

Steelhead & Salmon Habitat Requirements



Adult Migration

- Adequate stream temperatures (55° - 70° F)
- Moderate flow velocities
- Lack of impassable barriers such as road culverts, crossings, and dams
- Adequate water clarity
- Habitat complexity with holding areas and shelter
- Hiding cover from predators

Spawning

- Clean, un-silted gravel (1-4 inches in diameter)
- Adequate, sustained streamflow
- Cold water temperatures (55° to 70° F)
- Complex channel habitat: pools, riffles, riparian trees, large logs
- Gravel bed not subject to scour or siltation

Incubation/Emergence

- Clean, well-aerated gravel
- Sustained cold streamflow
- Lack of excessive channel scour and siltation
- Complex channel habitat: pools, riffles, riparian trees, large logs

Juvenile Rearing

- Cool summer water temperatures (< 70° F)
- Habitat for feeding and refuge: pools, riffles, riparian trees, large logs
- Good water quality
- Sustained cold streamflow
- Hiding cover from predators

Smolt Outmigration

- Adequate streamflow in late spring
- Hiding cover from predators
- Cool water temperature and adequate water quality
- Lack of barriers or low-flow obstacles

Indicators of Watershed Health

A watershed's ecological health is directly reflected by the condition of its salmonid populations. Migratory fish, including steelhead and salmon, are **indicator species**, meaning they are highly sensitive to environmental disturbance such as habitat alteration and pollution, and therefore, provide an early warning sign of ecosystem deterioration. Reductions in water quantity, poor water quality from pollution and siltation, and habitat degradation all have direct, negative impacts on salmonids.

A large, diverse population indicates a healthy watershed system while low numbers are indicative of overall habitat degradation. The diminishing salmonid populations in Napa County reflect how aquatic systems have been altered over the past century.

Protection Efforts

Many groups and individuals are actively involved in efforts to ensure the survival of Napa County's remaining steelhead and salmon populations. These efforts include monitoring fish abundance and distribution, improving the condition of existing fish habitat, expanding habitat through stream restoration and barrier removal, and educating the public about the importance of protecting these vanishing species. The goal is to improve and restore fish populations to self-sustaining levels through habitat improvement, land stewardship, and education.

The RCD is actively engaged in this effort. To find out how, visit www.naparcd.org or contact Jonathan Koehler, RCD Senior Biologist, at (707) 252-4188 ext. 109.

Sources

- Dewberry, Dr. T. C. of Ecotrust and Friends of the Napa River. 2001. *Whole-basin Snorkel Count for Steelhead Trout in the Napa Watershed, California (Year 2001) - Final Report.*
- Jonathan Koehler, Senior Biologist, Napa County Resource Conservation District .
- Leidy, Robert A., Gordon Becker, and Brett Harvey. 2003. *Historical Distribution and Current Status of Steelhead, Coho Salmon, and Chinook Salmon in Streams of the San Francisco Estuary, California.* www.cemar.org/pdf/solano.pdf.
- Moyle, Peter B. 2002. *Inland Fishes of California.* Berkeley, CA: University of California Press.
- Napa County Resource Conservation District. 1994. *Napa River Watershed Owner's Manual: An Integrated Resource Management Plan.* A collection of natural resource management recommendations developed by the RCD with assistance from private citizens, local interest groups, and federal, state, and local government agencies. Purchase it at the RCD/NRCS office or view sections of it on the RCD's website at naparcd.org/ownermanual.htm.
- NOAA National Marine Fisheries Service. *Chinook Salmon species account.* www.nmfs.noaa.gov/pr/species/fish/Chinook_salmon.html.

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Understanding Napa County Watersheds Steelhead and Salmon

Steelhead and salmon are **anadromous** fish, meaning they are born in freshwater, migrate to the ocean, and return to freshwater as adults to spawn. The Napa River and many streams in Napa County historically supported large numbers of steelhead trout, chinook salmon, and coho salmon. Unfortunately, their populations have declined sharply in the past several decades. Coho salmon became extinct in the Napa River Watershed in the 1960s and steelhead were listed as threatened in Napa County in 1997 under the Endangered Species Act. A small chinook salmon run still exists in the Napa River, but it is not clear whether these are wild fish or strays from hatcheries in the Sacramento and San Joaquin River systems. Improving and expanding habitat for steelhead and chinook salmon is a top priority in the Napa River Watershed.



Adult female chinook salmon, Napa Creek, 2003

Steelhead Trout *Oncorhynchus mykiss*



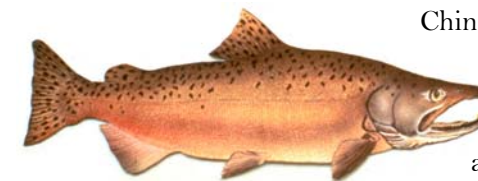
Steelhead and rainbow trout are the same species; only their life history pattern distinguishes one from the other.

Steelhead migrate to the ocean and rainbow trout remain in freshwater their entire life. Interestingly, both can come from the same parents, regardless of their life-history, and most populations contain a mix of anadromous and resident fish.

Adult steelhead have a blue to nearly brown iridescent back, silver sides, an iridescent pink to red lateral band, pinkish cheeks, a silver, white, or yellowish belly, and numerous black spots on the tail, adipose fin, dorsal fin, and back.

Steelhead populations in Napa County have been greatly reduced from historical levels of approximately 8,000 adults as recently as 100 years ago. The population is currently estimated to be between 200 and 1,000 adult fish, but is not well known. Steelhead spawning has been documented consistently in many tributaries each year, and most streams appear to be well-seeded with juvenile steelhead.

Chinook Salmon *Oncorhynchus tshawytscha*



Chinook salmon (also known as king salmon) in the Napa River Watershed are a fall run species, meaning they begin to migrate from the ocean to their freshwater spawning grounds in the fall. While at sea, chinook have blue-green backs and silver flanks, but as they reach spawning age they become olive brown to dark maroon and develop conspicuous streaking or blotches on their sides and numerous black spots on their back, dorsal fin, and tail. Spawning males are darker than females and have hooked jaws and slightly humped backs.

Chinook have been sporadically reported in the Napa River since the 1980s; however, until recently, no one had collected information on how many there are or where they spawn. In the winters of 2003 and 2004, a significant number of spawning chinook returned to the Napa River basin. Field surveys along a 3.5 mile stretch of the Napa River conducted by the Napa County Resource Conservation District (RCD) in the winter of 2004 documented 62 spawning nests and over 100 spawning adults. The surveys also showed that some of the fish were strays from fish hatcheries in the Central Valley. Regardless of their origin, it is possible that a self-sustaining population of chinook salmon is developing in the Napa River.

Did You Know?

- Chinook salmon, coho salmon, and steelhead trout belong to the family *Salmonidae*. Fish in this family are called **salmonids**.
- They also belong to the genus *Oncorhynchus*, which means "hooked snout". The name refers to the elongated hooked snout spawning salmon males develop.
- Chinook salmon are the largest of any salmon. Spawning adults often exceed 40 pounds. The largest on record for California weighed just over 84 pounds.
- The Napa River basin has been identified as San Francisco Bay's most significant direct tributary with the highest potential for maintaining and restoring current and historical salmonid populations.

The Steelhead and Salmon Life Cycle

The unique life cycle of steelhead and salmon poses challenges for protection efforts. Their populations are controlled by ecological conditions throughout the watershed, bay, and ocean. Protecting inland waters is particularly important. Rivers and streams must provide the complex habitat conditions essential for spawning and rearing. Steelhead and salmon require clean water, adequate water flow, abundant food, and a well-functioning riparian zone to thrive. If any of these requirements is absent or limited, their populations decline.



Migration into the Napa River begins in the fall

Adult Migration

Adult chinook salmon move into the Napa River immediately following the first rains in fall, returning to the same streams where they were born. Adult steelhead follow salmon into the basin arriving in late fall/early winter.

They find their way back to the Napa River Watershed by “remembering” smells, visual cues, and other unique stream characteristics they encountered during their seaward migration as juveniles.

Typically, once they enter fresh water from the sea, they don’t eat. All their energy is focused on migrating upstream to suitable spawning areas, engaging in courtship, nest building and spawning.

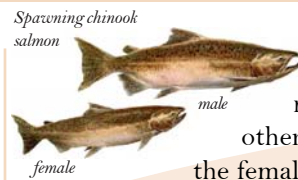


Ocean adult chinook salmon



Spawning chinook salmon in the Napa River

Spawning



Spawning chinook salmon
male
female

Once the adults reach their natal stream or other suitable site, the female chooses a nest site, called a **redd**, in gravel and builds it by fanning her tail (**caudal fin**), thus creating a depression where the eggs will be deposited and incubate.

During spawning, the female deposits the eggs into the downstream portion of the depression and simultaneously the male releases **milt** to fertilize the eggs.

Adult chinook salmon die shortly after spawning; however, steelhead may return to the ocean and repeat the spawning cycle in subsequent years. In the Napa River watershed, chinook salmon are more likely to spawn in the main stem of the river while steelhead prefer smaller tributary streams.



Chinook salmon eggs in the Napa River

Incubation

The eggs will remain in the gravel for one to three months, depending upon environmental conditions. They are a translucent yellow to orange color and are relatively large (1/6 to 1/3 of an inch).

The eggs cannot develop without well-aerated, cold, clean water. The eggs are highly sensitive to fine sediment and other pollutants, which can clog the spaces between the gravel and reduce the amount of water flowing over the eggs.

A constant flow of freshwater is vital to bring oxygen to the developing embryos and carry away waste. Too much silt, lack of flowing water, or increased water temperature will kill the eggs. During incubation, eggs are vulnerable to stream bed scour caused by high flows during storms.



Chinook salmon alevin and eggs

Emergence



Chinook salmon alevin

After the eggs hatch, the tiny fish remain buried in the gravel, nourished by an attached yolk sac for two to three weeks. At this stage the fish are called **alevins**.

Once the yolk sac is absorbed, the small fish emerge from the gravel and move into the calm stream margins to begin feeding and growing. The fish are now called **fry**. They are very small and are easy prey for other fish, birds, otters and other animals.

To survive, the fry must find cover and protection in the stream. Most often this protection comes in the form of undercut banks or beneath logs where there is low water velocity. Chinook salmon fry seek shelter in side channels and backwater areas; much of this protective habitat has been lost in the Napa River.



Chinook salmon parr from the Napa River

Juvenile Rearing



Chinook salmon parr

Young fry tend to congregate in schools around cover along banks and under logs. As they grow older and larger, fry become **parr** with distinct markings and begin to find and defend territories within the stream.

During their stay in freshwater, they feed mostly on aquatic insects and require clean, cool water and good quality habitat to survive.

During Napa’s hot dry summer, juvenile steelhead are typically found in deeper, well-shaded pools where they can hide from predators and move into fast-moving riffles to actively feed.

Life in the river is difficult and most are eaten or die within the first year. Juvenile steelhead spend one to three years in freshwater, while chinook salmon spend just a few months in the stream and move downstream to the estuary.



Migration out of the Napa River begins in the spring

Smolting



Chinook salmon smolt

As the young fish move downstream they undergo physiological changes that allow them to live in saltwater.

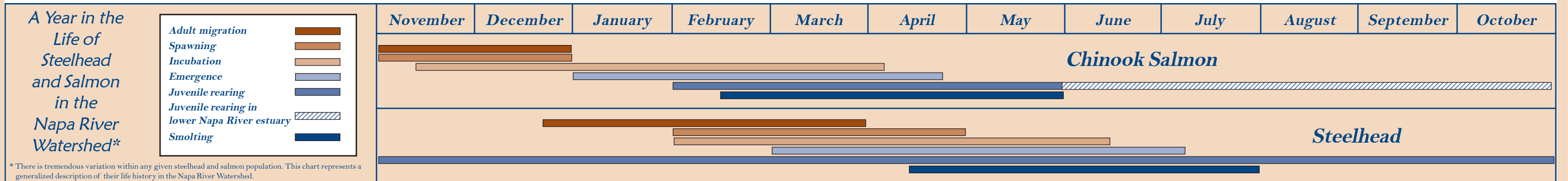
During this phase, the juvenile fish lose their parr marks and turn a silvery color. This process is known as **smoltification** and the fish are now called **smolts**.

Generally, smolts reach the lower portion of a river system in several days or weeks. Some will stay in the estuary to grow, while others simply head straight for the ocean. Young chinook salmon smolt at a very small size (2-3 inches), while steelhead smolts are typically older and larger (5-6 inches).

Fish illustrations courtesy of the U.S. Fish & Wildlife Service

Life in the Ocean

Once salmon and steelhead reach the ocean, there is abundant food and growth is rapid. The first year of life in the ocean is the most critical year for the young salmon and steelhead, as there are many predators in the ocean that eat fish of their size. Chinook will spend 2-5 years, and steelhead 1-2 years, in the ocean before returning to the Napa River Watershed to spawn.



* There is tremendous variation within any given steelhead and salmon population. This chart represents a generalized description of their life history in the Napa River Watershed.