

Willamette Spring Chinook: Life in the River



Circles of Life

Inside the gravel nest, newly hatched salmon begin to wriggle their way to the surface. These salmon fry have been developing through the winter in the cold water of an upper McKenzie River stream. Now, as the days lengthen and the water warms, the fry emerge. So begins a long and incredible journey—full of challenges and dangers that few will survive.



Some of the fry will remain near the spawning area, while others will migrate quickly downstream; traveling to the lower McKenzie or far down into the Willamette River. If a fish grows quickly, it may leave the Willamette River in its first summer (subyearlings). Others will remain through the summer and leave in the fall, and some juvenile salmon stay through the winter and leave in the spring (yearlings).

After spending 2–3 years in the ocean, the salmon return as adults and enter the Columbia River as early as February. As they work their way into the lower Willamette River, hundreds of anglers try to catch one of the prized salmon in a popular fishery right in the heart of Oregon's largest urban area. By the end of May, most of the salmon have passed over Willamette Falls.

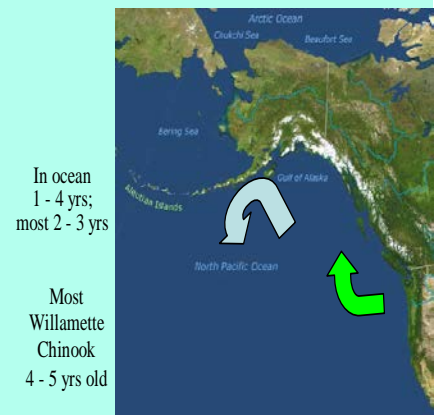


Through the summer, the salmon are rarely seen as they hold in deep pools. When September arrives, Chinook begin to appear on shallow gravel bars, seemingly from nowhere. Their spawning ritual begins, perhaps at the same gravel patch where their lives began 4–6 years earlier. Eggs are laid in the gravel nests and covered, and the adults soon die. But their bodies deliver nutrients from the ocean that enrich the stream and help the fry grow and survive. One journey ends, another begins.

The Life Cycle

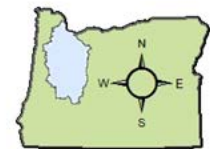


Juveniles rear in Columbia River estuary before entering the ocean. They migrate north.



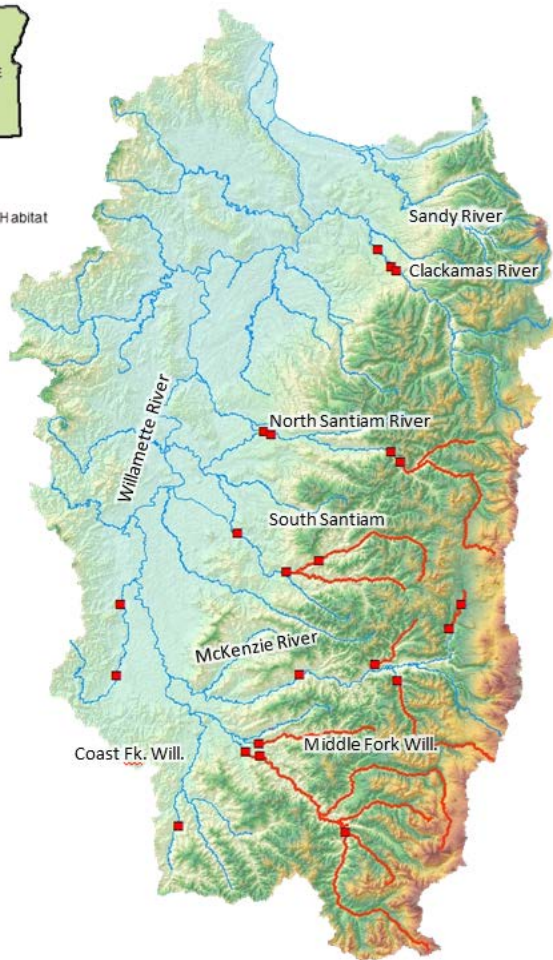
A Threatened Species

For over a century, the Willamette River Basin has undergone many changes as the population of the Valley grew and the basin became developed. Many miles of river were transformed from a complex network of channels to a single channel and held in place by armored banks. Dams built in the basin prevented salmon from reaching some of their most productive spawning areas. Large numbers of spring Chinook were harvested in the Columbia and Willamette rivers, and large hatchery programs were started to offset the loss of fish. All of these factors and more led to the decline of the wild fish, and in 1999 spring Chinook in the Willamette Basin were listed as a threatened species under the Endangered Species Act.



Legend

- Barriers
- Blocked Spawning Habitat
- Streams



Dams

- Block passage
- Change temperature
- Change flow
- Allow development in floodplains



River Changes

- Bank armoring
- Loss of gravel
- Loss of channels
- Loss of large trees



River Threats

- Sewage outfalls
- Industrial wastes
- Runoff from farms & cities
- Increased water withdrawals
- Development along river banks

Perceptions and Possibilities

Our view of the Willamette River will affect what we think is possible for recovering spring Chinook and restoring the river. Many people in the Willamette Valley have seen the river only from their car as they cross a bridge, or from a city walkway. Their perception of the Willamette River as it flows through these developed areas may lead them to think the river would be a bad place to spend time if you were a juvenile Chinook.

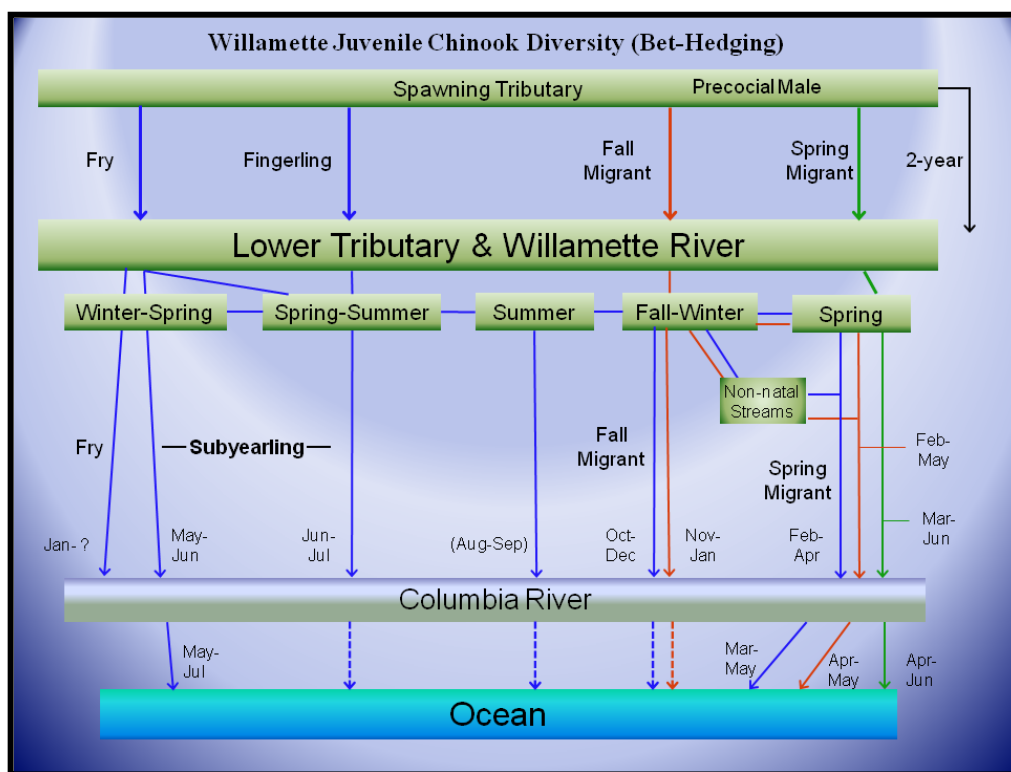
Indeed, for many decades the Willamette River was in poor condition and a goal of water management was to release water from reservoirs to quickly move adult and juvenile salmon through the river corridor. However, the perception of the river as poor habitat for juvenile Chinook persisted even as the water quality of the river improved, and the practice of “flushing” juvenile salmon out of the river continued.

Our perceptions of the Willamette River are changing as studies over the last decade have increased an understanding about wild spring Chinook—where they live and how they move throughout the basin. Information about life history of the wild fish will be a key part of planning effective restoration measures and identifying important habitats to conserve and restore.

Life in the Willamette River

Wild Chinook salmon can take many different pathways between the time they first emerge from the gravel until they leave the Willamette River on their way to the ocean. They may stay close to the spawning areas or move long distances downstream; they may leave the Willamette within 5–6 months after emerging or may stay for 18 months or longer. All of the pathways lead through the Willamette River, and even fish that are migrating quickly will spend a month or more in the river. However, the river is also an important home for large numbers of juvenile salmon who may remain several seasons in the river before going to the ocean.

Juvenile fish begin migrating into the Willamette River shortly after emerging from the gravel in late winter and early spring. Migrations of fry into the lower areas of the spawning tributaries and into the Willamette River help to distribute the little fish into productive habitats where they have a better chance to grow and survive. This life history may have evolved when the Willamette Valley was a broad and extensive network of braided channels that provided a rich nursery area for the young fish to grow.



Young salmon continue to migrate into the Willamette River throughout spring, and some of the fry that arrived earlier are now beginning to leave the Willamette River for the ocean. Movement out of the Willamette River continues into summer, and then slows down when the lower river becomes too warm. Juvenile fish in the river continue to grow through the summer, and some of them leave when the fall rains come. At the same time more juvenile fish are moving into the Willamette from the spawning tributaries where they have spent the spring and summer, and most of these fish will

stay in the river through the winter. As their second spring approaches, juvenile salmon again begin to leave the Willamette, and yet more salmon migrate out of the spawning tributaries and slowly move downstream. Meanwhile, another generation of newly emerged fry are moving downstream into the Willamette River, and another cycle begins.

Pathways and Habitats – Important Connections

The kind of habitat juvenile Chinook salmon use in the Willamette River depends on their size and the time of year they move into the river. Fry use the edges of the river, where they can stay in slower moving water and have some protection from predators.

As juvenile salmon grow, they move away from the shoreline and closer to currents that carry insects and other food to help the salmon keep growing. In spring and early summer they are found near shallow gravel bars, and will move onto flooded gravel bars during high water where insects are abundant. Juvenile salmon will move into deeper pools in late summer seeking cooler water.

As juvenile Chinook follow their various pathways on the way to the ocean, they must have connections with good habitat so they can grow and survive. Good habitat is found not only within the main river channel, but also in small channels and floodplains.

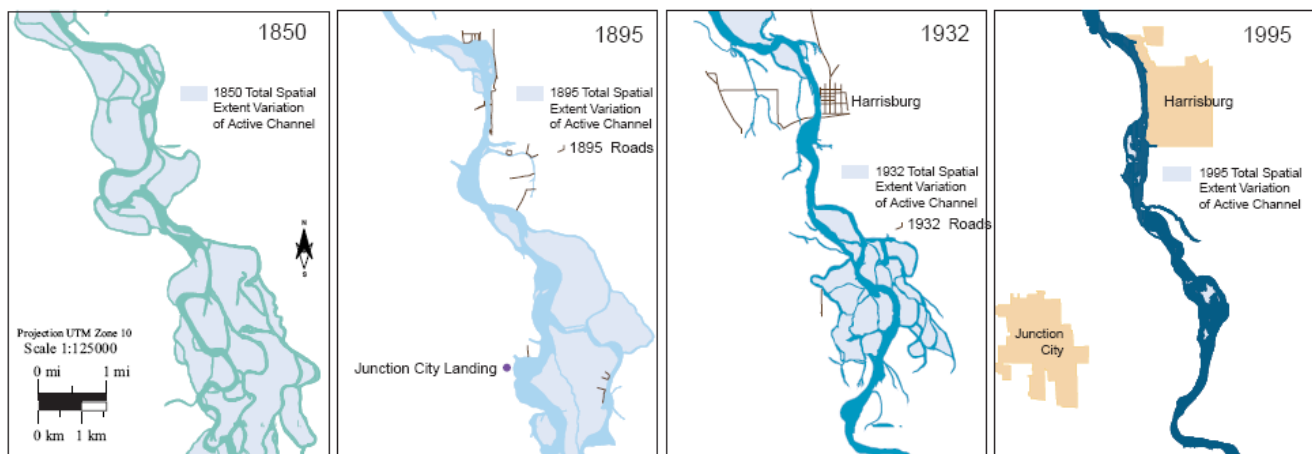


Floods can be challenging for juvenile salmon because of strong currents. However, in places where the river is not confined to a single channel and can spread out, the high water allows fish to move onto floodplains or into small, flooded channels. These areas not only offer refuge from the fast currents, but they also provide a rich and productive source of food for the young fish. Juvenile salmon may also migrate out of the Willamette River in the winter and into small streams flowing into the river from the east and the west. Even flooded agricultural fields are used as winter habitat for juvenile Chinook.

Pathways and Habitats – Restoring Connections

The upper Willamette River historically was a vast network of braided channels. These channels provided opportunities for juvenile Chinook to connect with very productive habitats during all seasons. The river often changed channels or formed new ones not only during large floods, but also during small, frequent floods. As the channels formed and moved, they created habitats such as gravel bars and islands that provide good habitat for juvenile Chinook.

Through time, the Willamette River has lost much of its historic braided network through blockage of channels and clearing of large logjams that helped to form channels. River banks were armored with boulders (rip-rap) to keep the river confined to a single channel. Construction of dams reduced the size and number of floods.



From "Historical Willamette River Channel Change". 2002. S. Gregory, L. Ashkenas, D. Oetter, P. Minear, K. Wildman

Although much of the Willamette River has been altered, many miles remain where the channel moves, and where the river forms new gravel bars and islands. These active areas provide very important habitats for juvenile Chinook. For example, gravel bars have shallow areas for salmon fry to rear and productive habitat for insects, which in turn provide food for juvenile salmon. River water also seeps through the gravel bars, which helps keep the water temperature lower in the summer, and provides areas of cool water for juvenile salmon and other native fish.

Areas outside the main river channel are also important for juvenile salmon, but the fish must be able to access these habitats. Some restoration projects in the basin are seeking to reconnect the river to old channels, while others are working to restore old gravel mining areas. Land purchases and easements will prevent additional development in some floodplain areas, and may provide an opportunity to allow small-scale flooding to occur more frequently, which in turn will allow juvenile salmon to reach important winter habitat.



Juvenile Chinook and The River

Juvenile Chinook exhibit a wide diversity in their life histories, each using the Willamette River in different ways and at different times of year. Although there is still much to learn about how these fish use the river, it is clear that the Willamette River plays an important role in the life cycle of Willamette spring Chinook salmon.

Protecting and conserving the Willamette River and floodplain areas are an important part of Chinook restoration plans. Providing a diversity of habitats will be important for juvenile fish rearing in the river. However, the fish must be able to reach these habitats along the length of the river as they migrate downstream, and across the river channel and floodplain as flow changes and as fish grow. River flow directly influences how juvenile fish can reach habitats, and flow in the Willamette River is influenced by management of dams in the basin. Efforts are underway to explore options that would allow for more frequent but small floods, which in turn will connect juvenile Chinook to some of their important habitats.

The diverse pathways and habitats juvenile Chinook use have given them options for dealing with river conditions that change from year to year and from season to season. This diversity also gives the species the ability to adapt to changes occurring over decades and centuries. Maintaining this diversity by protecting diverse habitats will help insure the continued persistence of Willamette spring Chinook.

What Do We Know?

- **Willamette River is more than a migration corridor**
- **Willamette Chinook have many life histories and follow different pathways before migrating to the ocean**
- **Juvenile Chinook migrate into the river at different life stages**
- **Multiple sizes of juvenile fish are present**
- **Juvenile Chinook are present in the river year-round**
- **Some rear in the river for many months**
- **Some spend summer and winter in the river**
- **Use many different types of habitats:**
 - **Main river (shallow gravel bars, pools)**
 - **Side channels**
 - **Floodplains**
 - **Small, seasonal tributaries**
- **Habitat use changes as fish grow**
- **Habitat use changes with seasons**
- **Fry emigrate into the Willamette River shortly after emergence**
- **Juveniles Chinook exhibit high growth rate in the Willamette**

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