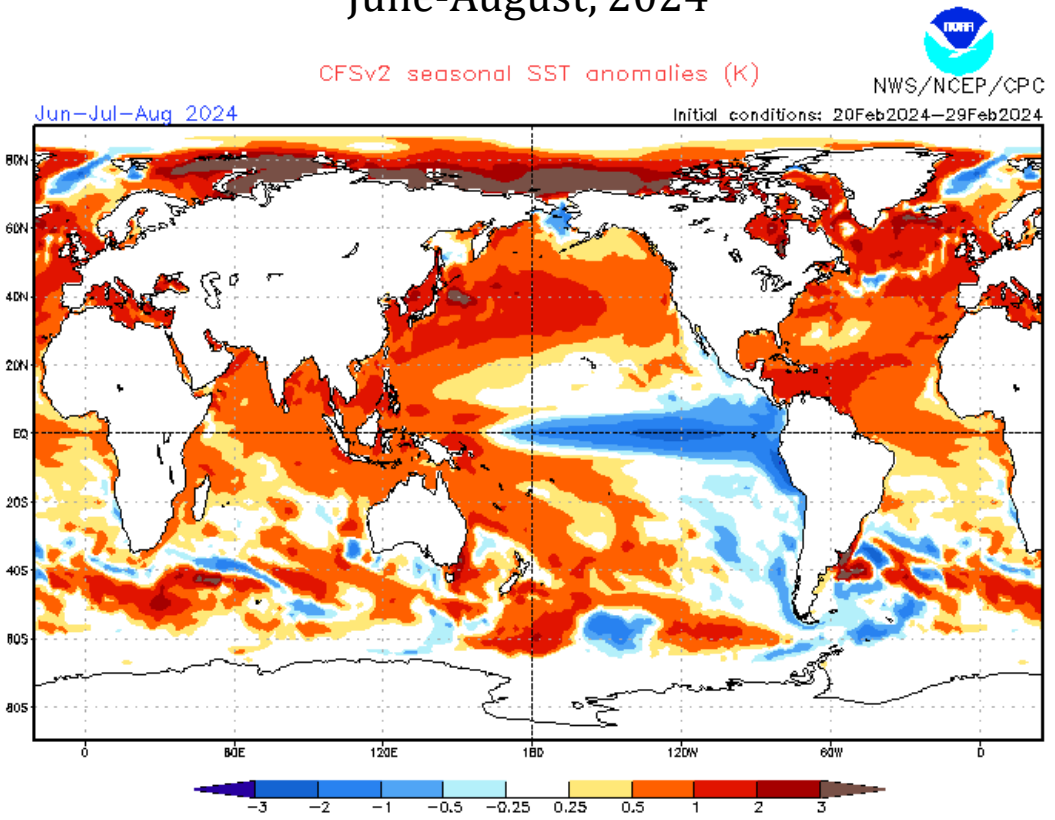
What's in store for this summer?

March-May, 2024



June-August, 2024



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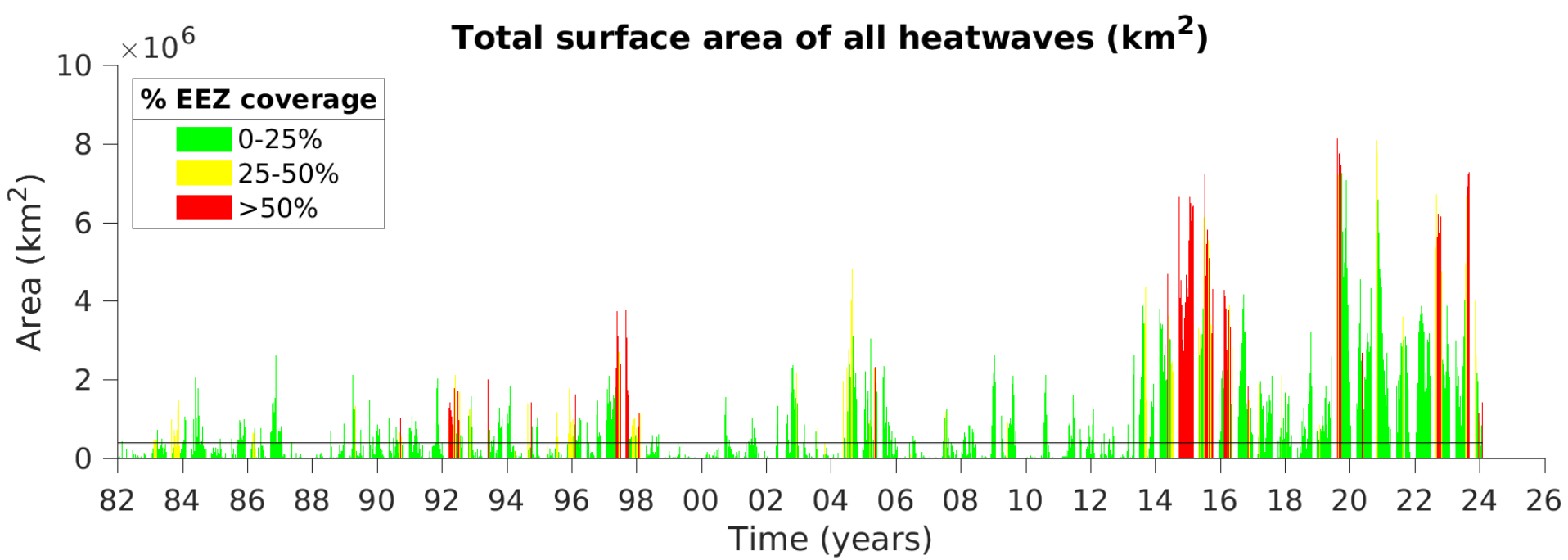
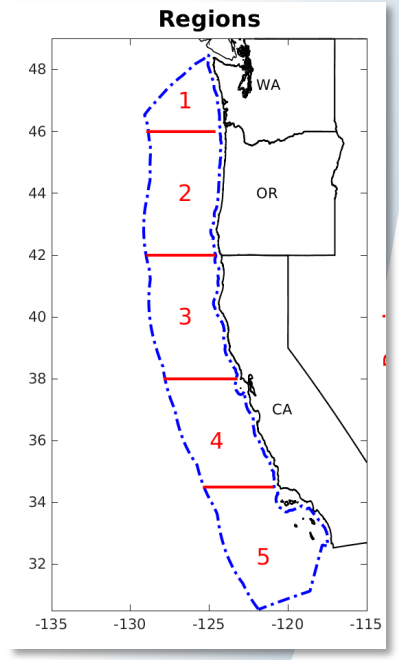
NE Pacific marine heatwaves are increasing





California Current Ecosystem Status Report NOAA
https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-marine-heatwave-tracker-blobtracker

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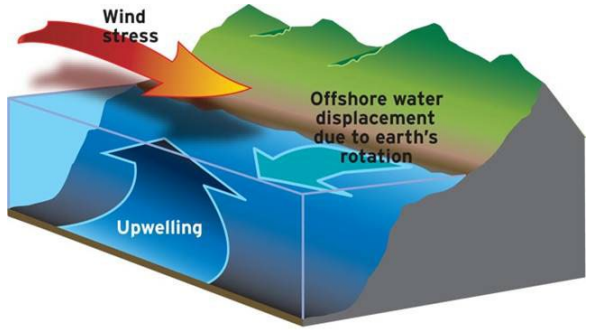
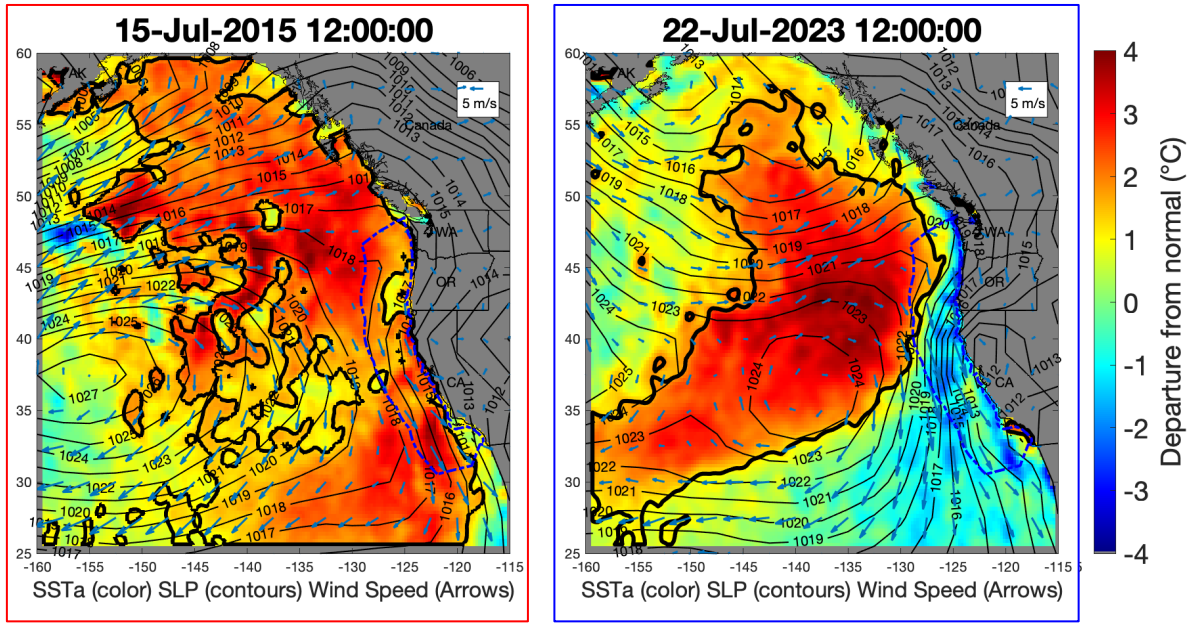
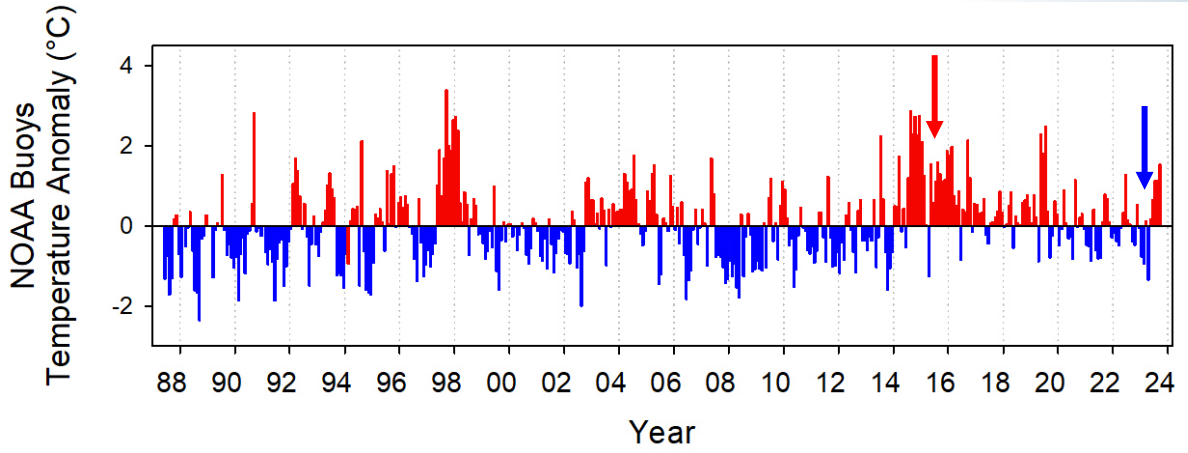
Local conditions depend on complex dynamics



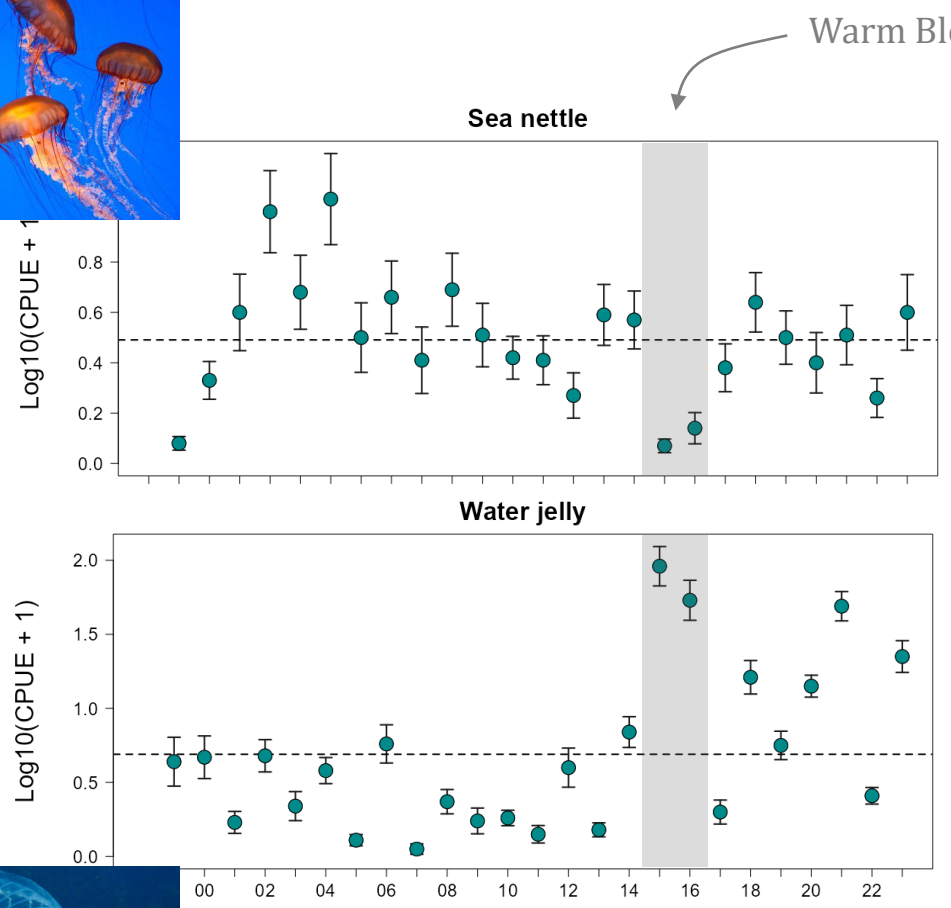


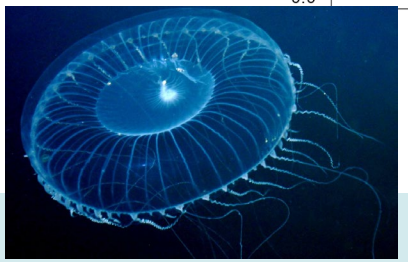
Local OR / WA Conditions



From Hunsicker et al. 2024
(California Current IEA: https://www.integratedecosystemassessment.noaa.gov/regions/california-current)

Long time series help us understand the trends





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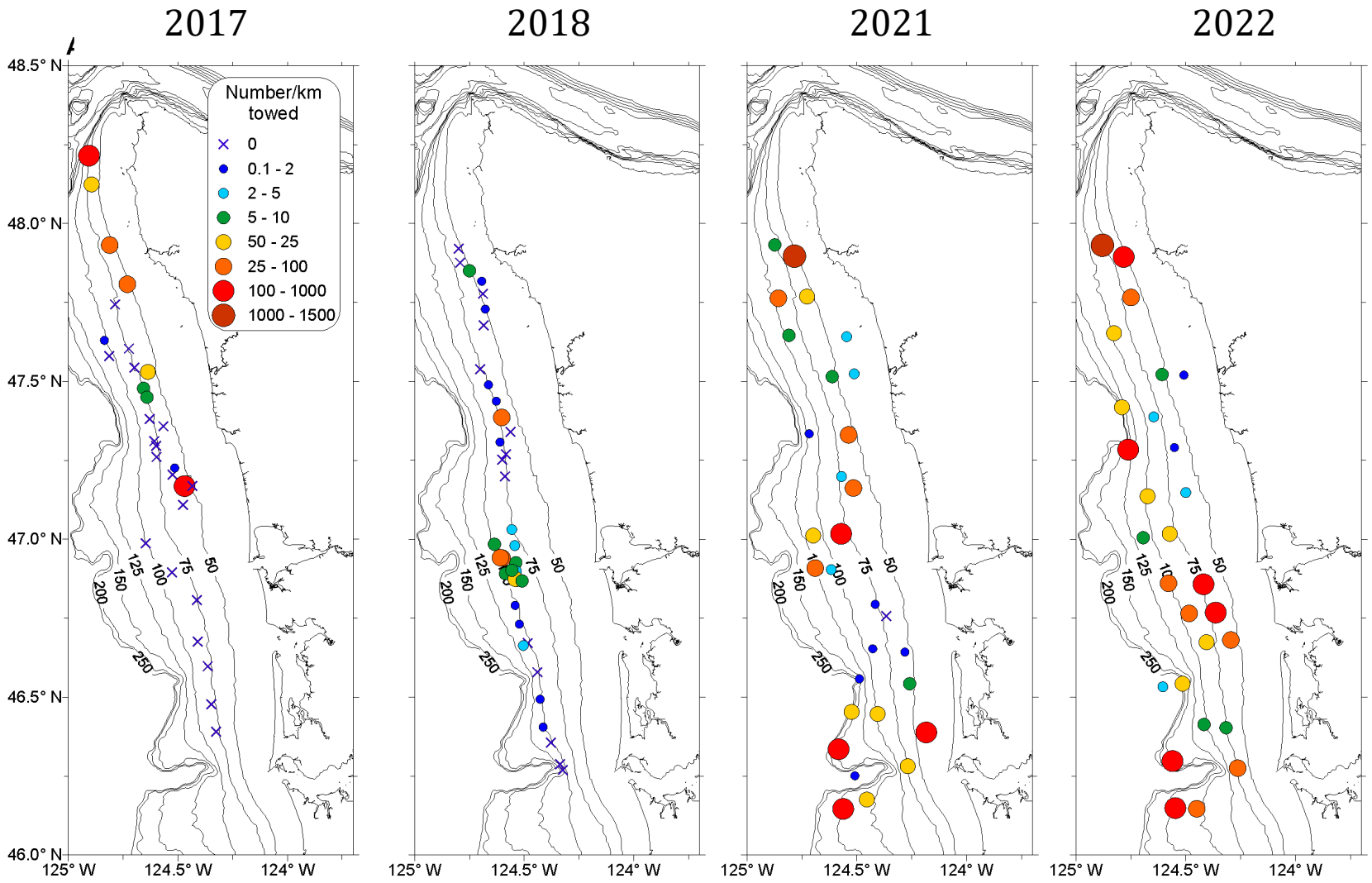
Pacific Sardine (larval)



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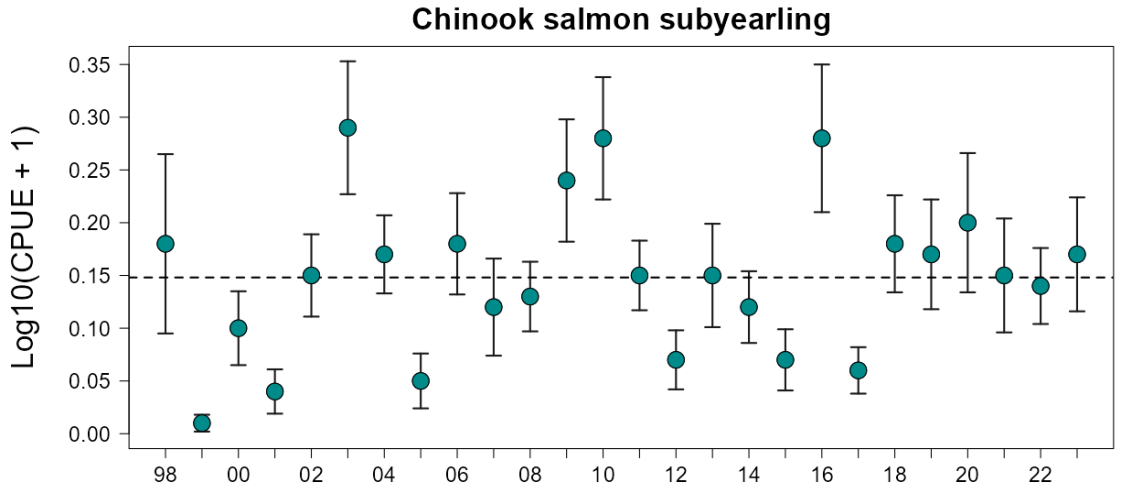
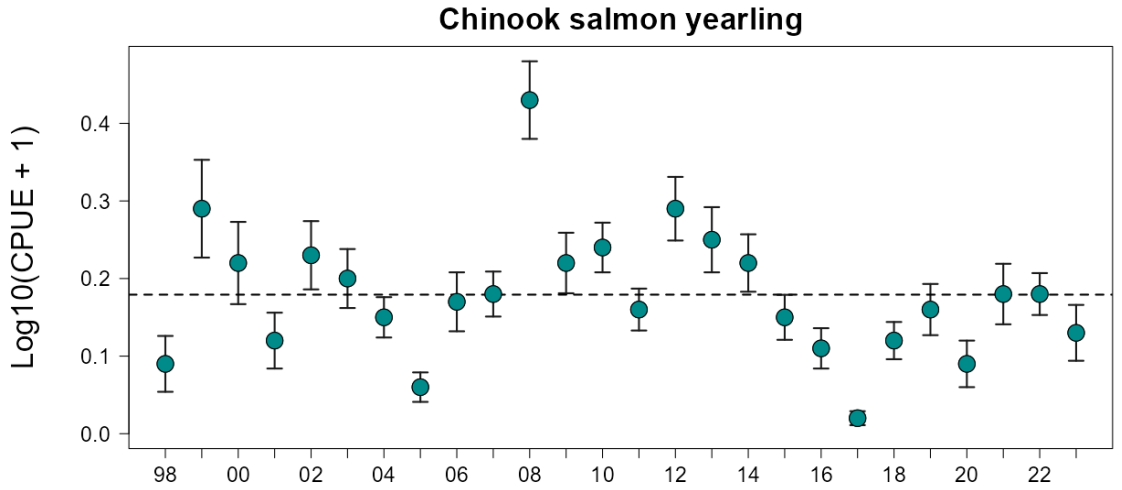
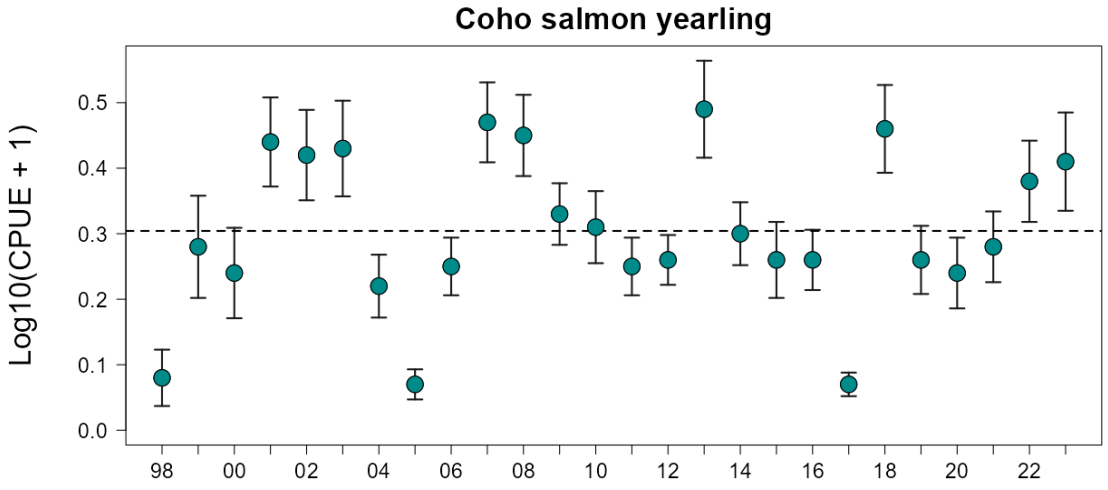
JSOES Catches - June, 1998-2023







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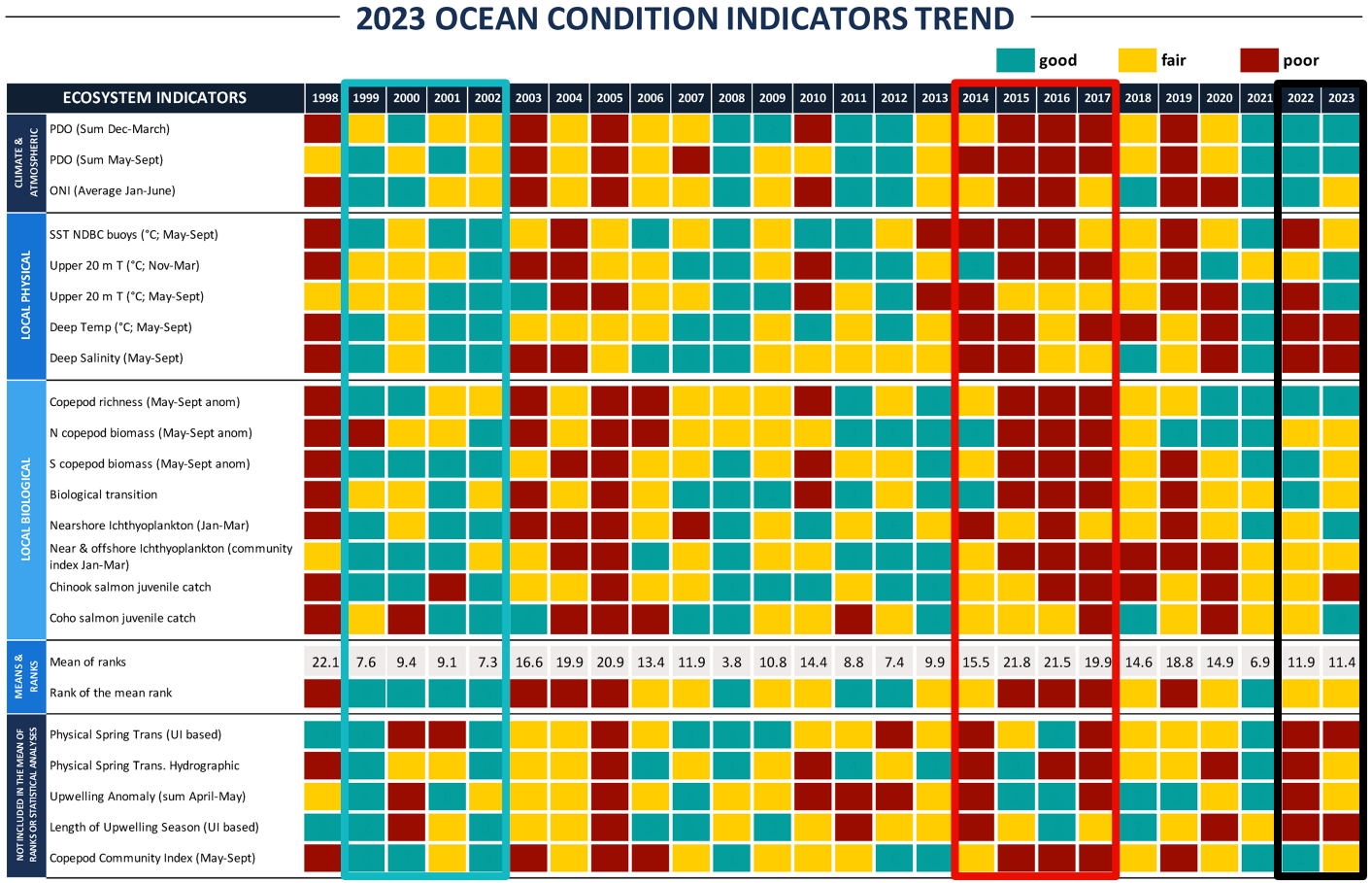
NOAA's 'Stoplight'

https://www.fisheries.noaa.gov/west-coast/science-data/ocean-ecosystem-indicators-pacific-salmon-marine-survival-northern



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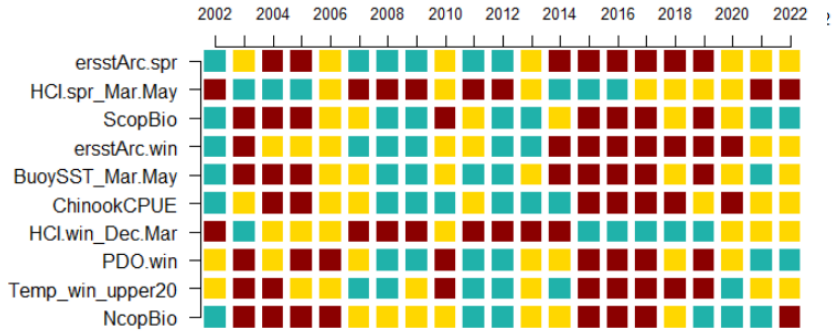
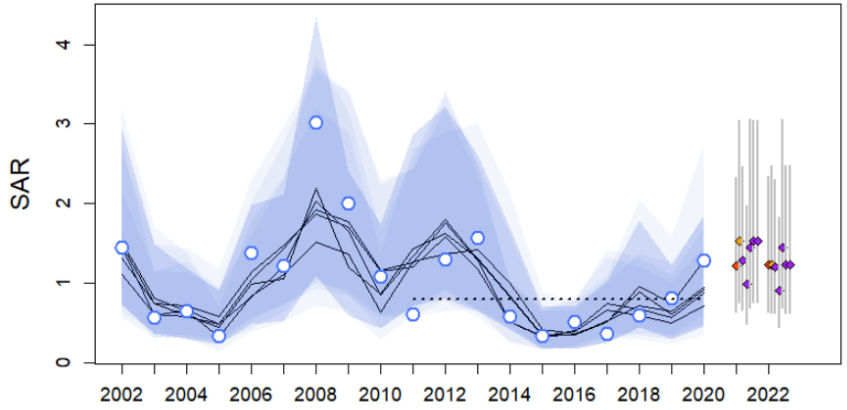
slide from last year…

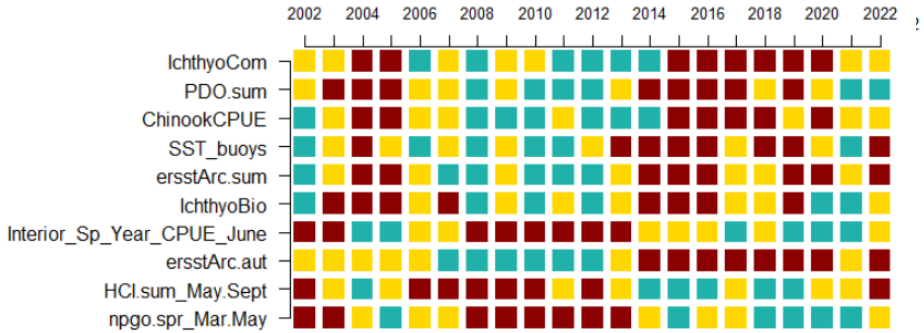
Stock-specific indicators would be better for forecasting

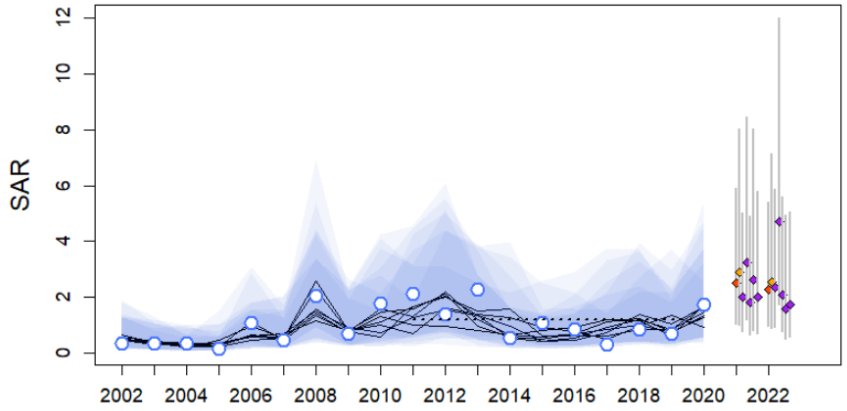
Snake River Spring Chinook





Snake River Fall Chinook





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2023-24 CCIEA Ecosystem Status Report Highlights

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KEY TAKEAWAYS FROM 2023

- Basin-scale climate patterns were mixed, with negative Pacific Decadal Oscillation (PDO) and a transition to strengthening El Niño conditions
- Atmospheric rivers added record mountain snowpack in early 2023, reducing prolonged drought conditions in California
- Diverse and productive prey communities provide positive preconditioning ahead of emerging El Niño

Unfavorable Conditions & Risk Factors

- Overall ocean warming. 4th-largest marine heatwave on record.
- Extreme weather/flooding in early 2023
- HAB events caused closures and delays in fisheries, and deaths of marine mammals
- Poor habitat conditions for all CA salmon stocks the last three years
- Decline in sea lion pup indicators
- Declining catches and revenue for most sectors; Closure of CA salmon fishery
- Impacts of wind lease area locations continue to come into focus

Mixed to Positive Ecological Signals

- Total upwelling below-average, but periods of intense local upwelling
- Lipid-rich northern copepods relatively stable off Oregon
- Abundant forage, especially anchovies and pelagic juvenile groundfish
- Mixed indicators but encouraging expectations for Columbia / Snake R. Chinook salmon returns in 2024
- Positive trends in productivity and densities of seabirds in north & south
- Increase in crab landings and revenue

An extended graphical summary is provided in Appendix D

INTEGRATED ECOSYSTEM ASSESSMENT

From Hunsicker et al. 2024
(California Current IEA: https://www.integratedecosystemassessment.noaa.gov/regions/california-current)

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Take Home Messages

1. The Ocean is not homogenous – where and when salmon migrate will determine their ocean experience, growth, and survival
2. 2022 and 2023 were about average – adult returns this year and next year should be too

Outline

- Who we are and what we do
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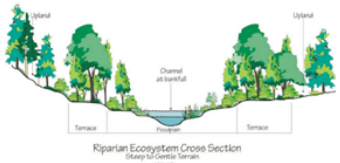
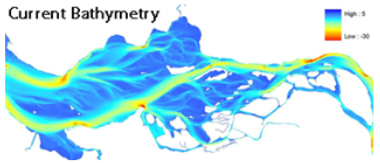
We Have Management Options for Ocean Survival

Riparian and floodplain restoration





Estuary Restoration Act

Fishery Management Plans:
- Coastal Pelagic Species
- Hake
- Salmon

Colony management

Marine Mammal Protection Act
Pinniped Removal Program

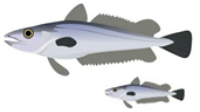
https://www.fisheries.noaa.gov/west-coast/marine-mammal-protection/marine-mammal-protection-act-section-120-pinniped-removal

Smolt body size and timing — Carryover effects

Zooplankton, invertebrates, fish larvae — Prey

Anchovy — Competitors, Prey

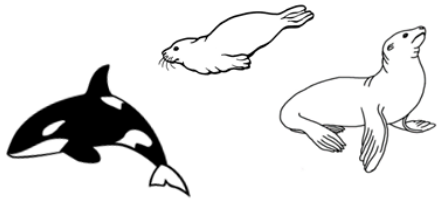
Hake — Predators, Competitors



Other Fisheries — Indirect effects

Seabirds — Predators

Marine mammals



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Size, growth, and timing can influence marine survival

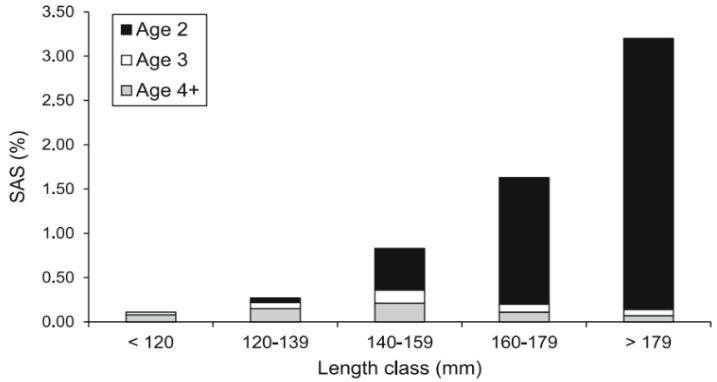
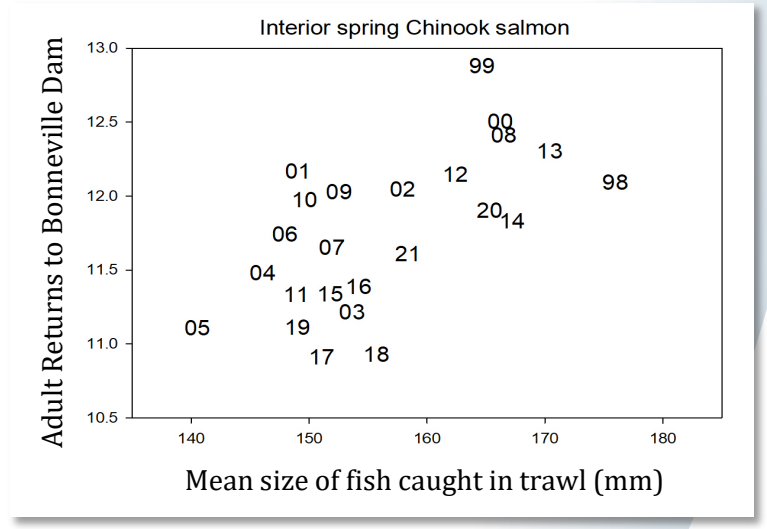


FIGURE 2. Smolt-to-adult survival (SAS) for hatchery-origin Tucannon River spring Chinook Salmon of ages 2, 3, and 4+ (4 and older) from brood years 2006–2013 that were categorized by length (mm FL) at release and were detected as returning to the Columbia–Snake River system based on PIT tag detections.

Gallinat et al. 2022. DOI: 10.1002/naaq.10269



Vol. 691: 131–149, 2022
https://doi.org/10.3354/meps14069
MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser
Published June 16

OPEN ACCESS

Freshwater growth can provide a survival advantage to Interior Columbia River spring Chinook salmon after ocean entry

C. R. Norrie[1,*], C. A. Morgan[1], B. J. Burke[2], L. A. Weitkamp[3], J. A. Miller[4]

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Carryover Effects:
Size and Growth are artifacts from freshwater experiences

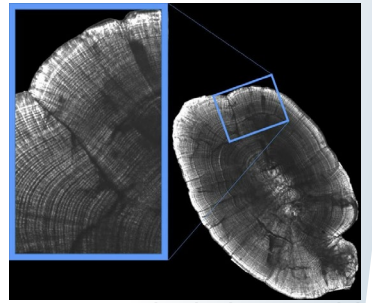
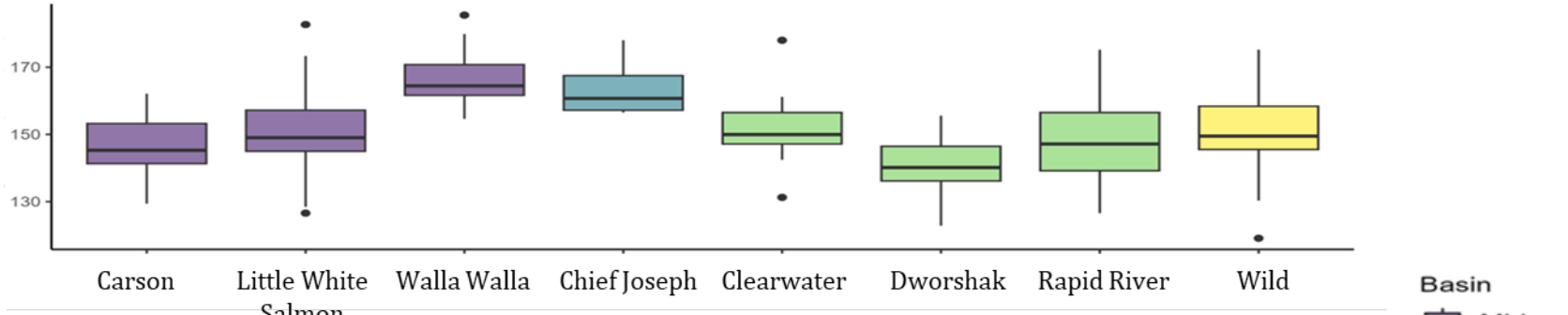
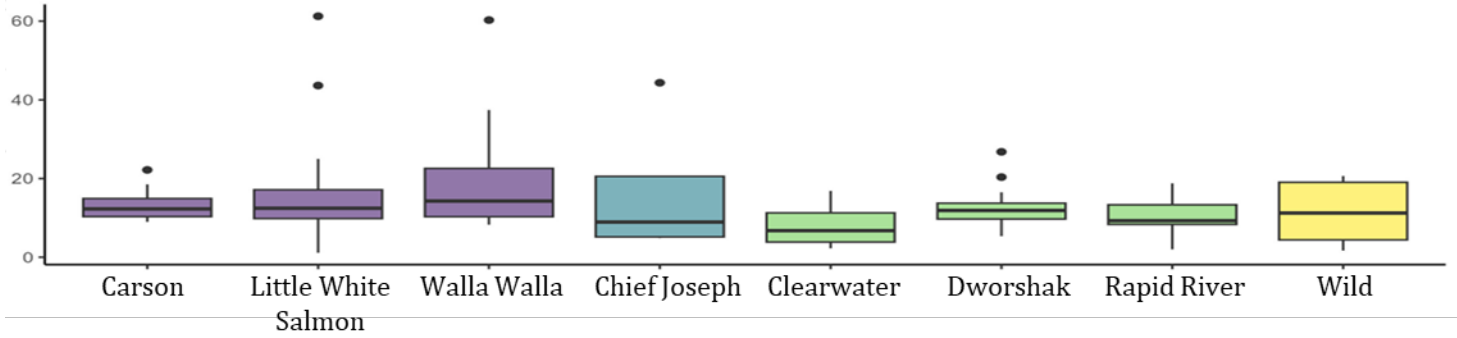


Photo by Elianna Rosenthal

Size in the Ocean



Ocean Growth



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Take Home Messages

1. The Ocean is not homogenous – where and when salmon migrate will determine their ocean experience, growth, and survival
2. 2022 and 2023 were about average – adult returns this year and next year should be too
3. We *can* influence marine survival; even freshwater management can affect marine survival

Outline

- Who we are and what we do
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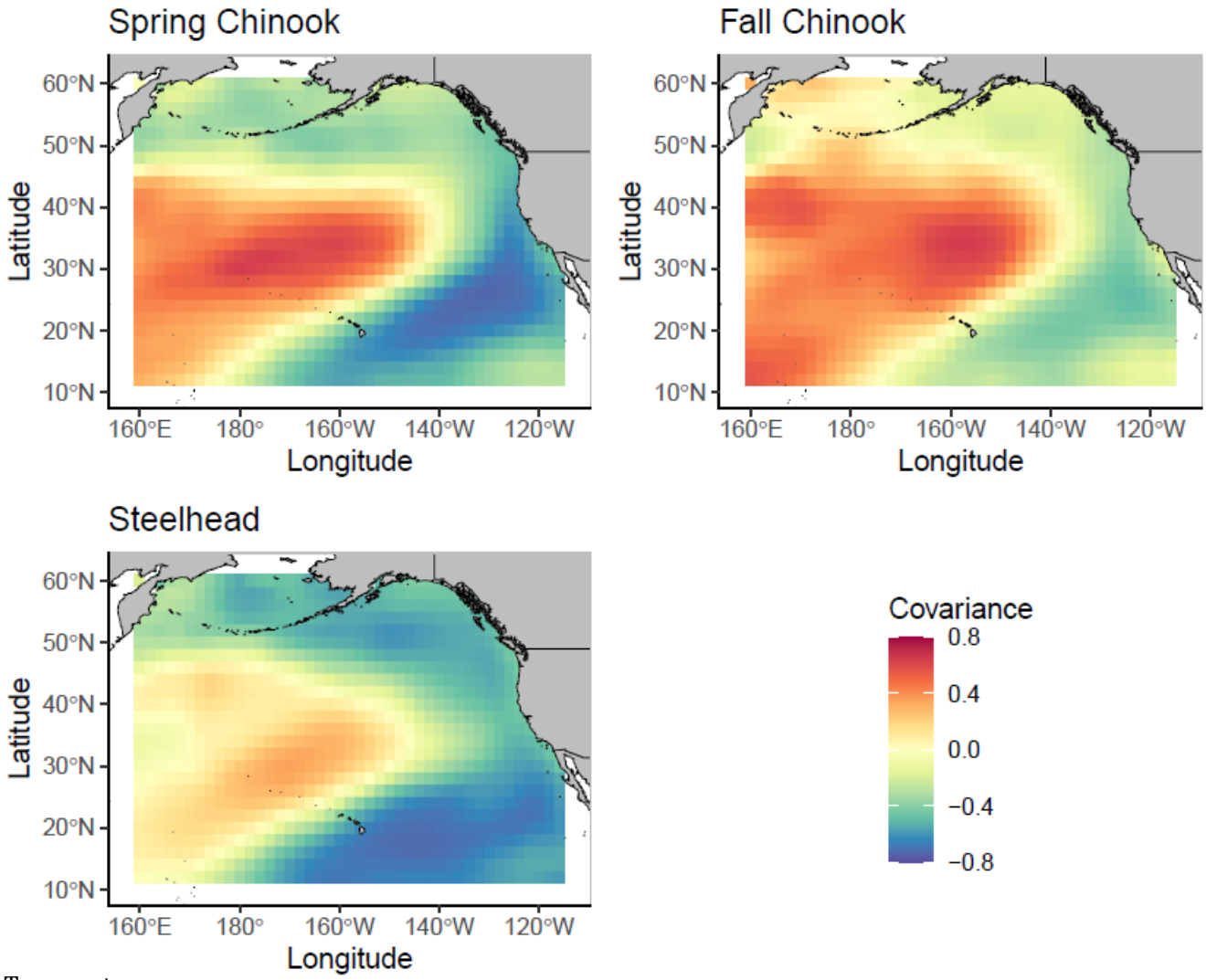
Covariance Maps can be created for any stock!



CMISST = Covariance Map Index of Sea Surface Temperature

Maps calculated based on Adult Counts at Bonneville Dam.

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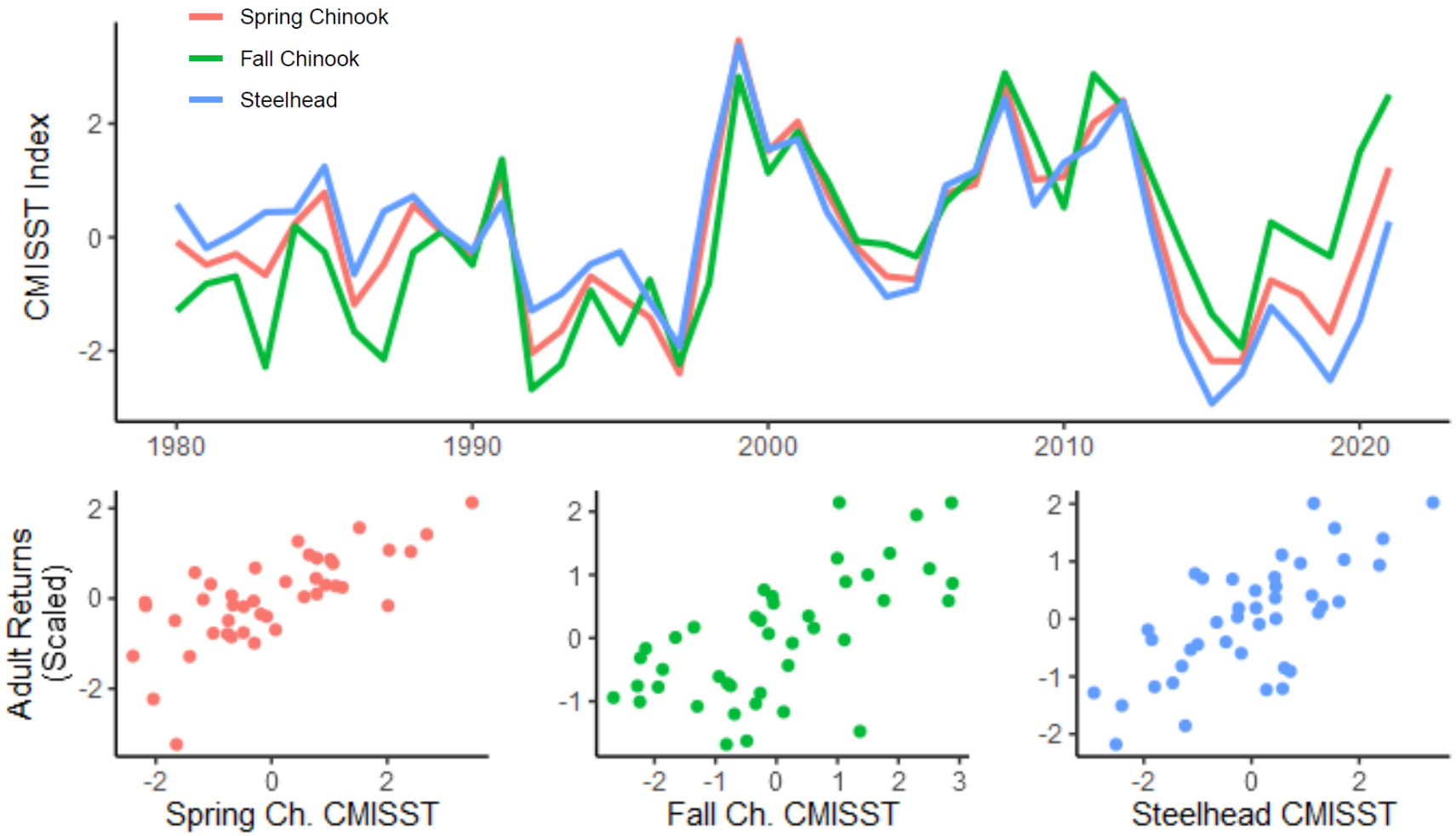
A Stock-Specific Index can be created from each Map



CMISST = Covariance Map Index of Sea Surface Temperature

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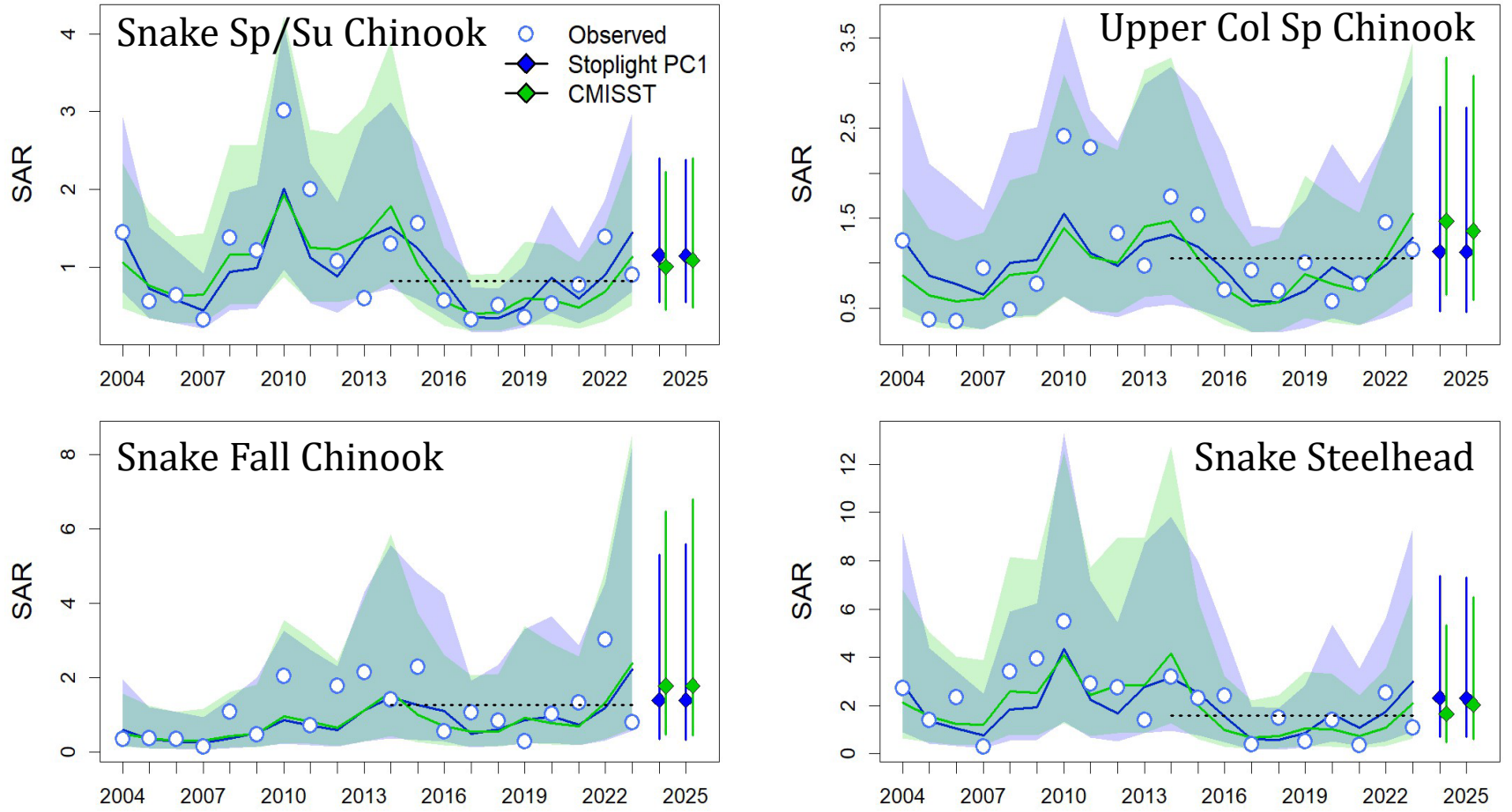
Near average returns expected for the next couple years



SAR Data obtained from: https://www.cbr.washington.edu/dart/query/pit_sar_esu

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Take Home Messages

1. The Ocean is not homogenous – where and when salmon migrate will determine their ocean experience, growth, and survival
2. 2022 and 2023 were about average – adult returns this year and next year should be too
3. We *can* influence marine survival; even freshwater management can affect marine survival
4. In the absence of ecosystem-based stock-specific stoplight charts, we can create correlative stock-specific tools for use by managers

Questions?

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