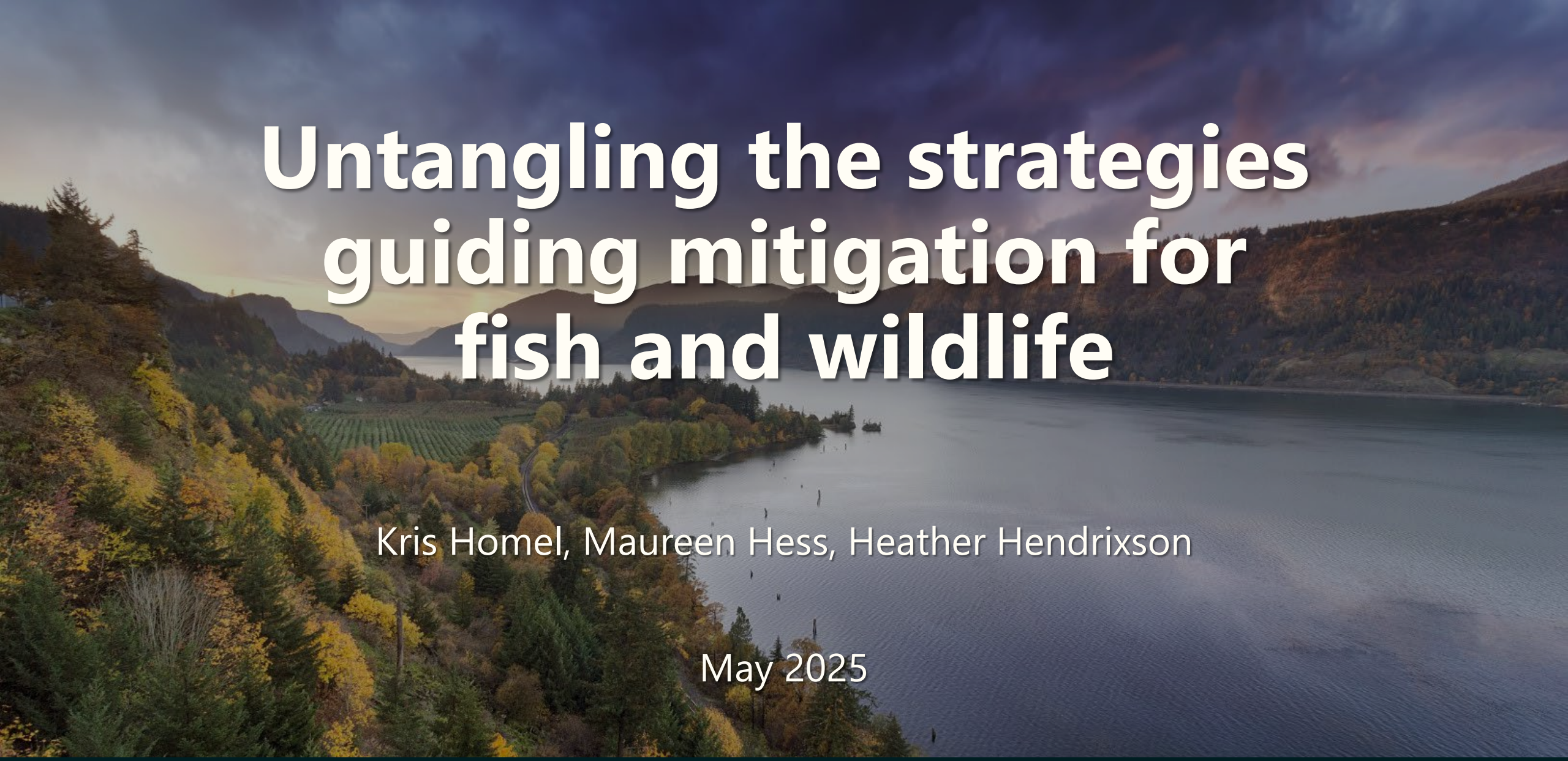


Untangling the strategies guiding mitigation for fish and wildlife

Kris Homel, Maureen Hess, Heather Hendrixson

May 2025

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

Outline

1. **Foundational elements of Act and Program guiding mitigation**
   - The Act, Vision, Scientific Principles
2. **Multi-species, ecosystem- approach**
   - Examples of mitigation actions
   - Which species benefit from these actions?
3. **Organization and intersection of different strategies**
   - How are actions organized by strategies?
     - Action-based, species-based, principle-based
   - Why does the Program look like this?
   - Examples
4. **Combining clear action with logical organization**
   - Importance of Program organization
   - What is already clear, what could be improved?

1. Foundational elements of Act and Program guiding fish and wildlife mitigation

What does the Northwest Power Act require?

The Council shall request …recommendations for

- **measures** … to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, affected by the development and operation of any hydroelectric project on the Columbia River and its tributaries; [4(h)(2)(A)]
- **objectives** for the development and operation of such projects on the Columbia River and its tributaries … [4(h)(2)(B)]
- **fish and wildlife management coordination and research and development** …which, among other things, will assist protection, mitigation, and enhancement of anadromous fish at, and between, the region's hydroelectric dams. [4(h)(2)(C)]

- Anadromous fish, especially noted in Section 2(6), resident fish, wildlife
- This includes ESA-listed and not listed; hatchery and natural origin fish, wild fish

The vision

- The vision for this program is a Columbia River ecosystem that sustains an **abundant**, **productive**, and **diverse community of fish and wildlife**, supported by mitigation across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem. This envisioned **ecosystem** provides abundant opportunities for … harvest, and the conditions that allow for restoration of … fish and wildlife ….
- The vision will be accomplished by **protecting and restoring the natural ecological functions, habitats, and biological diversity** of the Columbia River Basin. Where this is not feasible, other methods that are compatible with **self-sustaining fish and wildlife populations** will be used, including certain forms of production of **hatchery fish…**

- Diverse community of species in the ecosystem
- Specifically notes role of hatchery production in vision

Scientific principles

- Healthy ecosystems sustain **abundant, productive, and diverse plants and animals** distributed over a wide area
- Biological diversity allows ecosystems to adapt to environmental changes
- Ecosystem conditions affect the well-being of **all species including humans**

- Diverse plants and animals
- Ecosystem, all species, humans

2. Multi-species, ecosystem approach

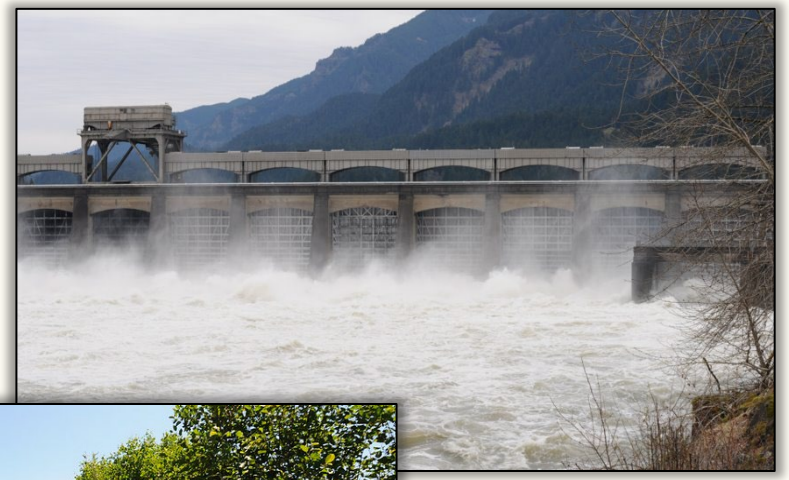
What are the mitigation tools & how are they used

On-site mitigation:

- Hydrosystem operations for reservoir elevations and flows
- Water quality associated with dams
- Dam passage for anadromous and resident species

Off-site mitigation:

- Habitat protection & restoration
- Artificial production
- Improvements to water quantity and quality
- Management of predators and non-native and invasive species
- Research, monitoring and evaluation to (adaptive management)



Actions benefit multiple species across the landscape

Species

- Salmon & Steelhead
- Resident fish
- Sturgeon, Lamprey, Eulachon
- Native freshwater mussels
- Wildlife
- **…and more**

- ESA listed (threatened, endangered)
- Non listed
- Hatchery origin
- Natural origin
- Wild

Habitats/Locations

- Plume
- Estuary
- Mainstem
- Tributaries
- Blocked areas

Example: Hydrosystem flow and passage

Mainstem hydrosystem flow and passage operations

- "Manage dams and reservoir operations to protect and restore **ecosystem function** and habitat, and to improve fish passage and survival through the hydrosystem…"
- "…manage water to protect and improve habitat conditions for **all fish affected by the hydrosystem, not just listed species**."

- Operations affect resident and anadromous aquatic species upstream and downstream of projects, including:
  - hatchery origin, natural origin, and wild
  - ESA-listed and non listed

Example: Habitat restoration throughout basin

Habitat

- Protect, enhance, restore and connect **aquatic** and **terrestrial** habitat. Protecting existing habitat is as important as enhancing degraded habitat.
  - Restore **ecosystems**, not just single populations
  - Use **native species** whenever feasible

- Restoration affects resident and anadromous aquatic species, wildlife, throughout the basin, including:
  - Hatchery origin, natural origin, and wild
  - ESA-listed and non listed

Restore ecosystems, not just single populations

- Projects are managed to achieve multiple objectives – flow, habitat, native species, diversity
- Restoration occurs in diverse habitats for benefit of diverse species, runs, origins
- Objectives may include improved:
  - Growth and survival
  - Natural production (spawning, rearing)
  - Ecosystem function

Example: Artificial production of multiple species

Artificial production actions

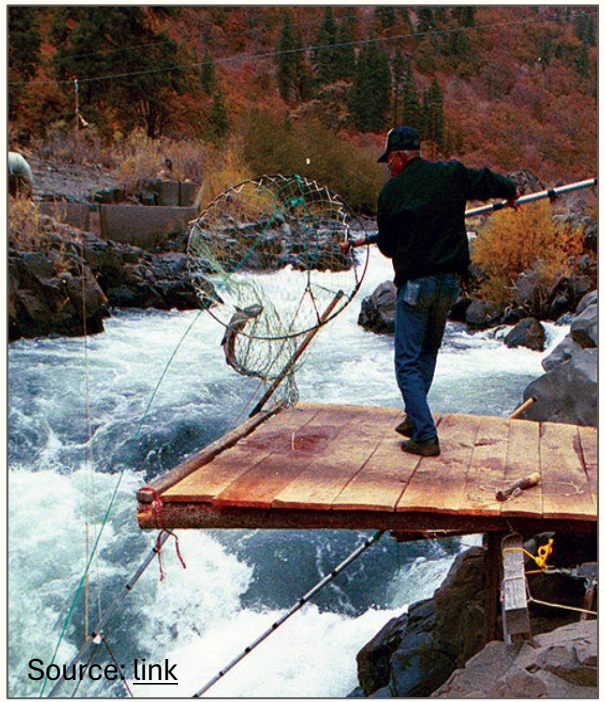
- Fish propagation including hatchery programs:
  "Use hatchery programs as tools to help meet the mitigation requirements of the NPA."
- Hatcheries for reintroduction:
  "…return lost salmon and steelhead into blocked areas, or to re-establish populations in watersheds accessible for anadromy but where the native population had been extirpated or the risk of extirpation is very high…"

- Artificial production supports multiple species throughout the basin:
  - Salmon, Steelhead,
  - Sturgeon, Lamprey
  - Resident fish
  - Native freshwater mussels (developing)
  - Including:
    - ESA-listed and non listed species
    - Hatchery and natural-origin

Artificial production – Multiple objectives

Fishery only

- **Fishery** – Fish for harvest


Source: link


Source: link


Source: link

Slide source: October 2024 Council meeting

Conservation & Fishery

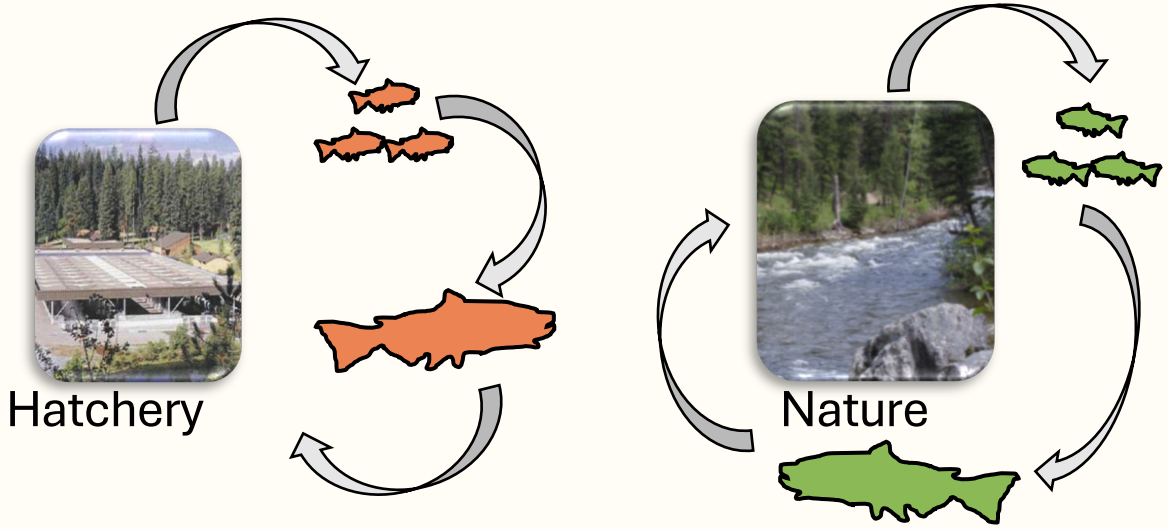
- **Supplementation** – Prevent extirpation, rebuild natural production
- **Reintroduction** – Restore extirpated populations


Source: 1996-040-00

Artificial production – Multiple objectives

Fishery only

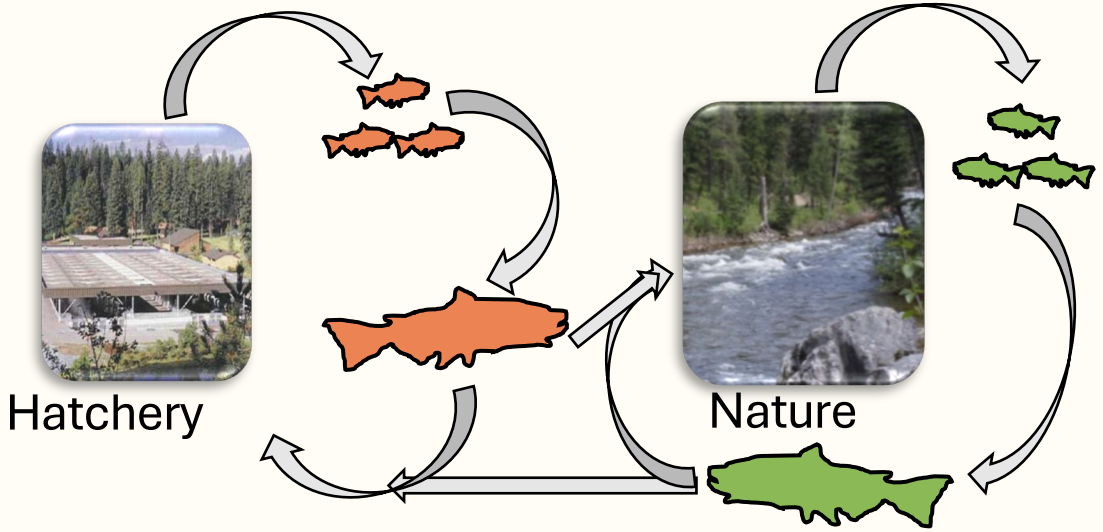
Segregated management



- Two environments, two populations
- Promotes harvest of hatchery fish
- Managed to not impede recovery of natural populations

Conservation & Fishery

Integrated management



- Two environments, one population
- Support rebuilding natural production
- Prevent or restore extirpated populations

Fishery only objective

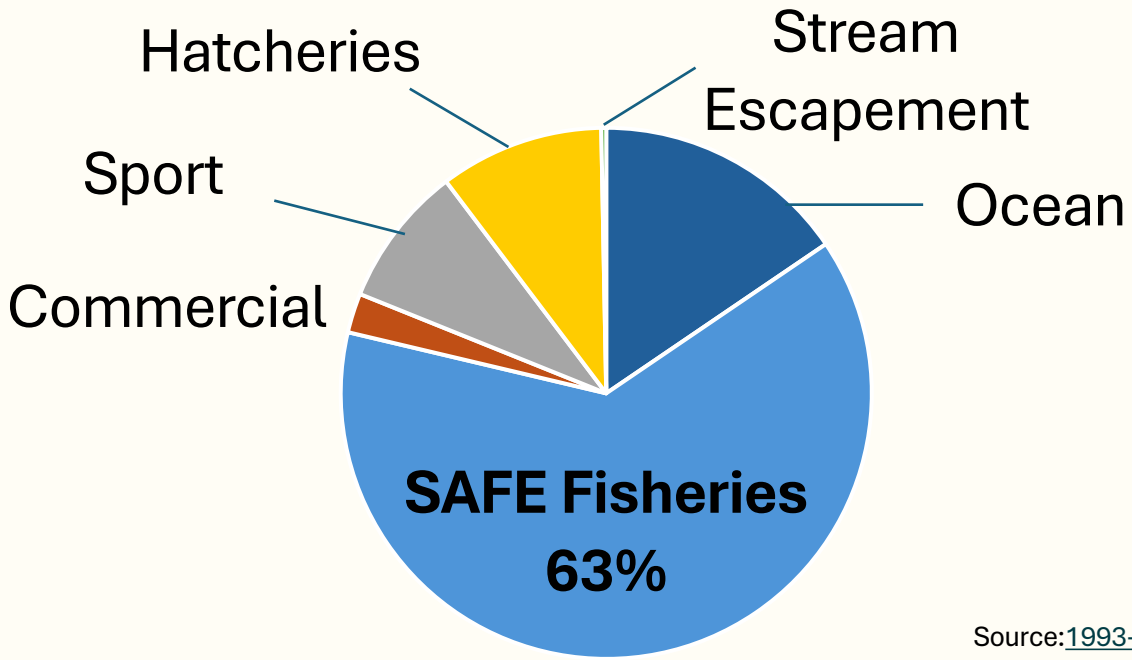
Resident fish: Lake Roosevelt Rainbow Trout

- Hydrosystem limits the ability of naturally producing native resident fish populations to provide sustainable fisheries.

- Managed to not impede recovery of natural populations:
  - Produce triploid Rainbow Trout

Anadromous fish: Select Area Fisheries Enhancement Coho

- Harvestable fish for ocean and off-channel areas of Lower Columbia River
- Minimize risk to non-target stocks
  - Managed to not impede recovery of natural populations:

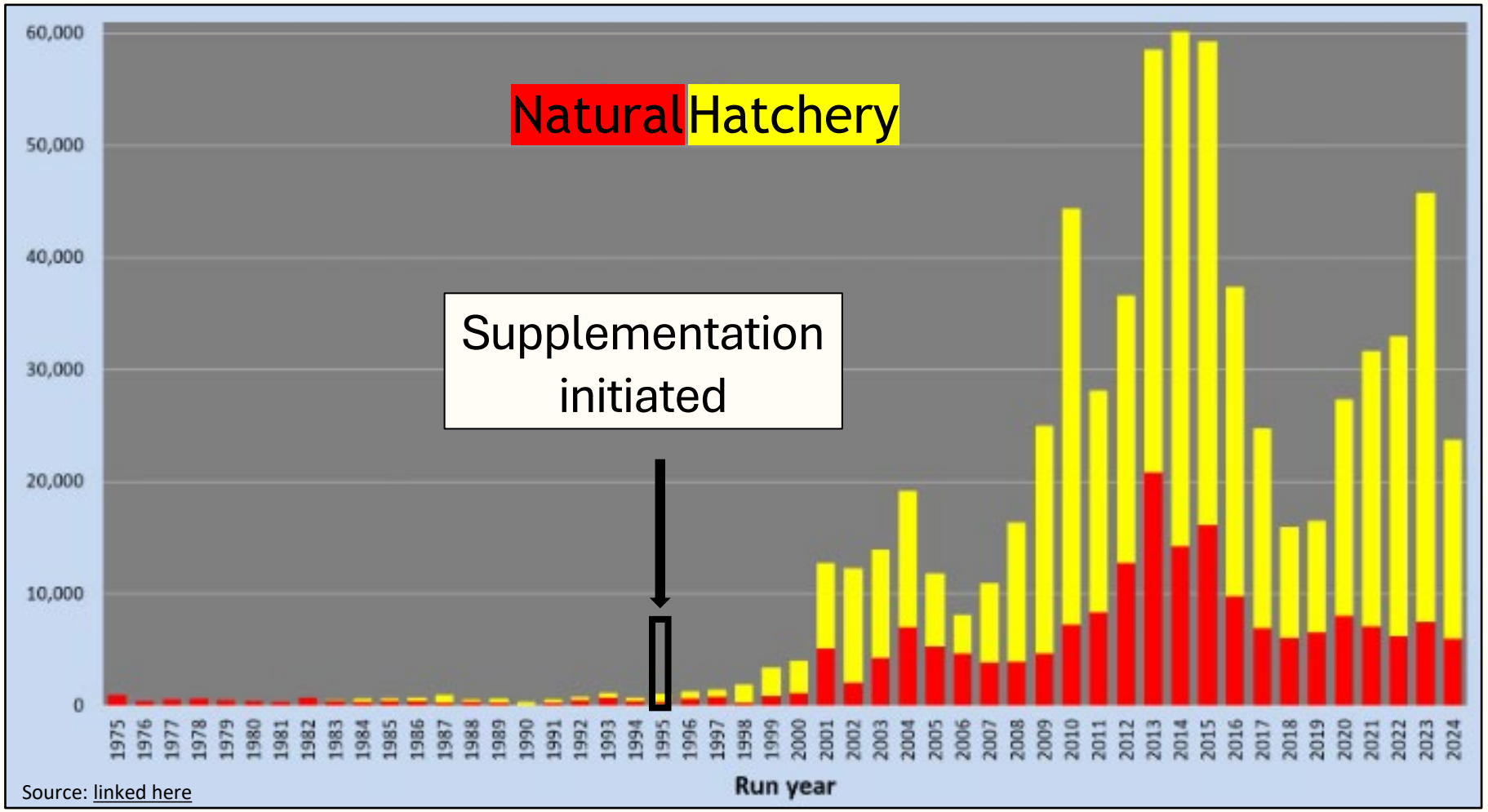


Source:1993-060-00

Conservation & fishery objectives – Snake River Fall Chinook

- Prevent extirpation
- Hatchery fish spawn naturally to support rebuilding natural production

- Fish for natural spawning (56%) and supporting both treaty & non-treaty fisheries (44%)



Number of Fall Chinook returning to Lower Granite Dam, annually

Actions benefit multiple species across the landscape

- Numerous examples of mitigation actions to:
  - Improve ecosystem function
  - Benefit anadromous or resident fish, and wildlife in general
  - Target particular species (ESA- listed and not listed)
  - Benefit hatchery origin, natural origin, and wild fish
- Actions include:
  - Onsite (hydrosystem)
  - Offsite (e.g., Habitat, AP, predator management, etc.)
- Mitigation occurs throughout basin in different kinds of habitats
  - Mainstem, tributaries
  - Estuary, plume

3. Organization and intersection of different strategies

How are mitigation actions organized into strategies?

On-the-ground Actions

- Habitat
- Mainstem hydrosystem flow and passage
- Predator management
- Non-native and invasive species
- Artificial Production
- Use of hatcheries for reintroduction
- Water quality
- Wildlife mitigation

Species

- Sturgeon
- Lamprey
- Eulachon
- Resident fish mitigation

Locations

- Estuary
- Plume and nearshore Ocean
- Anadromous fish mitigation in blocked areas

Principles

- Ecosystem function
- Strongholds
- Wild fish
- Investment
- Protected areas and hydroelectric development
- Climate Change
- Public engagement

Why does the Program look like this?

- Measures organized by salmon/ steelhead life cycle
- Measures calling for restoration and passage for anadromous fish in **tributaries** and describing build out of AP
- Same but for resident fish
- Process to determine mitigation requirements

1982 Program

- Section 300: Anadromous fish- **downstream** migration- water budget
- Section 400: Anadromous fish downstream migration- passage
- Section 500: Anadromous fish- **ocean** survival
- Section 600: Anadromous fish- **upstream** migration
- Section 700: Wild, natural, hatchery **propagation**
- Section 800: Resident fish
- Section 900: Yakima River Basin Enhancement
- Section 1000: Wildlife

Why does the Program look like this?

- Implementation strategies, … describe the actions leading to the desired **ecological conditions**.
- Multi-species and ecosystem focused
  - *Example*: Actions to improve juvenile and adult fish passage through mainstem dams … should protect biological diversity by benefiting the **range of species, stocks and life-history types in the river** ….

2000 Program

…

D. Strategies
   1. Introduction
   2. Linkage of biological objectives with strategies
   3. Habitat strategies
   4. Artificial Production strategies
   5. Harvest
   6. Hydrosystem Passage and Operations
   7. Wildlife
   8. Ocean Conditions
   9. Research, Monitoring, and Evaluation

Where are we today?

- **Mature Program**
  - 45 years of additions and changing emphasis
  - Periodic substantial changes in organization
- **Current organization results in:**
  - Lots of overlap and duplication in actions across these strategies
  - Combination of (1) strategies describing mitigation actions, (2) strategies describing benefits to individual species, or (3) strategies describing principles
- **Examples**:
  - One strategy relying on implementation of multiple others – Wild Fish
  - Related actions appearing in multiple strategies – Hydrosystem

Example of strategy relying on implementation of several other strategies: Wild fish

- 2014 Program is first time wild fish becomes a stand-alone strategy:
  - The council will consider the needs of wild fish in all facets of its program including: hydrosystem passage, fish propagation facilities, climate change, predation, …, and habitat actions
  - … Council will collect, organize, and review biological objectives for wild fish
- Strategy specifically links to:
  - Subbasin plans, Objectives, Strongholds, Fish propagation, Habitat, and Adaptive Management
- Other actions and strategies also key to mitigation for wild fish

- Strategy *does not explicitly define wild fish species* – mentions salmon and steelhead

Example of related actions appearing in multiple strategies: Hydrosystem

Key hydrosystem actions:

- Water management
- Fish passage
- Water quality
- Research, monitoring, and evaluation

Strategies containing flow and passage measures:

- **Hydrosystem flow and passage** – all
- **Ecosystem function** – flows
- **Lamprey** – flow and passage
- **Sturgeon** – flow and passage
- **Resident fish** – restore passage (Albeni Falls)
- **Water quality** – develop fish passage structures that produce less TDG
- **Wild fish** – address conservation needs of wild fish
- **And more**…

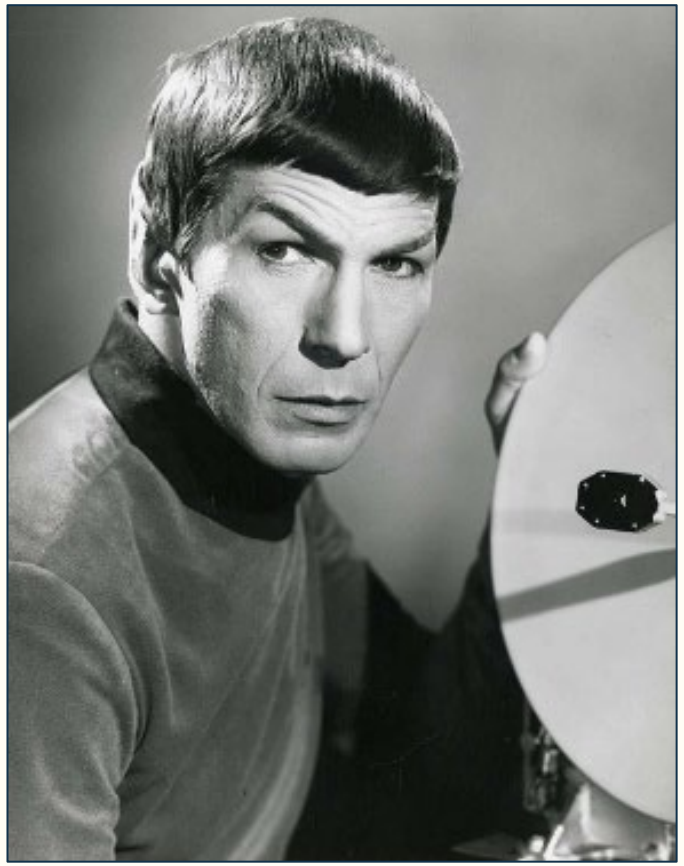
Kirk and Spock: combining clear action with logical organization

Importance of Program organization

- Substantial work done to develop framework and scientific foundation of Program along with measures and objectives representing scientific advancements over last 45 years
- This can be enhanced by a logical layout with clearly defined actions to:
  - Identify all mitigation actions on a given topic
  - Avoid gaps or redundancies in measures
  - Coordinate mitigation within and across strategies
  - Track implementation and assess performance

What is already clear?

- Requirements of Act, Council, Program, Action agencies
- Vision, foundation, principles
- Layout of framework
- Goals and objectives as described in addendum
- Priorities
- Investment strategies
- Specific text of many measures
- and more …



What could be improved?

- Content-neutral reorganization to create better layout for current measures/ incoming recommendations
  - Not radically different, just reorganized
  - All measures located in one section of Program
  - All goals and objectives combined in one section
  - Limit use of appendix to supporting information, not measures
- Simple fixes, too: number the measures!
  - Fourth bullet down on the third paragraph of the habitat strategy vs “measure 118”

Summary

- Implementation of work under the Program designed to create benefits for different species, life histories, runs, origins, and in different locations
- Because of how strategies and measures are organized in the Program, it can be difficult to identify those benefits or track implementation and performance
- Amendment provides opportunity to make more explicit how measures fulfill mitigation requirements of Act for all fish and wildlife, and habitats, negatively affected by hydrosystem
- This can be done in a way that:
  - **Preserves** importance of vision, foundation, principles, framework, and adaptive management
  - **Clarifies** what actions are being done, how they relate, who benefits, where done, by whom

Northwest **Power** and
Conservation Council

Extra slides

Significance of origin?

- Potential for different adaptation to existing environment
- Potential for different life-history characteristics
- Potential for different level of diversity that allows for future adaptation
- Potential for over representation of less adapted traits
- Potential for straying

- Historically – challenges with origin of out-of-basin hatchery stocks, disease issues, swamping of local adaptation, etc.

What is a wild fish? What is a natural-origin fish?

- Wild = DEF
  - How do we know a fish is wild? Genetic samples compared to established genetic baseline (which is distinct from introgressed populations – so some level of diversity must be present), a definition of how much introgression with hatchery-origin determines whether a fish is still wild, and/ or population is isolated from any hatchery influence
- Natural origin = DEF
  - How do we know a fish is natural origin? It is the offspring of parents reproducing in-stream.
  - *Complicating factors- not all hatchery-origin fish are marked. In the estuary, features like migration timing and body size might differ by origin, but might not. More often described as "Marked" and "Unmarked", reflecting that origin is unknown for unmarked fish.*

Example of strategy relying on implementation of several other strategies: Sturgeon

- Implement actions that result in **increased abundance and survival for Columbia River Basin green and white sturgeon**, including habitat actions, dam operations and passage, hatchery considerations, monitoring populations, and research to improve understanding of how the development and operation of the Federal Columbia River Power System affect survival and growth of sturgeon.

- **Listed as an emerging priority in 2014 and near-term priority in 2020**

- Hydrosystem flow and passage
- *2020 Addendum*: … evaluate alternative flow regimes
- Habitat
- Predator management
- Research
- Monitoring.
- *2020 Addendum*: increase monitoring
- Fish propagation including hatchery production
- Upper-Columbia specific

Example of ~stand-alone strategy: Protected areas and hydroelectric development and licensing

- Protect fish and wildlife from the adverse effects of future hydroelectric project construction and operations.
- As part of this strategy, the Council supports protecting **streams and wildlife habitats** from any hydroelectric development where the Council believes such development would have unacceptable risks to fish and wildlife.
- **Appendix F:** Future hydropower electric development and licensing, and protected areas