Invasive Species and Salmon: Interactions in the Pacific Northwest

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The Pacific Northwest is a vast area home to 119 plant and animal species that are federally listed as threatened or endangered, including populations of Pacific salmon. Salmon will swim hundreds of miles upstream past swift rapids, waterfalls, and dams to find the exact streams in which they were born. In this journey, the fish must avoid predation from osprey, eagles, and bears; however, recent research has revealed a new threat to this migration—**invasive species**.

Spawning adult coho salmon.

What are the issues affecting salmon recovery?

The NOAA Fisheries West Coast Region works to protect, conserve, and recover the region's 28 listed salmon and steelhead species. The most well-known barriers to salmon recovery are:

- *Harvest* of salmon
- *Hatchery* interactions
- *Hydro*-system modification
- *Habitat* alteration.

Though these are significant impediments to Pacific salmon recovery, NOAA biologists are discovering that invasive species are another big problem that may be reducing the number of young salmon making it to adulthood. By addressing invasive species impacts to salmon in the Pacific Northwest, NOAA is proactively addressing concerns outside of the conventional impairments to salmon recruitment, such as dams and commercial fishing.

Invasive species in the Pacific Northwest

"In the Columbia River system alone, Pacific salmon will encounter no fewer than eight documented non-native predator and competitor fish species en route to the Columbia River estuary," says Beth Sanderson, aquatic ecologist with NOAA's Northwest Fisheries Science Center. This is not surprising, considering that **one out of every four fish species in the western U.S. streams is non-native**.

The Pacific Northwest salmon are encountering non-native fish species such as smallmouth bass, channel catfish, American shad, brook trout, and walleye. Sanderson's team is examining how these invaders are affecting recovery efforts for Pacific salmon and other native species. "We want to understand not only how salmon are affected by invasive species, but how entire food webs are changed when non-native species take hold," says Sanderson.

Non-native *and* native invaders

Non-native means that an organism is found in an environment outside of its native range and has been transported via human activity. Not all non-native species are invasive; only when a non-native species is problematic do we label it as invasive. NOAA researchers have recently described some native species as "native invaders" because they are able to rival the ecological and economic impacts of many well-known invasive species, especially in areas where habitats have been altered for human use. "Invasive species are usually associated with being non-native or exotic. In the case of the Pacific Northwest, native and non-native invasive species are both causing negative impacts to riverine ecosystems," says Sanderson.

Did You Know?

- Migratory Salmonids in the Pacific Northwest:
  - Steelhead
  - Chinook
  - Coho
  - Pink
  - Chum
  - Sockeye
- Non-native species are cited as a cause of endangerment for 48 percent of the species listed under the U.S. Endangered Species Act. In 2005, non-native species cost the U.S. economy in more than $120 billion.
- Some migratory salmonids will travel up to 900 miles to spawn in the exact stretch of river where they were born.
- After hatching, some salmon species spend only days while others spend years in their home streams before migrating to the ocean.
- Salmon carcasses support entire forest ecosystems—from insects, bald eagles, and grizzley bears to trees, plants, and algae.
- Non-native fishes in the Pacific Northwest include:
  - Smallmouth bass
  - Largemouth bass
  - Walleye
  - Northern pike
  - Brook trout
  - Brown trout
  - Channel catfish
  - American shad
  - Striped bass
- Native "invasive" species:
  - Stocked rainbow trout
  - Northern Pikeminnow
  - Caspian tern
  - Double-crested cormorant
  - Sea lions and harbor seals
- "all-H's" affecting wild salmon:

1. Habitat alterations
2. Hydro-system modifications
3. Harvest
4. Hatcheries
5. ***Harm from invasive species***

Impounding large rivers in the Pacific Northwest has changed cool, swift waters to deep, warmer, and slower waters that favor certain native species, such as the northern pike minnow. These native invaders are fish-eaters and consume young salmon as they migrate to the sea. They have become such a nuisance that a bounty program was implemented to encourage anglers to remove as many as possible.

- Rainbow trout are native to the Pacific Northwest, but are commonly stocked in the region as game fish, including into formerly fishless lakes. Transplanting species can disrupt native ecosystem processes and result in reductions to biodiversity.

Certain avian predators are also native invaders. “Caspian terns are native birds, but since the 1980s they’ve established new colonies in the Columbia River estuary. Dredge spoil islands have created good breeding habitat for the terns and their populations have grown quite large. Terns nesting along these spoil islands consume millions of salmon each year,” says Katie Barnas, fisheries biologist at the Northwest Fisheries Science Center.

Sea lions and harbor seals can also cause problems for threatened and endangered salmon in the Northwest. They take advantage of Pacific salmon as they congregate at fish ladders below dams at what can be described as “salmon buffets.”

What’s next?

Many of these invasive species were introduced intentionally before natural resource managers understood the negative impacts of non-native species establishments. For others, such as walleye, the pathway of introduction is unclear. “It is hard to estimate the impacts that fish like walleye have on salmon populations, because we don’t even know how many walleye there are in a lake, how fast they grow, or how big they get. We need to answer these questions to understand their impacts on migrating salmon smolts,” explains Sanderson.

Salmon recovery is important. They are a keystone species and the main link between marine and freshwater food webs that support Pacific Northwest ecosystems. NOAA continues to study the effects of invasive species on salmon recovery and is working to better inform the public that both native and non-native invaders are consuming young salmon and might be influencing overall recovery efforts.

For more information on NOAA involvement with aquatic invasive species issues, visit the **Aquatic Nuisance Species Task Force website** and see the **Northwest Fisheries Science Center’s Non-Indigenous Species Research fact sheet.**