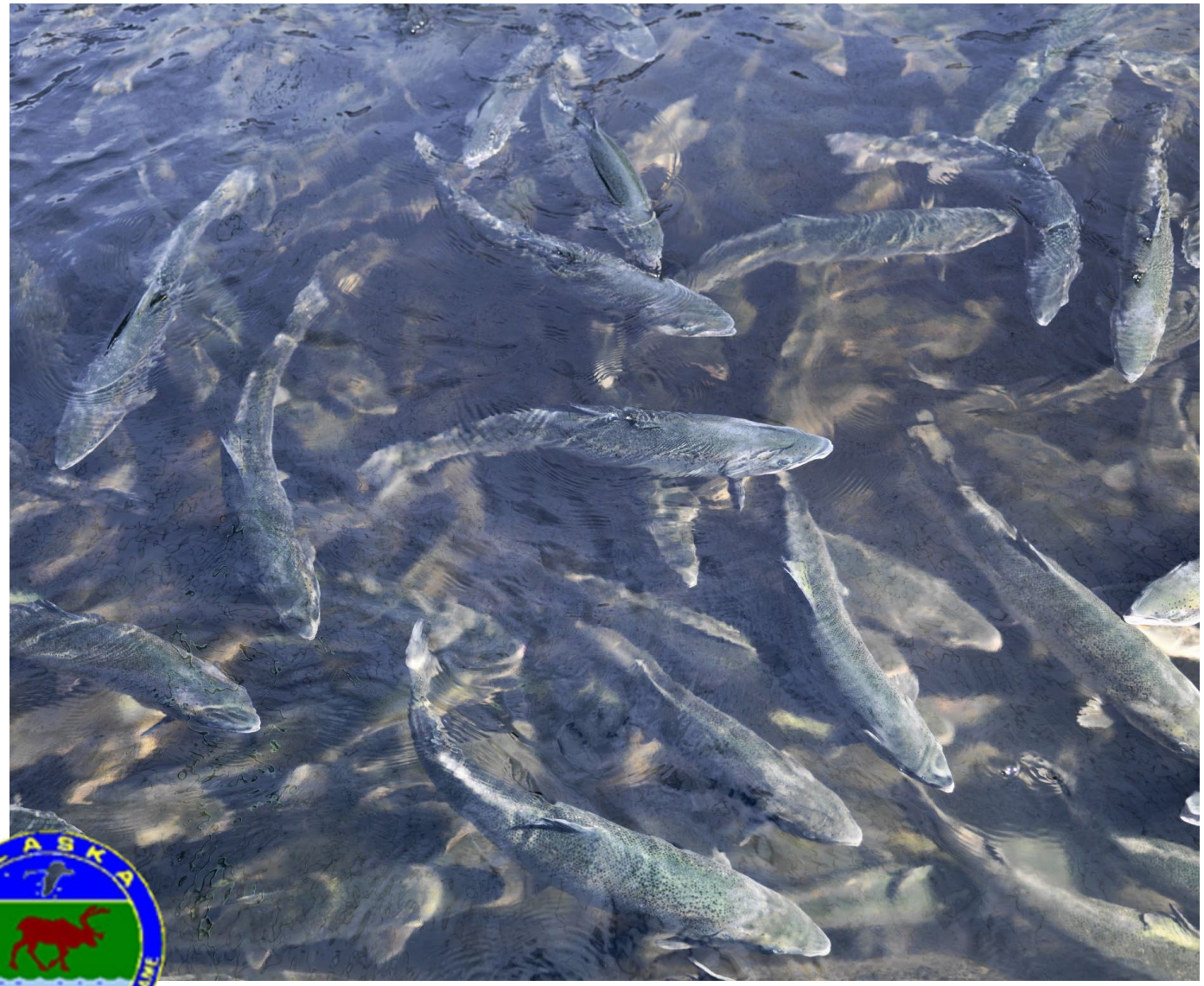


Yukon River Salmon Stock Status and Research Summary

Zachary Liller
AYK Research Coordinator
Alaska Dept. Fish & Game

Yukon River Drainage Fisheries Association
April 24, 2025
Fairbanks, Ak

Invitation to present

"…the overarching focus for the preseason meeting is to become more proactive in offering management recommendations throughout our salmon crisis."

"… presentation would set the stage for the meeting, and would provide a foundation on which the management presentations, break-out groups, and the rebuilding plan sections could build upon."

Blueprint

1. The salmon experience
2. Threats to salmon
3. Salmon patterns and trends
4. Action to understand and protect salmon
5. Planning for the future

Chum (dog) Salmon

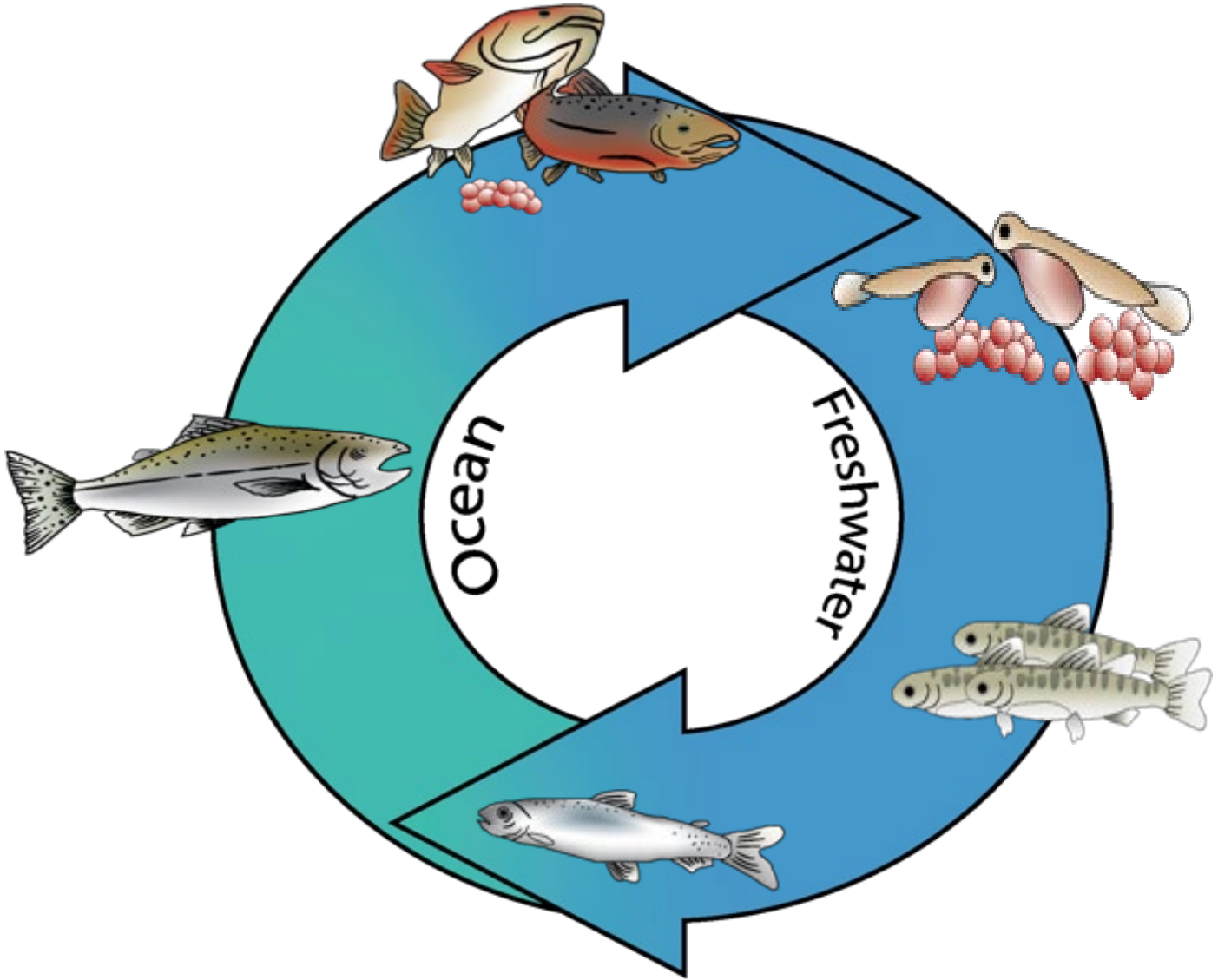
Coho (silver) Salmon

Chinook (king) Salmon

- The salmon experience

1

• The salmon experience



How we interact with adult Yukon River salmon is influenced by how many return each year, their size, condition, and distribution throughout the watershed.

1

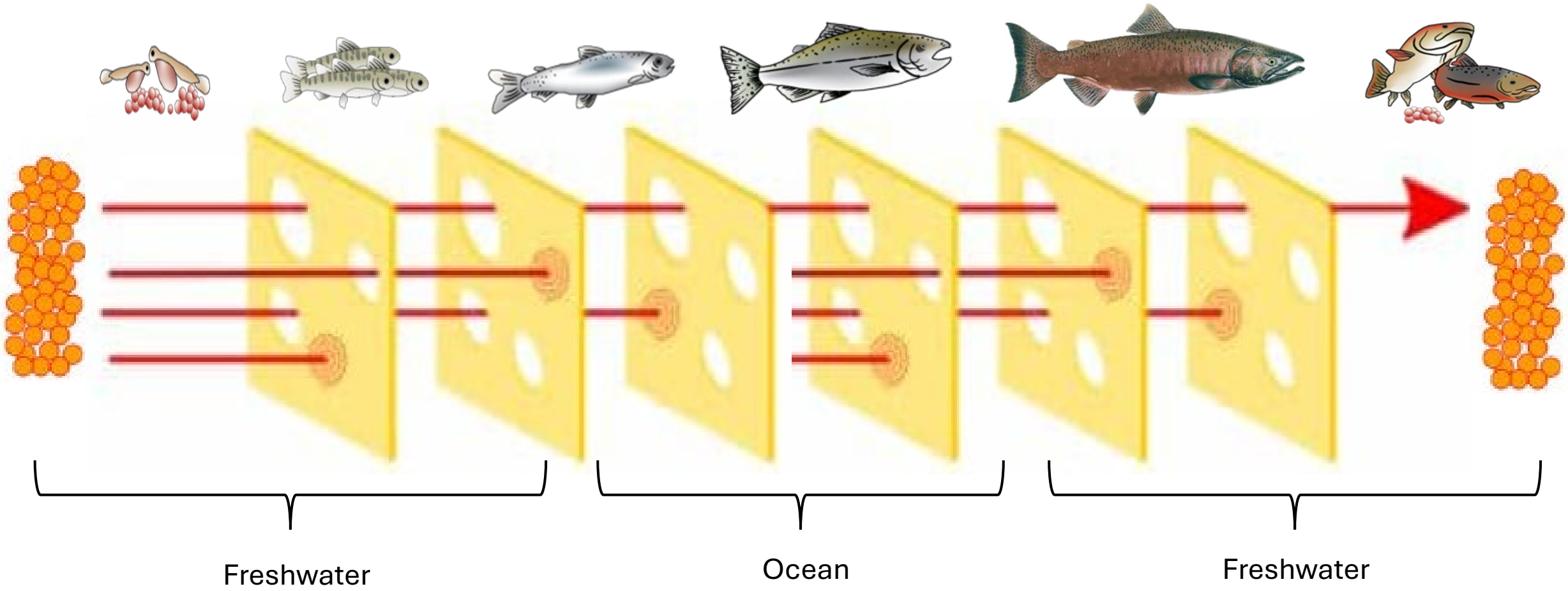
- The salmon experience

Yukon Fisheries News – Fall 2024

What's happening to Chinook Salmon?

Traditional Knowledge & Research Expert's Understandings and Perspective

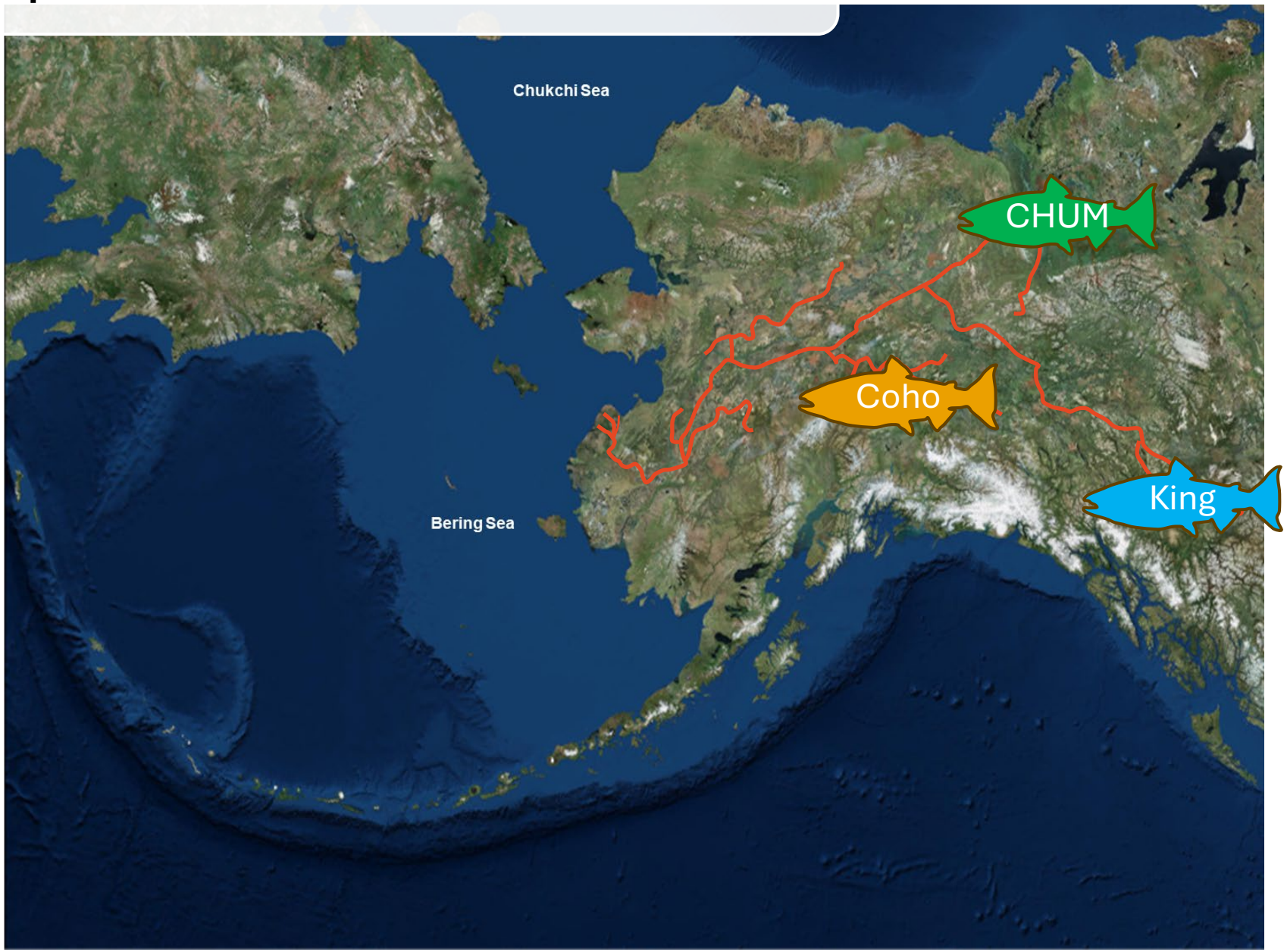
Sabrina Curtis, Fisheries Biologist student, Carnegie Mellon University



1

• The salmon experience

	Total Age	Fresh	Ocean
Coho	4	2	1
Chum	4 - 5	0	3 - 4
Chinook	4 - 7	1	3 - 5



2

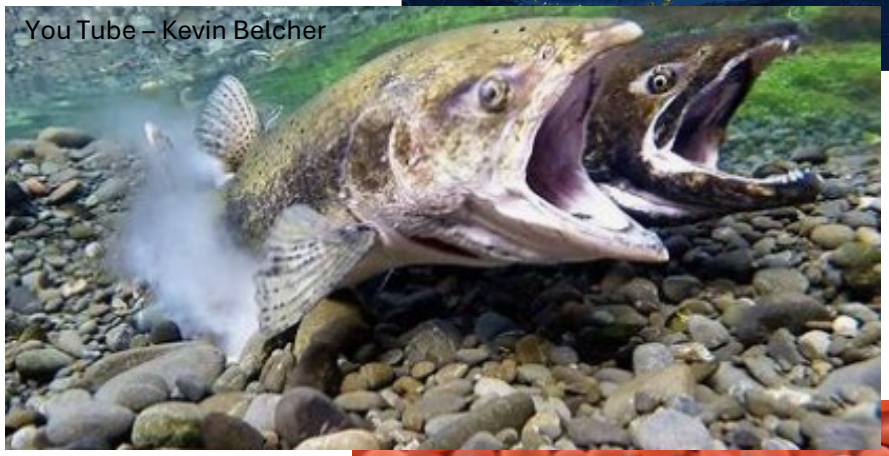
- Threats to salmon

2

• Threats to salmon

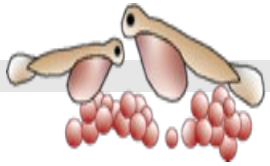
Spawning:

- Eggs represent the potential for production of the next generation.
- Single Yukon Chinook female can produce a 2,000 – 10,000+ eggs depending on size and condition.
- Success is associated with:
  - Health and condition of spawners
  - Access to clean gravel
  - Competition for mates (egg fertilization)
  - Competition for spawning locations
  - Ideal water flow
  - Protection from predators



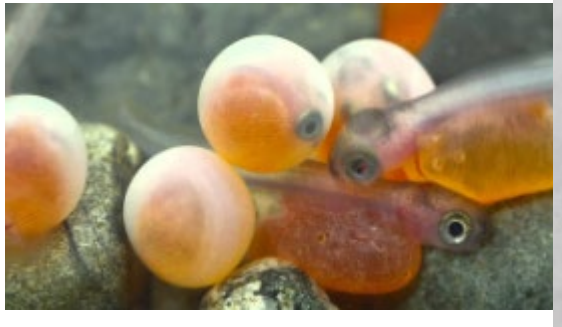
2

• Threats to salmon



Egg to fry survival:

- Fertilized eggs hatch after about 2 – 4 months depending on water temperature, and sac-fry spend another few weeks to months in the gravel before they emerge.
- Fry emergence is timed to correspond to optimal conditions for feeding, establishing territories, and/or downriver migration.
- Success is associated with:
  - Nutrients passed to the offspring by the mother.
  - Adequate water temperature.
  - Stable water flow.
  - Protection from ice.

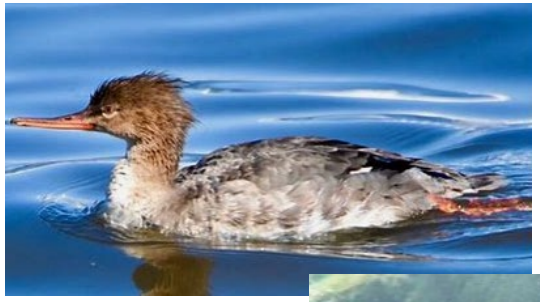


2

• Threats to salmon

Freshwater residency:

- Salmon that do not immediately migrate to the ocean seek habitats where they can find food and avoid predators.
- Success is associated with:
  - Access side channels and small tributaries.
  - A healthy ecosystem with high quality food.
  - Adequate water quality for growth and survival.
  - Safe passage over migration barriers.
  - Predator avoidance.

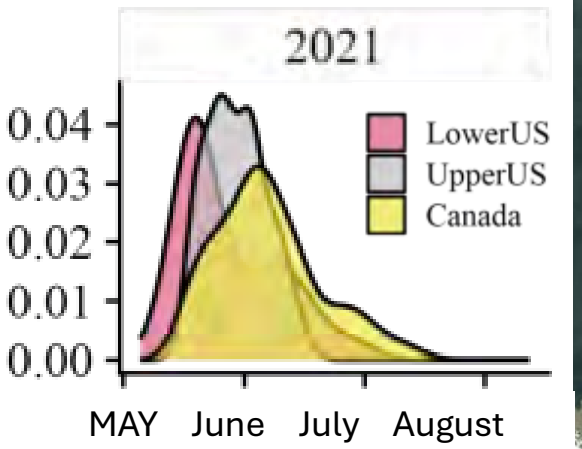


2

• Threats to salmon

Outmigration:

- Young salmon undergo stressful physiological changes as they prepare for life in the marine environment.
- Yukon salmon leave the Yukon River in early spring/summer and spend several months in the nearshore environment.
- Success is associated with:
  - Safe overwintering habitats.
  - Timing of ice breakup.
  - Food availability.
  - Predator avoidance.



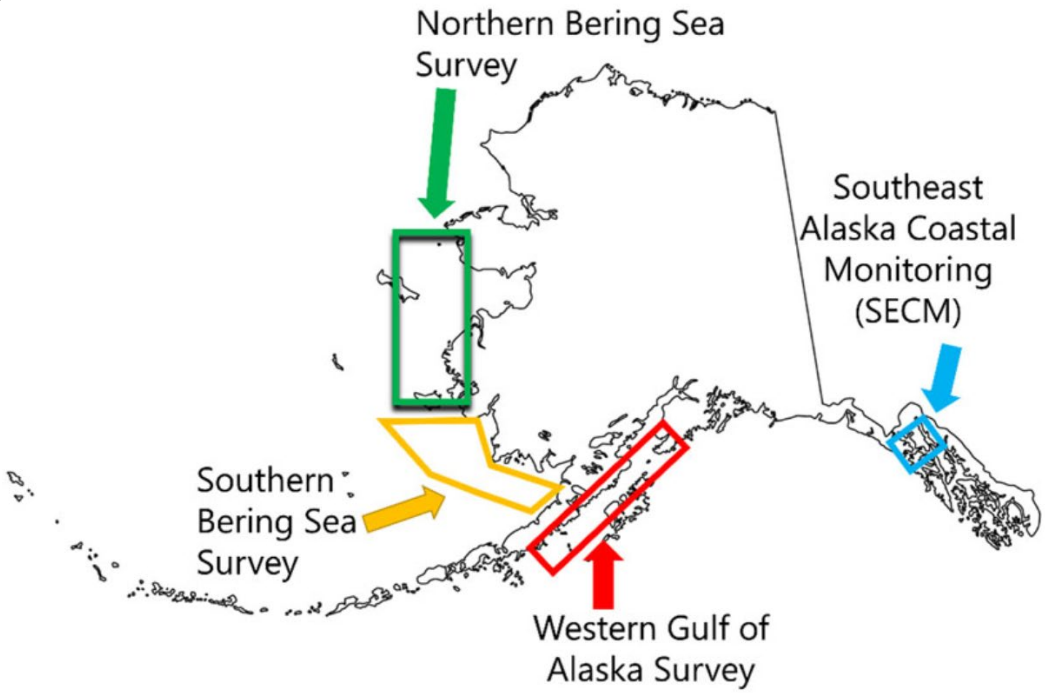
Outmigration timing of Yukon Chinook – credit, Yukon Delta Fisheries Development Association

2

• Threats to salmon

Marine residency:

- Yukon salmon migrate throughout the Bering Sea and Gulf of Alaska (chum) in search of food to develop the energy reserves needed to reach sexual maturity and complete their upriver migration to spawn.
- Success is associated with:
  - Marine environment – e.g., temperature.
  - Availability of high-quality food.
  - Competition with other salmon and fish.
  - Resistance to parasites and disease.
  - Avoidance of capture in marine fisheries.
  - Predator avoidance.



SALMON OCEAN ECOLOGY PROGRAM · ADF&G ·

NOAA FISHERIES

2

• Threats to salmon

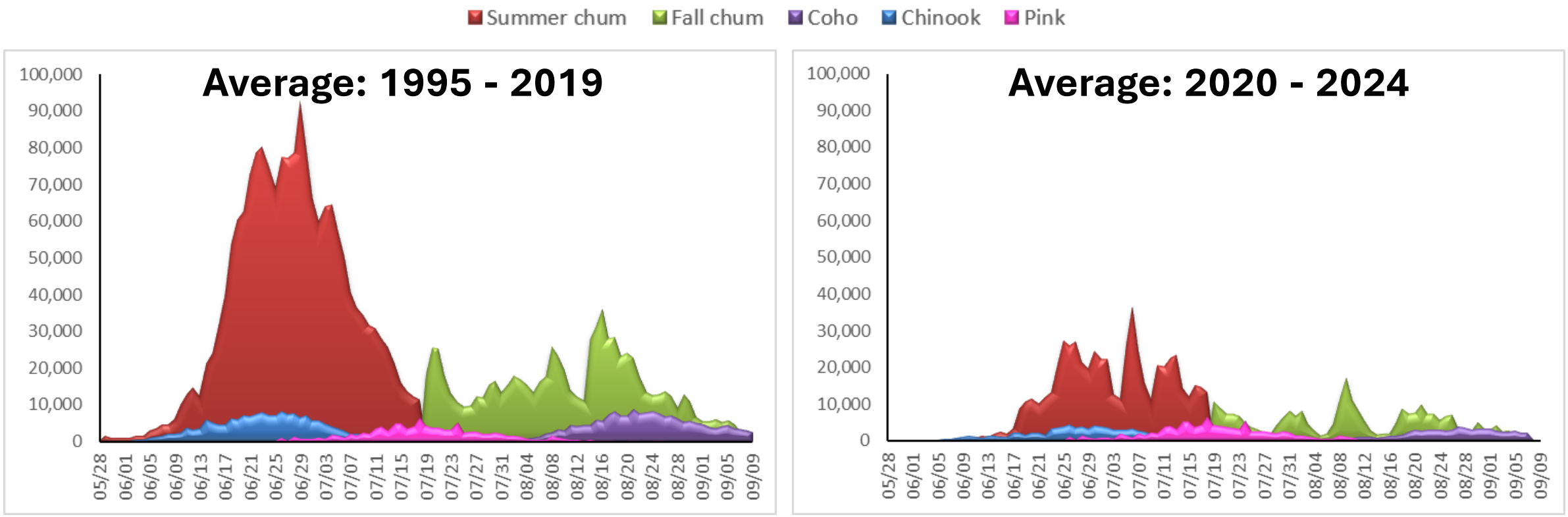
Upriver migration:

- Mature salmon undergo stressful physiological changes as they prepare to return to the Yukon River.
- Fitness for upriver migration is determined by the energy reserves and health acquired during marine residency.
- Salmon immune systems weaken as they travel to their spawning grounds, making them susceptible to stressors
- Success is associated with:
    - Suitable water temperatures and flow.
    - Avoidance of capture in freshwater fisheries.
    - Fish health and condition – ability to withstand stressors.

3

- Salmon patterns and trends

Salmon Abundance at Pilot Station Sonar

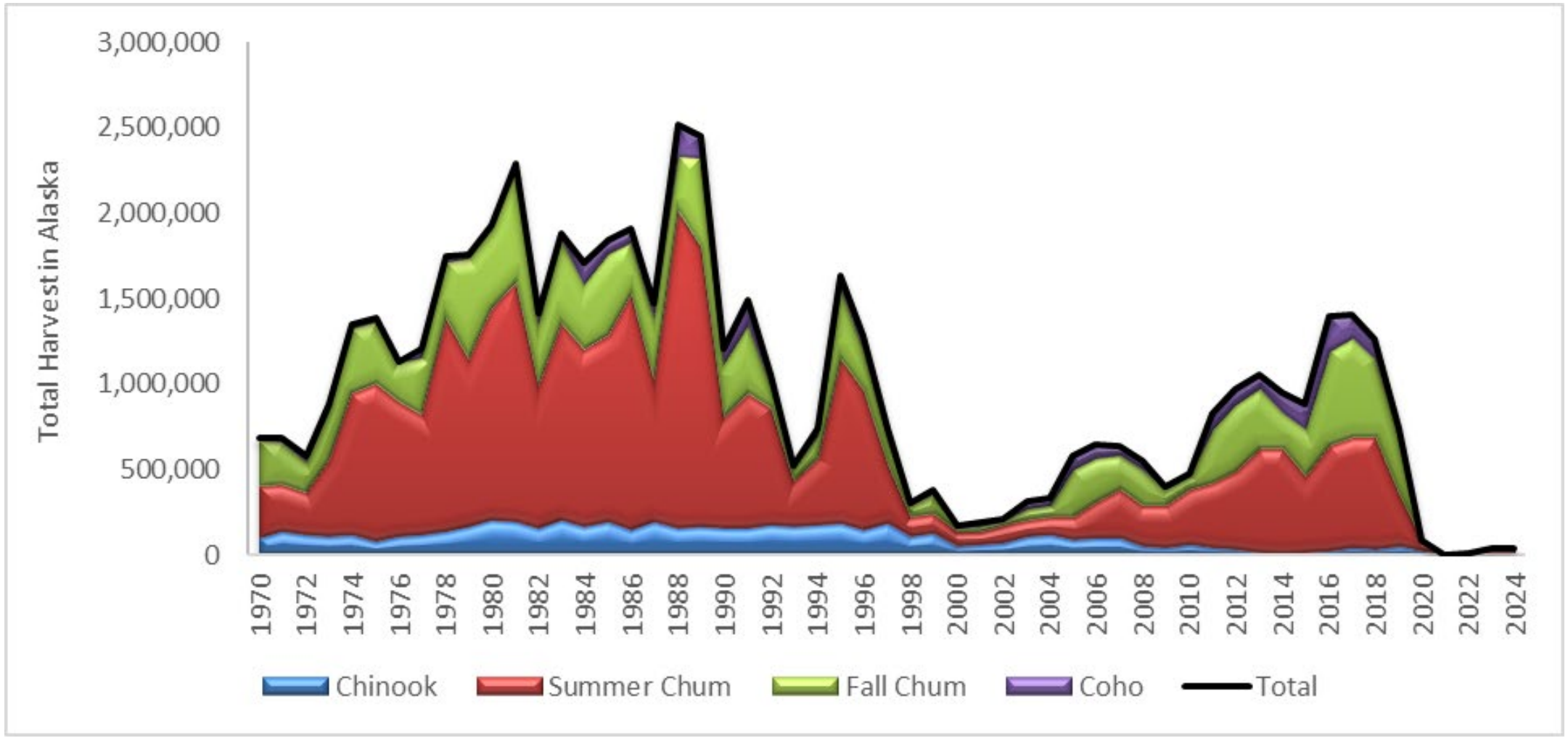


We are seeing many fewer salmon of all species with generally later run timings.

3

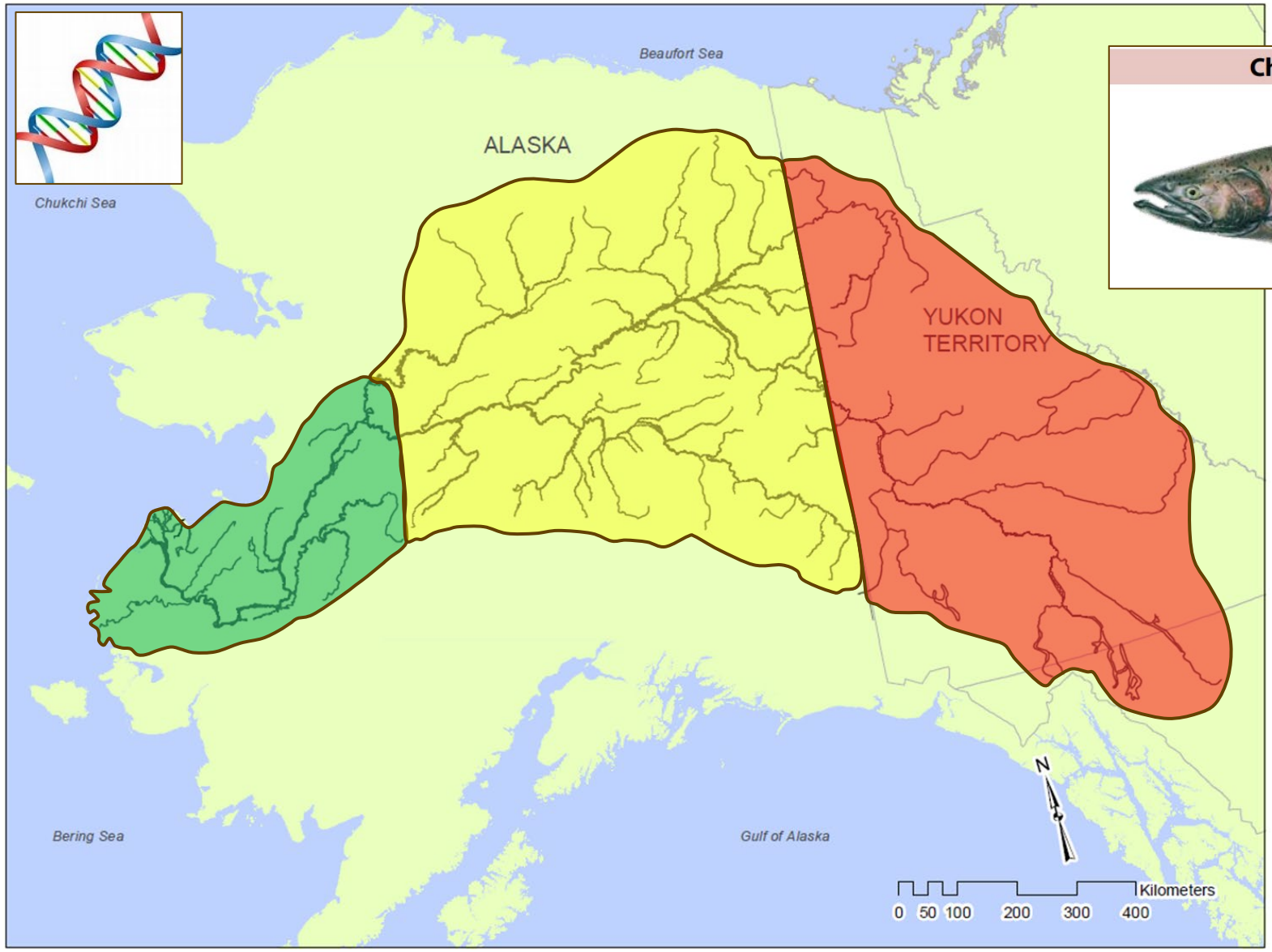
- Salmon patterns and trends

Yukon River Salmon Harvest



3

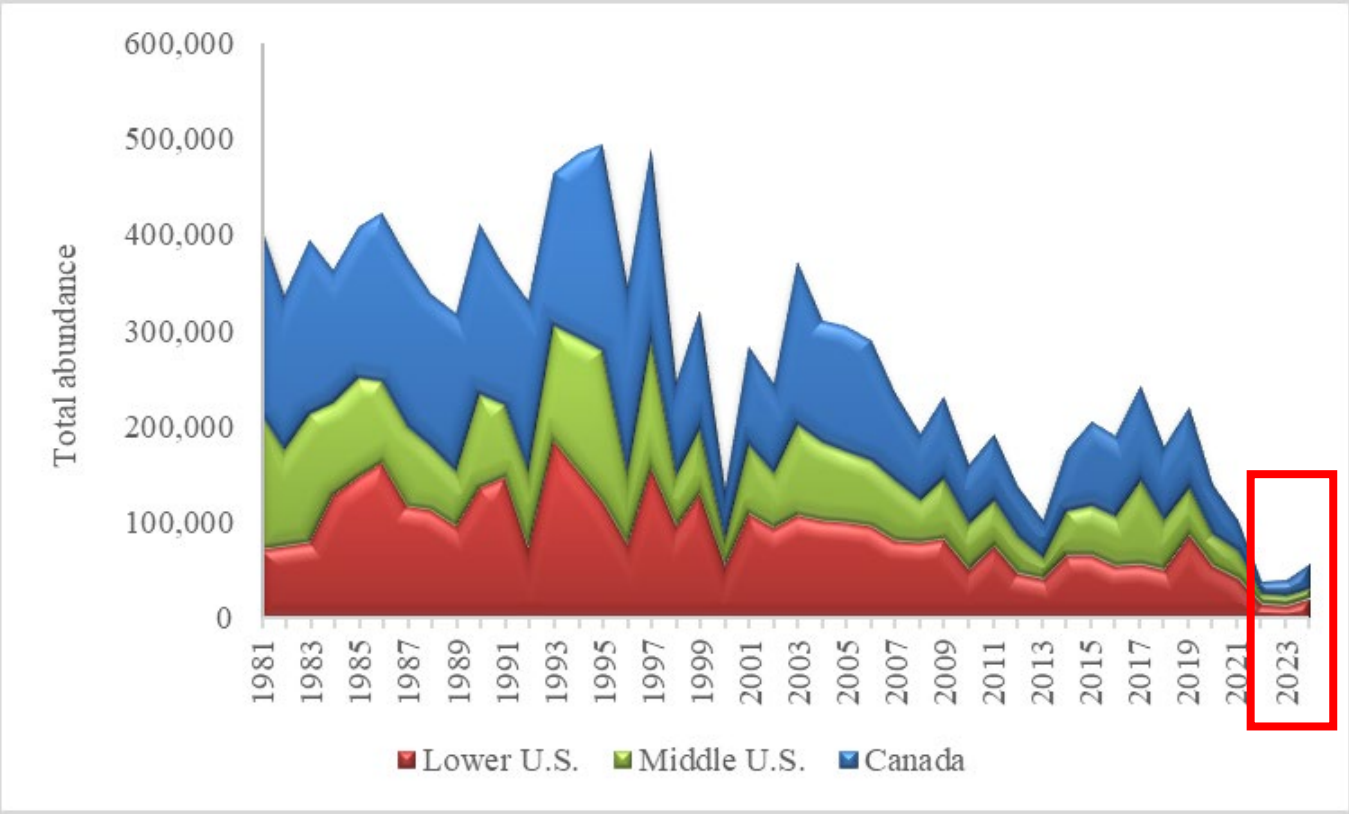
• Salmon patterns and trends

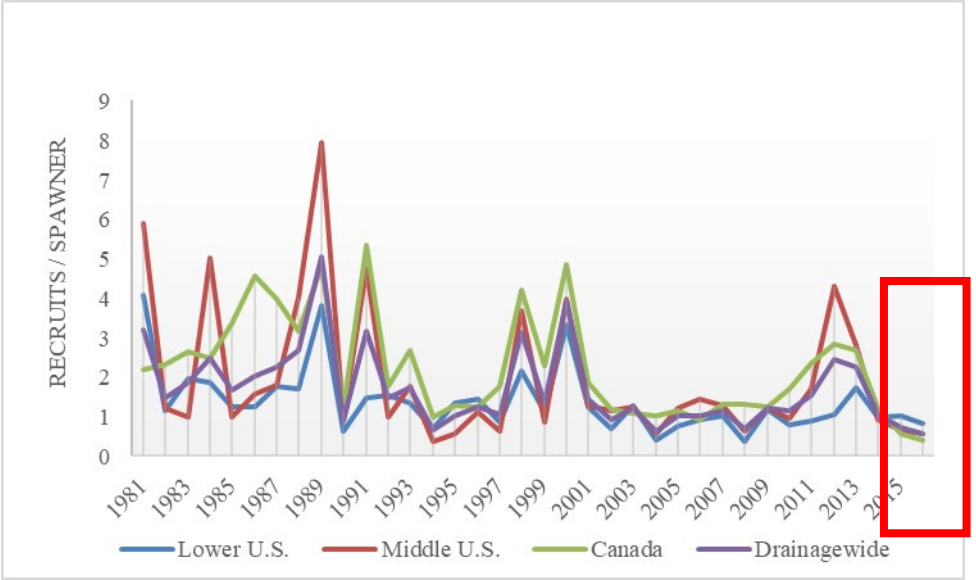


Genetic Stock Structure

- 32% Lower U.S.
- 26% Middle U.S.
- 42% Canadian

Chinook Salmon Abundance and Productivity

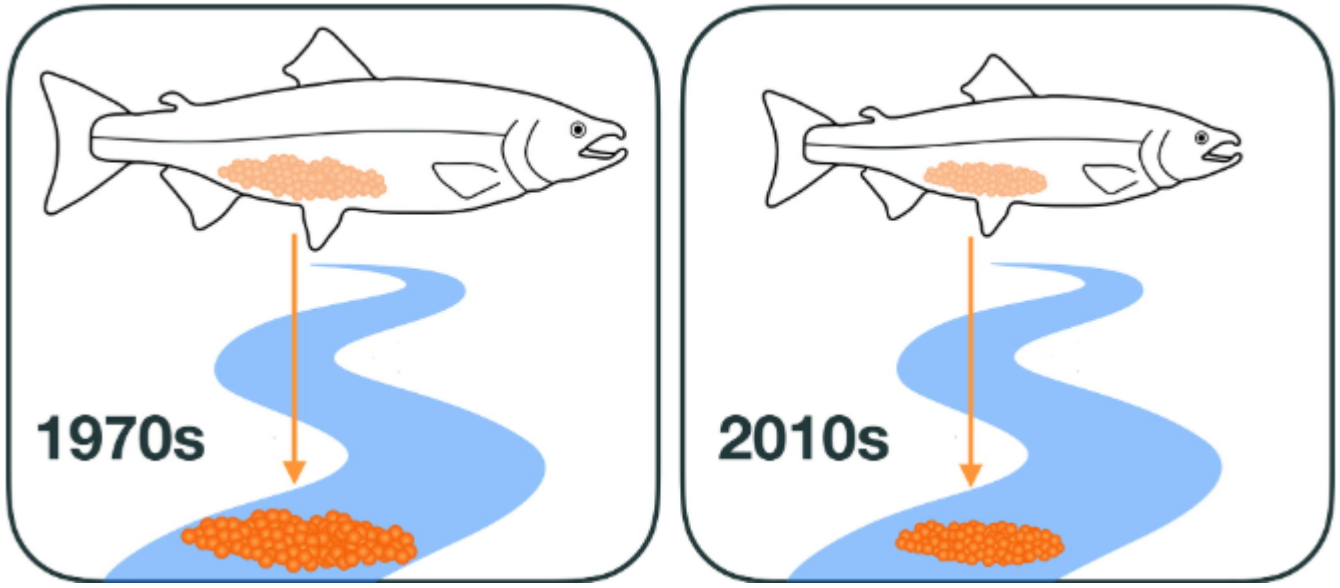




Extremely low run sizes in recent years are a product of below average brood years with very poor recruitment

Chinook Size, Age, Fecundity, and Egg Mass

- Proportion of females appears stable over time.
- Observed decline in females:
  - Body length ~ 6%
  - Fecundity ~15%
  - Egg mass ~28%
- Body size declines are primarily due to earlier age at maturity (Oke et al., 2020)



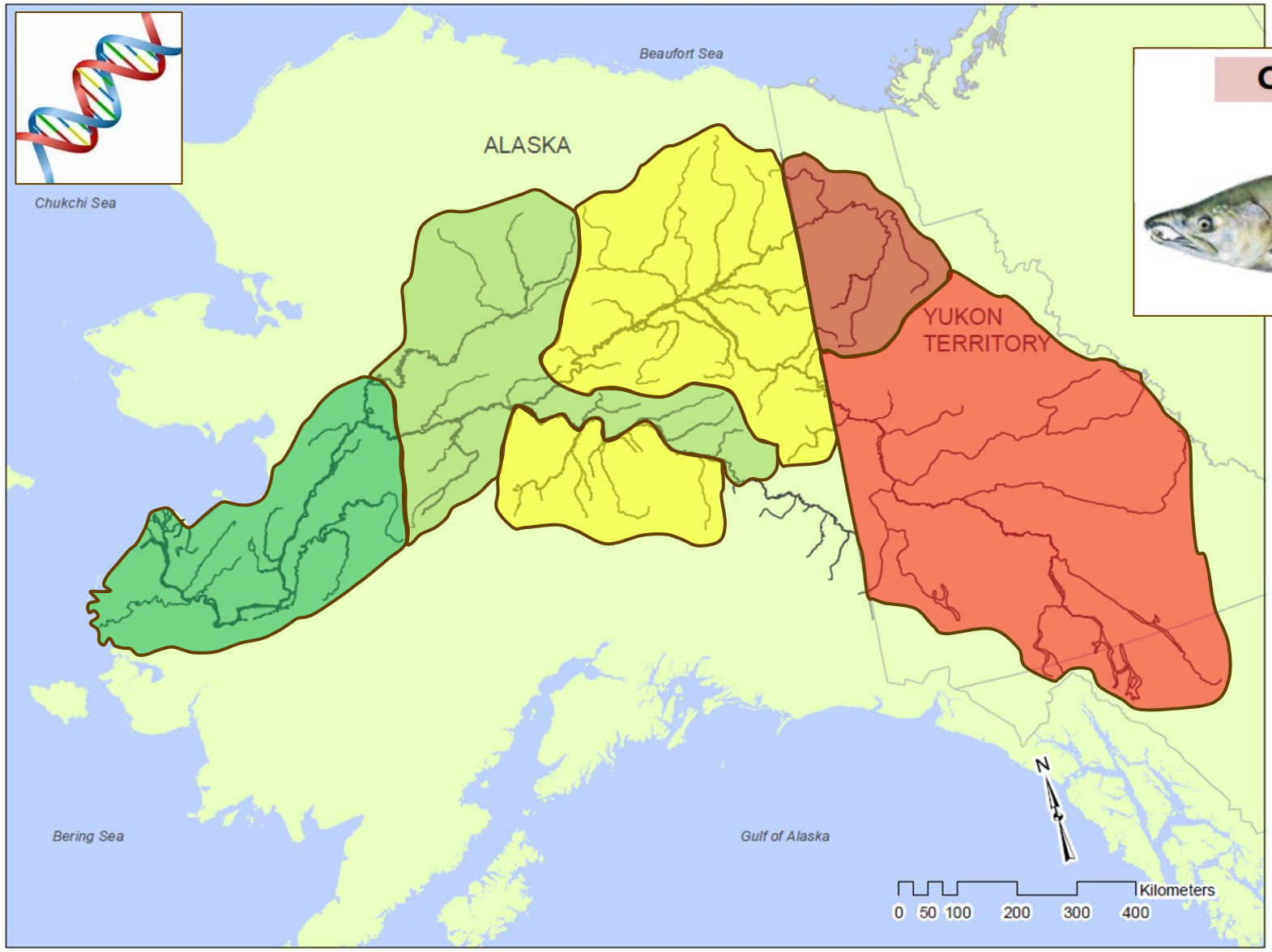
The reproductive value of large females: consequences of shifts in demographic structure for population reproductive potential in Chinook salmon

Authors: Jan Ohlberger ✉ Daniel E. Schindler, Randy J. Brown, Joel M.S. Harding, Milo D. Adkison, Andrew R. Munro, Lara Horstmann, and Joe Spaeder | AUTHORS INFO & AFFILIATIONS

Publication: Canadian Journal of Fisheries and Aquatic Sciences • 11 June 2020 • https://doi.org/10.1139/cjfas-2020-0012

3

• Salmon patterns and trends

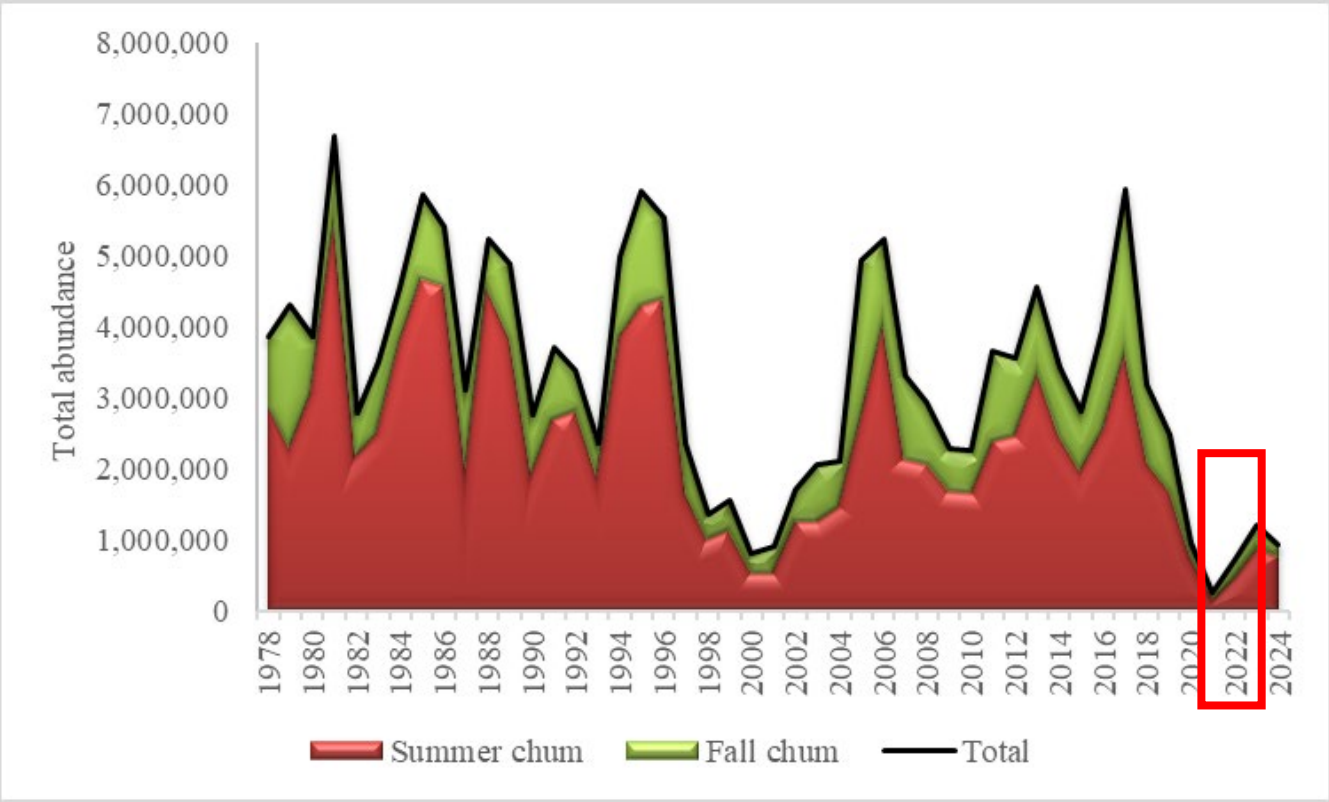


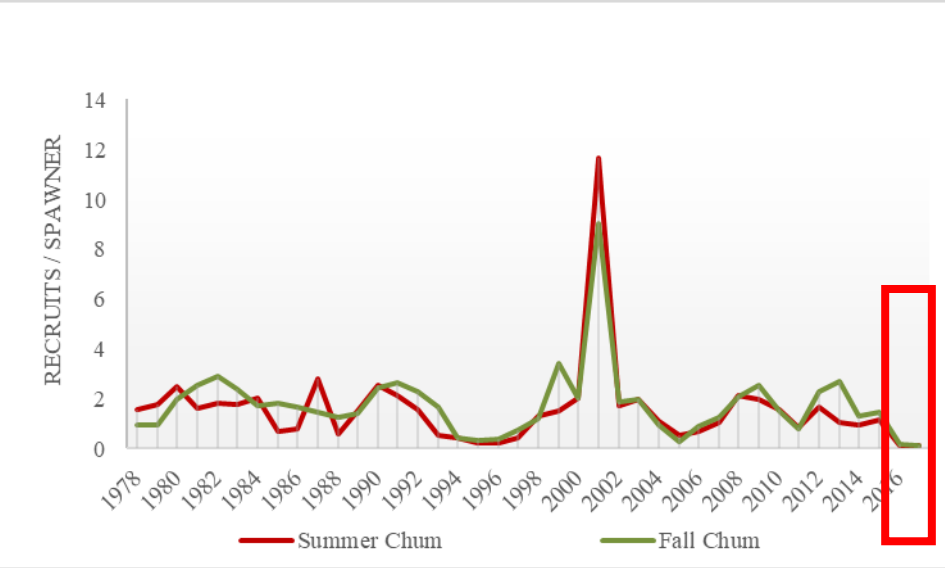
Genetic Stock Structure
- 75% Summer
- 25% Fall

Summer Run
- 77% Lower
- 23% Middle

Fall Run
- 70% U.S.
- 30% Canada

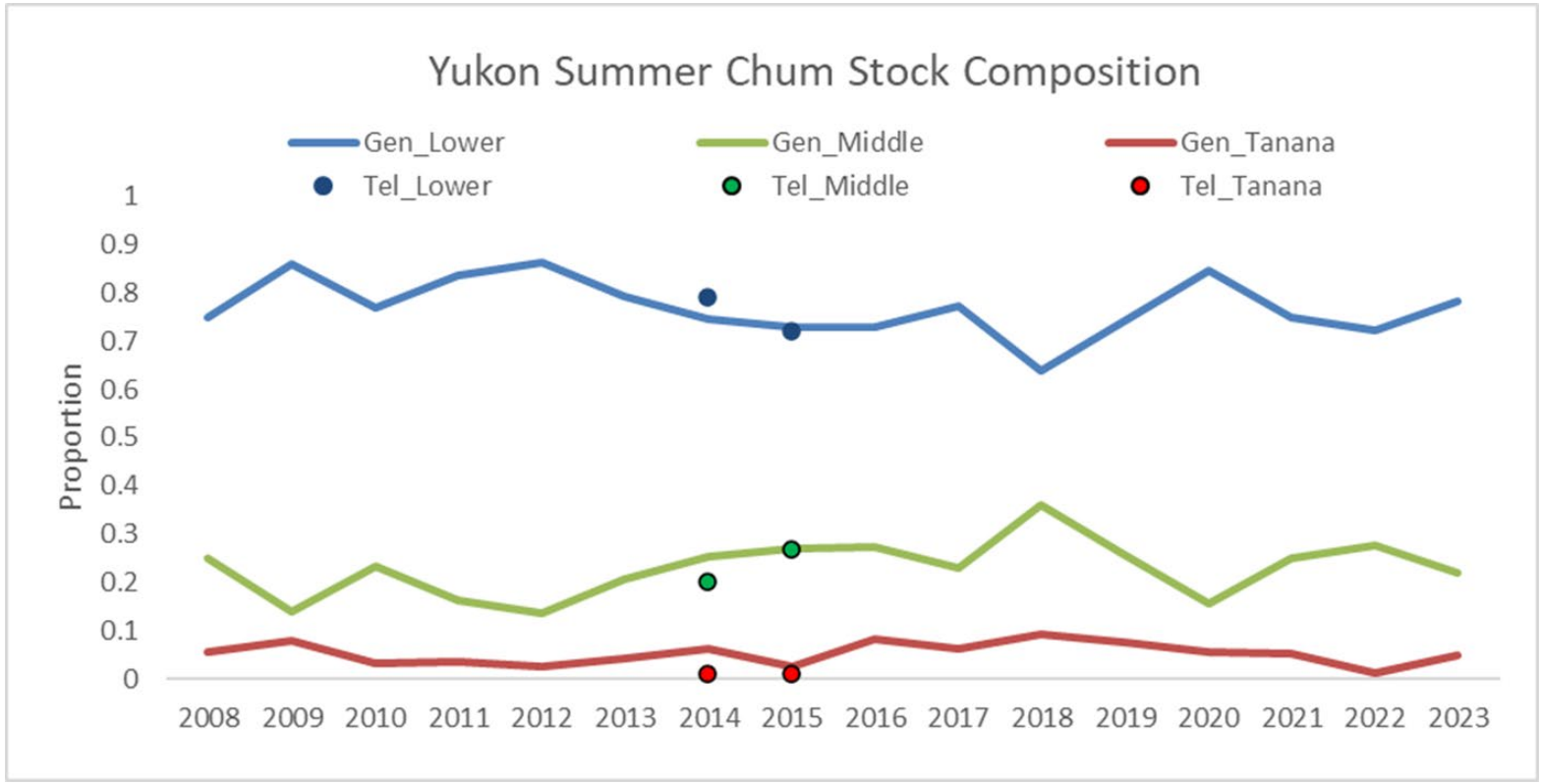
Chum Salmon Abundance and Productivity





Extremely low run sizes in recent years are a product of strong brood year escapement that experienced near total recruitment failure

Summer Chum Salmon Stock Composition

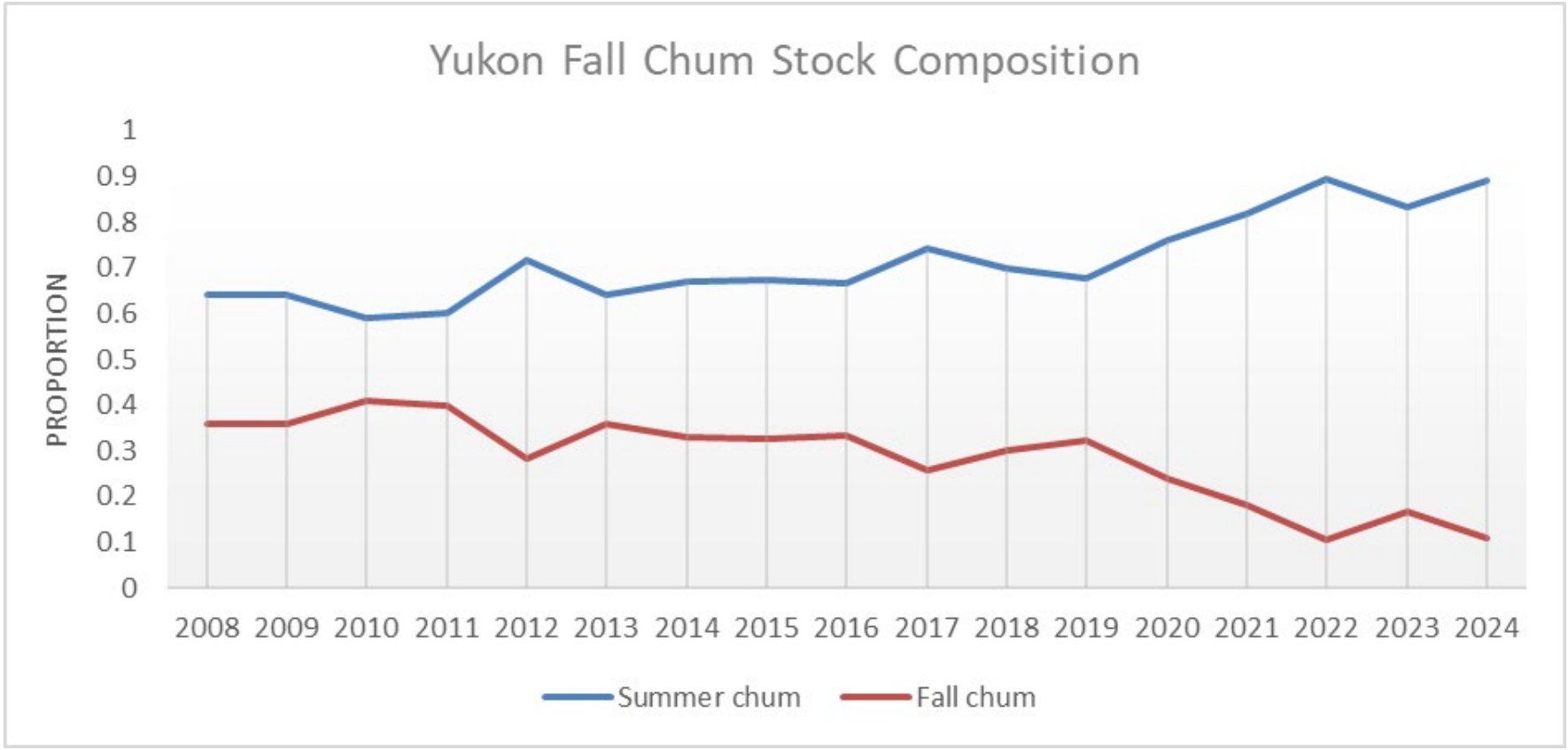


Lines based on genetic analysis

Dots based on radiotelemetry

The Anvik River is part of the lower river stock group. Pre ~2000, the Anvik River made up nearly half of the Yukon River summer chum salmon run. Since that time, production shifts resulted in the Anvik making up closer to 20% of the total. However, the overall lower river stock has remained stable.

Fall Chum Salmon Stock Composition

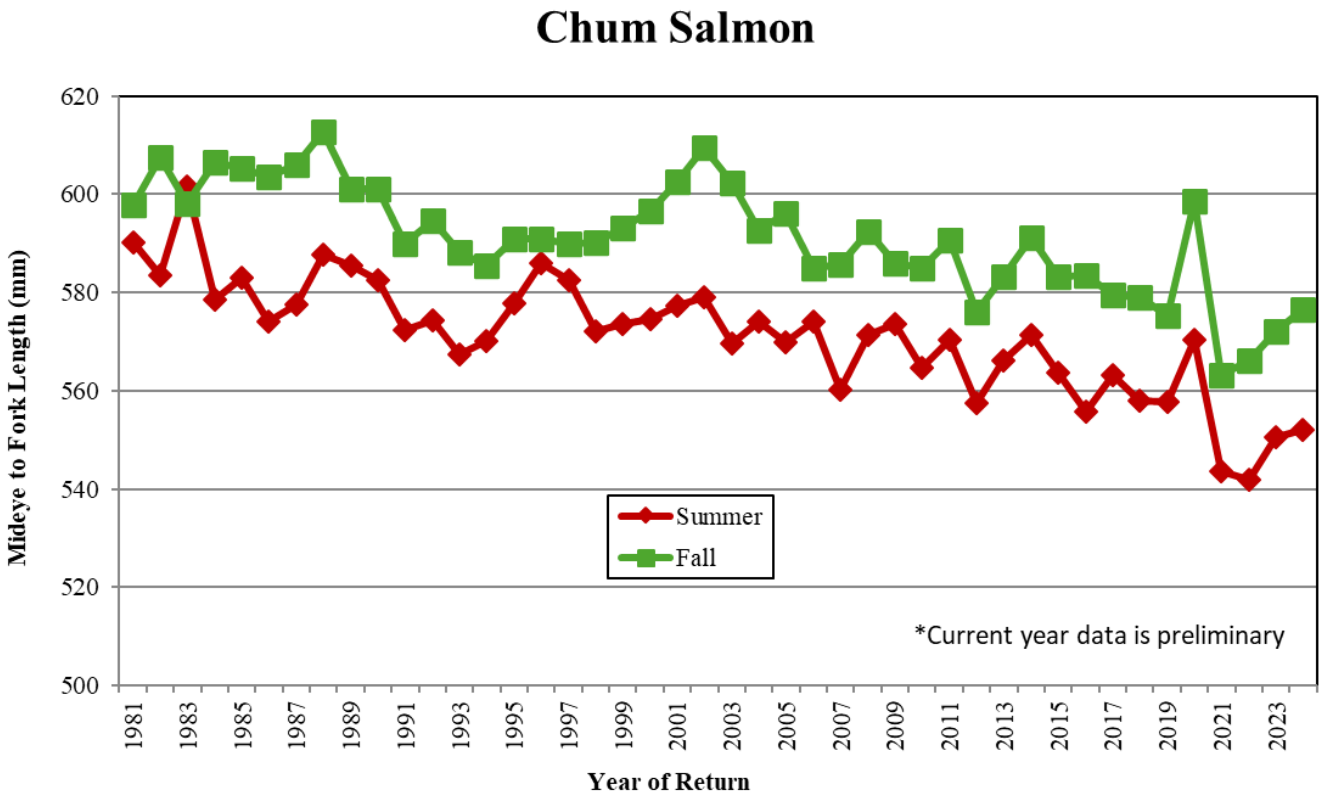


Based on genetic analysis

Canadian-origin Yukon fall chum were historically assumed to be about 25% of the total fall chum run, based on escapement data. Since 2008, genetic data suggests the Canadian stock was closer to 32%, until it dropped to record lows, 10 – 18%, starting in 2021.

Chum Age, Sex, and Length

- Mean length is down slightly (Oke et al., 2020; Schoen et al. 2023).
- Percent females appears stable (~60%) but was low in 2024 (~46%).
- Patterns in age composition are complex (Schoen et al. 2023), but body size declines are primarily due to earlier age at maturity (Oke et al., 2020).



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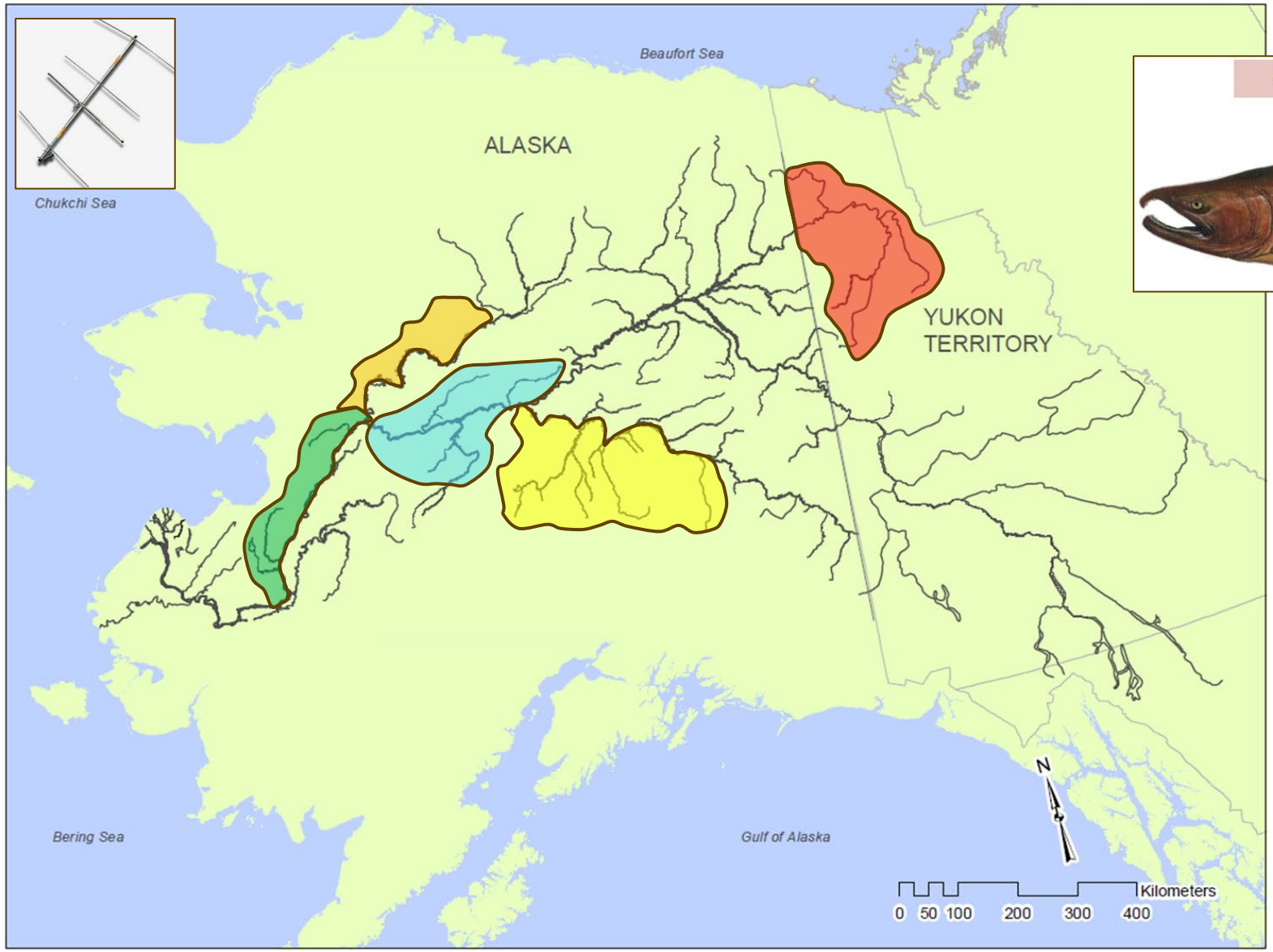
• Salmon patterns and trends

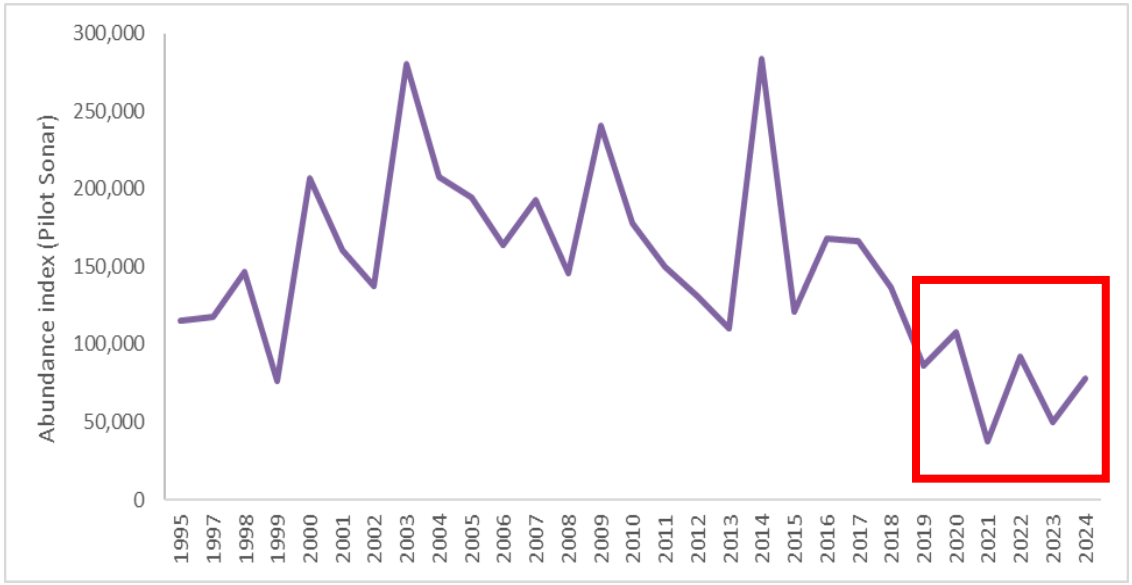


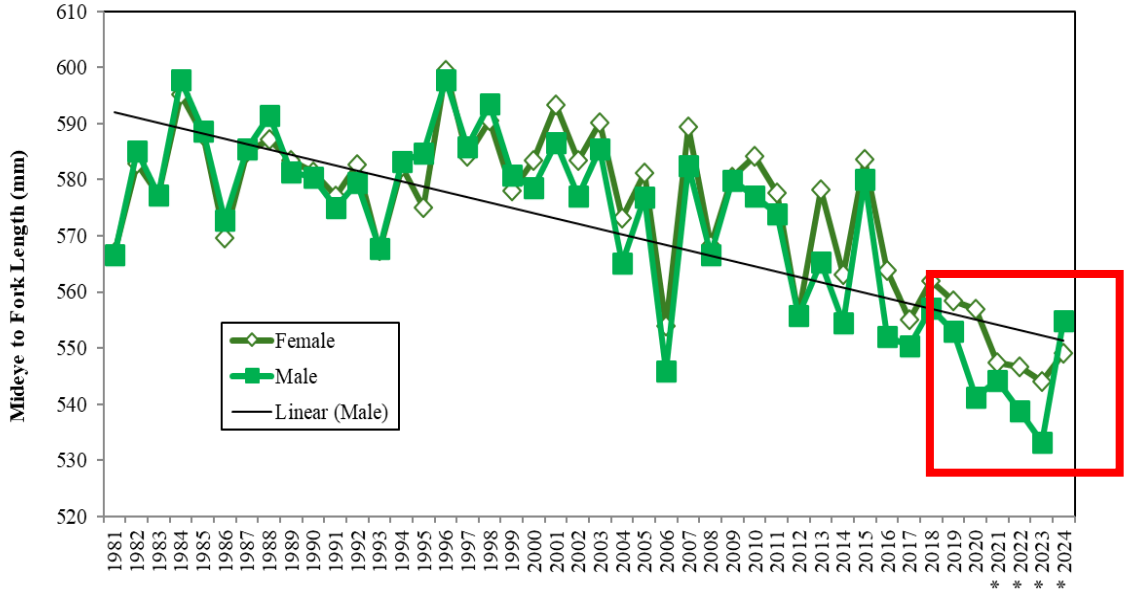
Telemetry distribution, 2022

- 34% Lower
- 6% Middle
- 7% Koyukuk
- 53% Tanana
- ?% Porcupine, Canada

• Salmon patterns and trends

Coho salmon





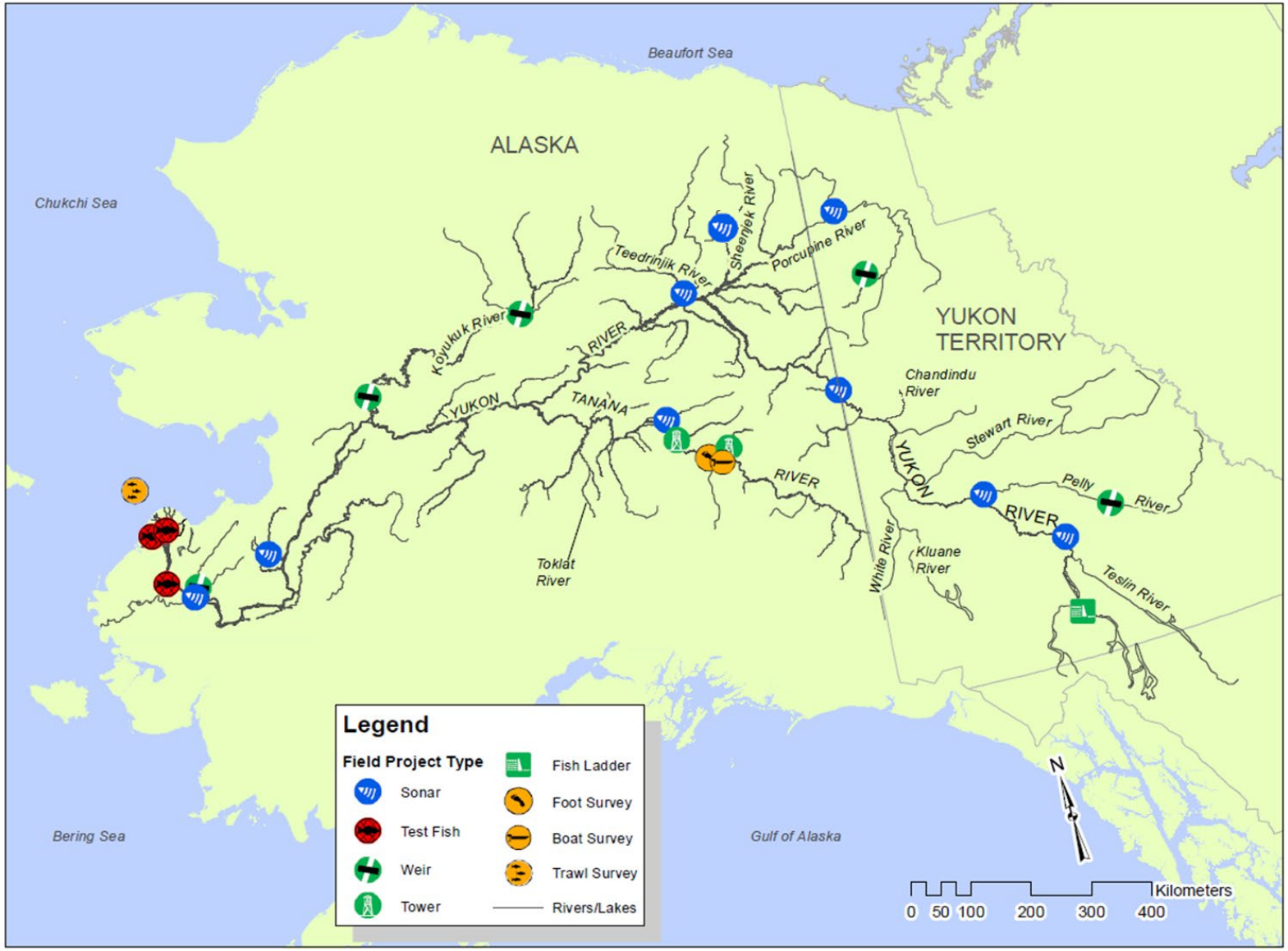
Over the past ~6 year, we have observed poor run abundance of coho salmon and the average size of returning fish have been some of the smallest observed. The proportion of females has been stable.

4

- Action to understand and protect salmon

4

• Action to understand and protect salmon



Example of "core" assessment locations used to monitor salmon abundance and serve as a platform for broader research

Not all projects operate every year

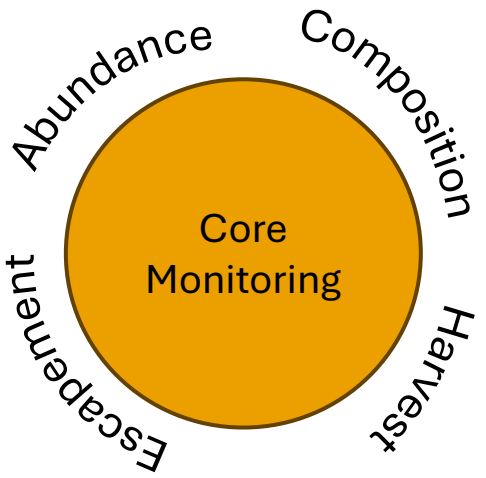
Deep “spider web” of research collaborations

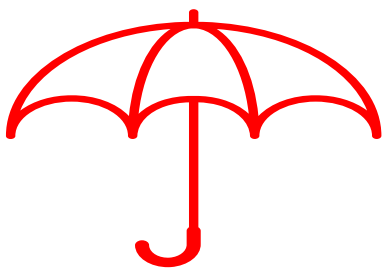
4

- Action to understand and protect salmon

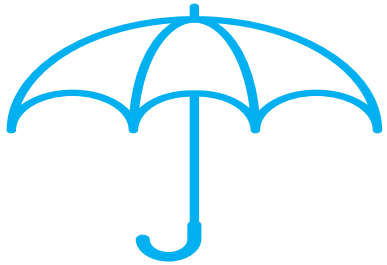
Umbrella Research “Themes”

Build from our “core” freshwater and marine monitoring programs

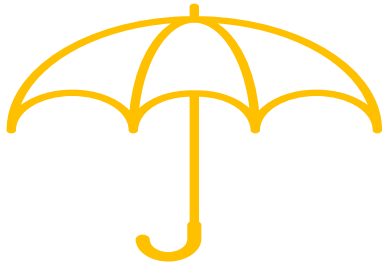




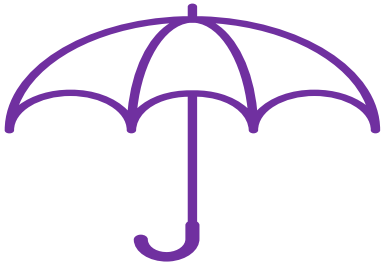
Population Trends



Drivers of Productivity



Marine Ecosystem



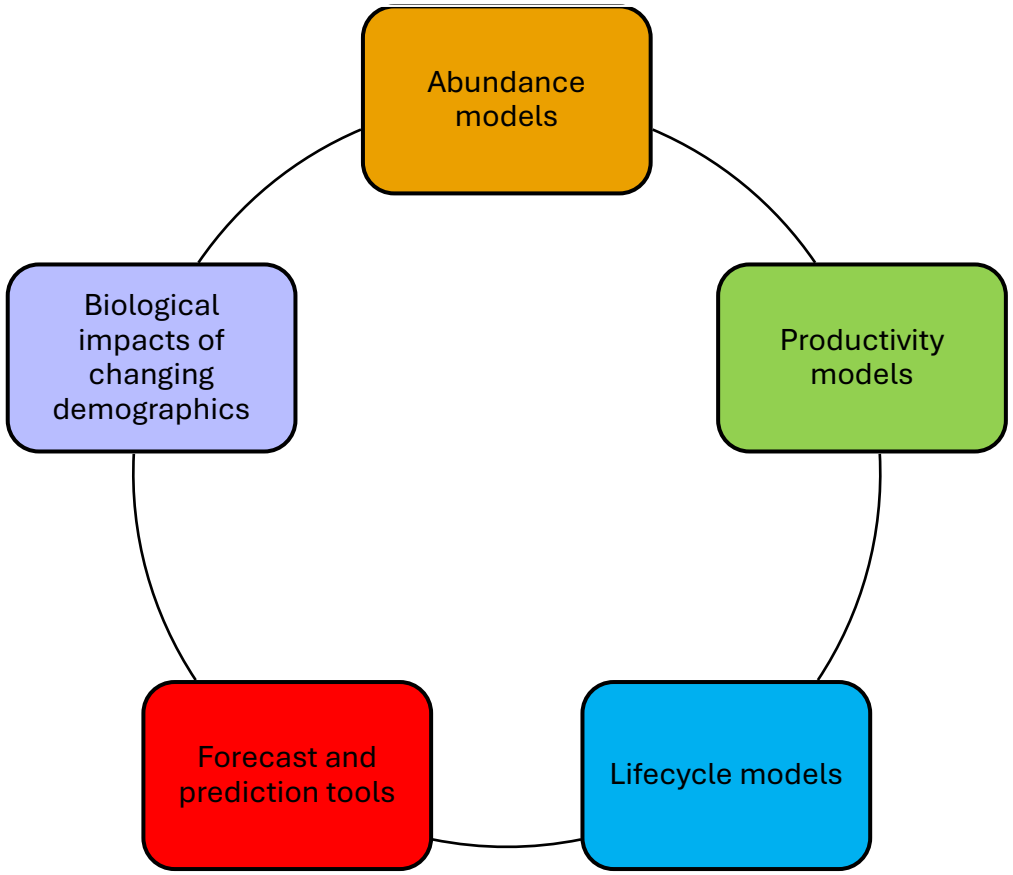
Fish Health

4

- Action to understand and protect salmon

Umbrella Research “Themes”

Population Trends

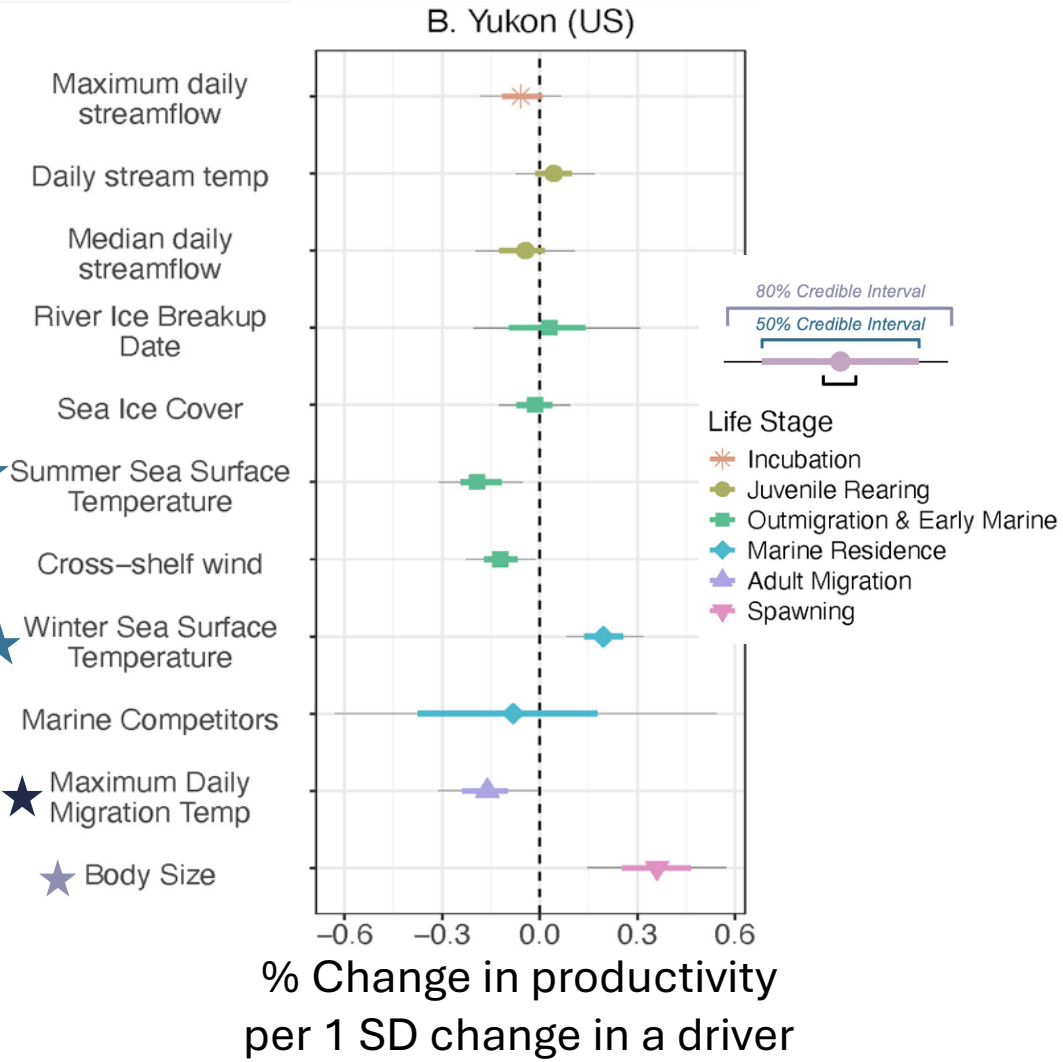


New tools that allow us to represent historical changes in salmon stocks in ways that may be helpful when thinking about how future runs may respond to environmental changes and management actions.

4

- Action to understand and protect salmon

Umbrella Research “Themes”



Drivers of Productivity

Declines in Yukon River Chinook salmon productivity are associated:

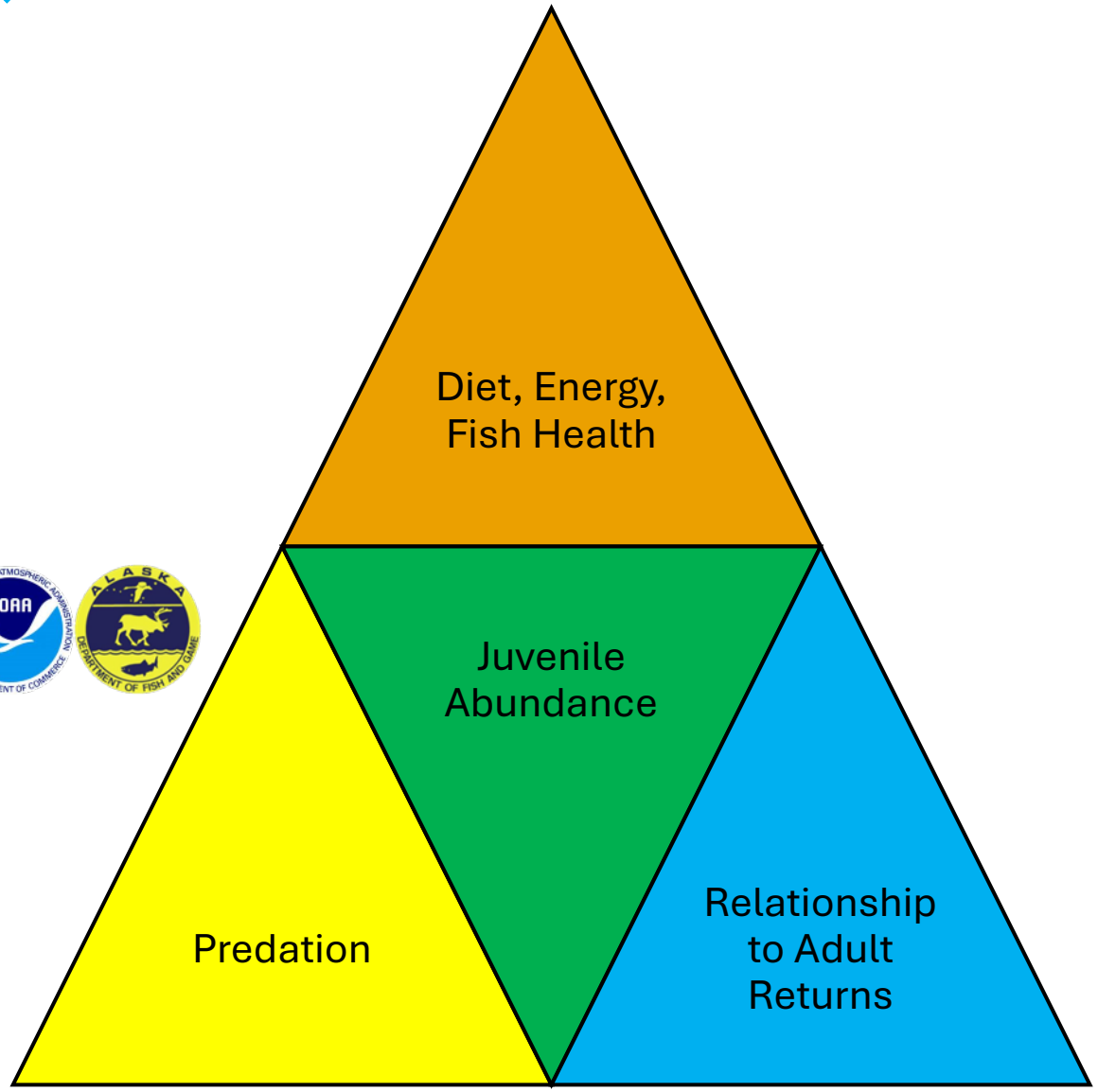
- Declines in body size
- Warmer temperatures in the ocean and during upriver migration

Feddern et al. 2024

4

• Action to understand and protect salmon

Umbrella Research “Themes”



Marine Ecosystem

Salmon and ecosystem surveys are providing cutting-edge insight into how juvenile salmon:

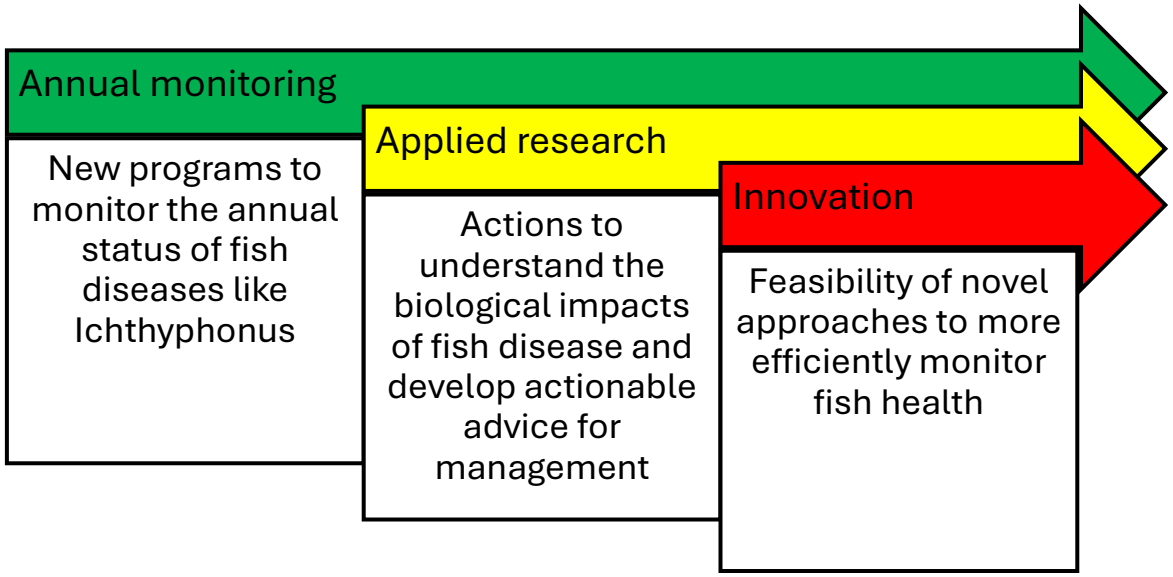
- interact with the marine environment and other species,
- diets and energy changes in response to temperature,
- and what this means for adult returns to the Yukon River.

4

• Action to understand and protect salmon

Umbrella Research “Themes”

Fish Health



Unprecedented collaborative efforts to incorporate fish health into the “core” Yukon salmon assessment program to inform fishery management :

- Marine health screenings,
- Adult disease and heat stress monitoring – implications for natural disease associated mortality,
- Development of non-lethal and rapid assessment protocols.
- Relationships between female health and viability of offspring (e.g., thiamine)

- Action to understand and protect salmon

Summarizing the research….

Harvest does not appear to be the primary driver of low runs and poor production.

Adult run size is largely defined by natural processes that take place during early freshwater / marine life.

Fish growth and energy are linked to water temperature. Overly warm temperatures can be problematic.

Fish are reaching sexual maturity faster resulting in smaller fish returning to the Yukon River.

Females have fewer and smaller eggs to contribute to the next generation.

Fish experience compounding stressors like nutrient deficiency, elevated water temperatures, and disease.

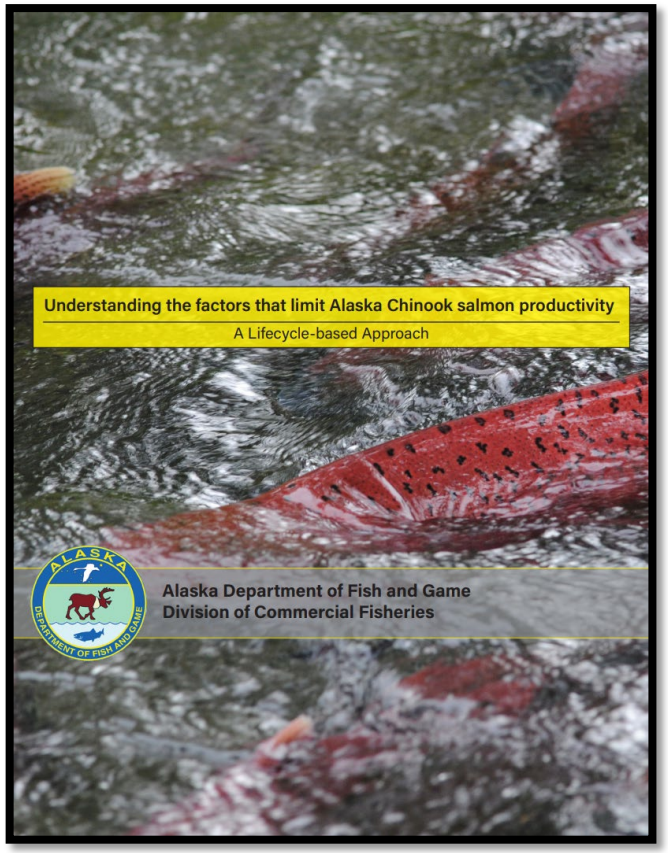
5

- Planning for the future

5

- Planning for the future

Identify and develop strategies to address threats to salmon



Feddern et al. 2023

5

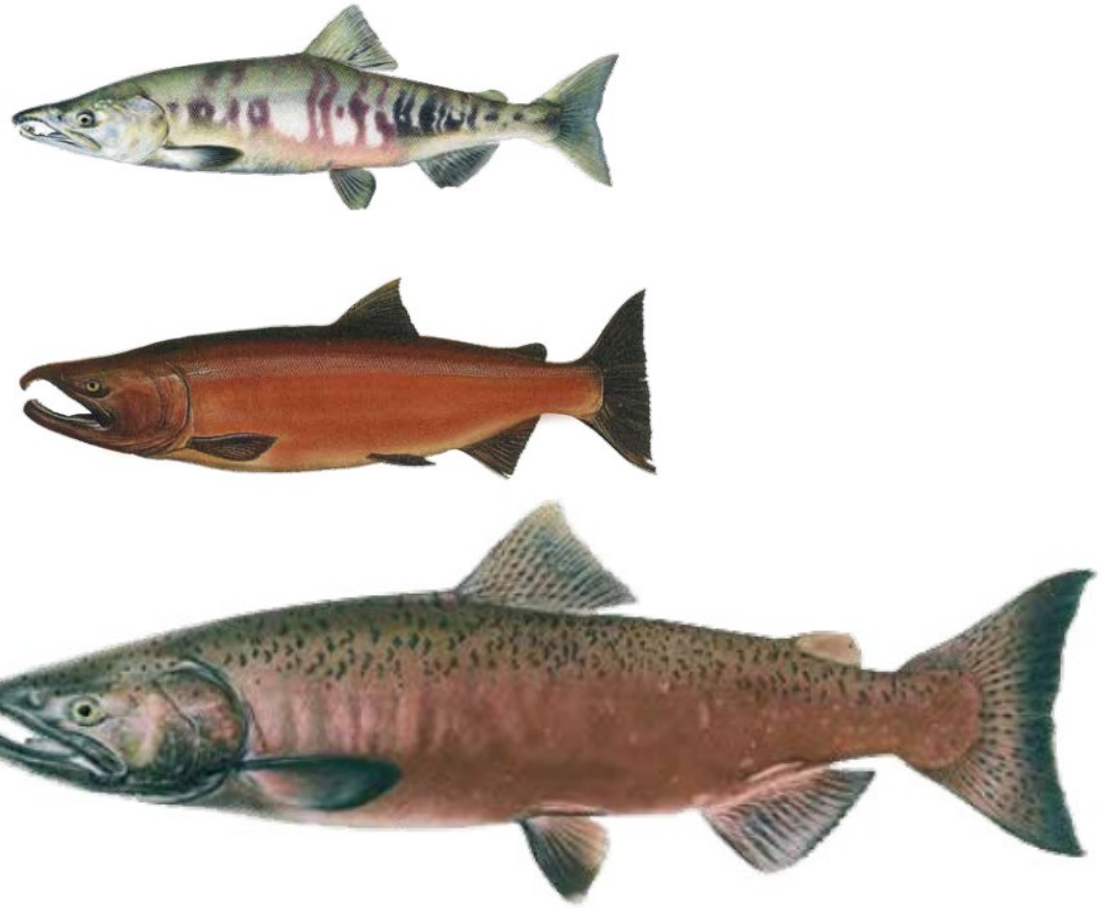
- Planning for the future

Consider options that are flexible and have merit under a range of future scenarios

- The Arctic is warming 2x faster than most other places on the planet.
- Historical patterns may not be the best predictors of the future – but they are still useful.
- Reshape expectations – e.g., rather than expecting accurate information about what WILL happen, consider how to use tools that allow us to think about what MAY happen.

• Planning for the future

2025 Salmon Run Forecasts



Yukon Summer Chum: 550,000 – 1,800,000

Yukon Fall Chum:

- Drainagewide: 114,000 – 322,000
- Canadian mainstem: 8,000 – 48,000
- Fishing Branch: 5,000 – 13,000

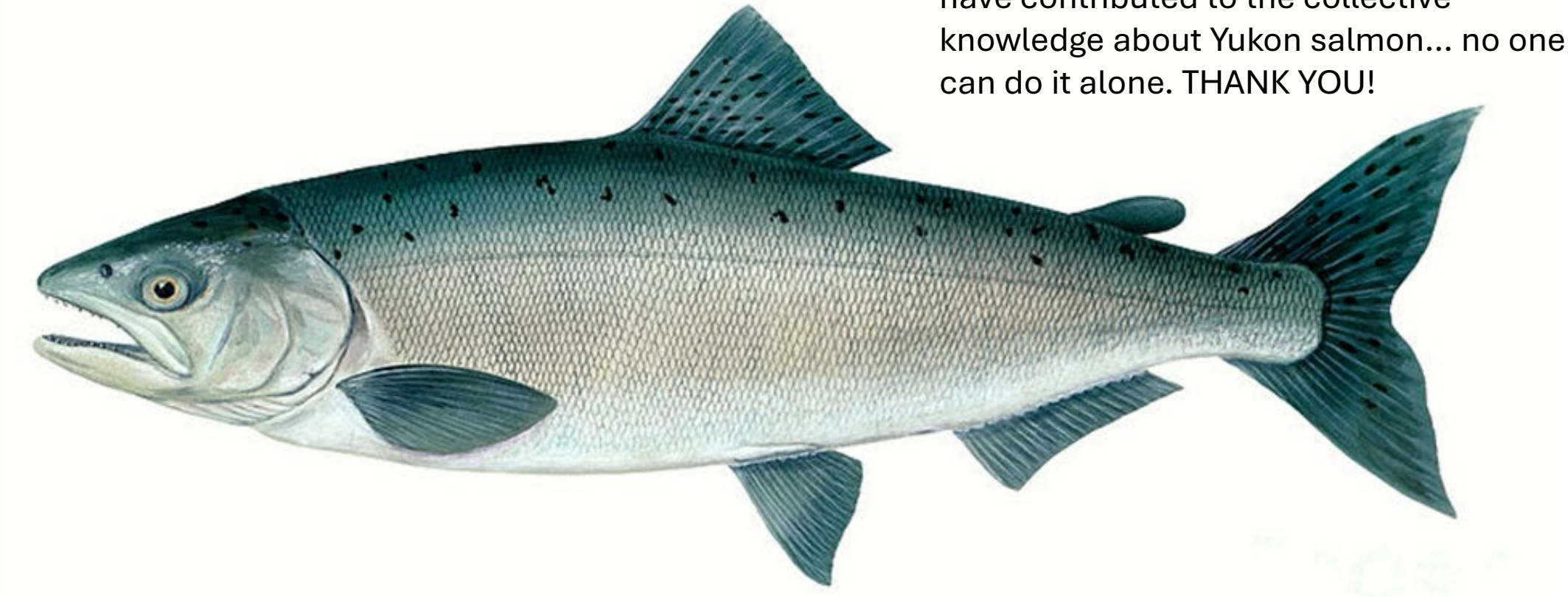
Yukon Coho: “Below average”

Yukon Chinook:

- Drainagewide: 58,000 – 88,000 (all stocks)
- Canadian mainstem: 24,000 – 37,000 (total run)
  12,000 – 32,000 (border expectation)

Acknowledgements

Many agencies, entities, and individuals have contributed to the collective knowledge about Yukon salmon… no one can do it alone. THANK YOU!



Discussion

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Alaska Dept of Fish and Game
Division of Commercial Fisheries
Phone (907) 267-2135