Coho Salmon: Monitoring to Understand Change

**Importance:** Coho salmon live in several of the coastal streams within the Golden Gate National Recreational Area and Point Reyes National Seashore. Because coho are an endangered species, the National Park Service (NPS) is responsible for monitoring and protecting these populations.

Olema, Redwood, and Pine Gulch Creeks in Marin County all support populations of coho salmon (*Oncorhynchus kisutch*); however, spawning stocks along the central California coast are only at about 1% of historical levels. Habitat loss from urbanization, dam construction, logging, water withdrawals, and stream channel alterations have contributed to their decline, as has over-harvest, climactic changes, and periods of poor ocean productivity.

Figure 1 illustrates the coho’s complex fresh and saltwater lifecycle. A female fish born in 2011 will not return to lay its own eggs until about 2014—a full three years later. Because females are three years old when they spawn, every three years represents a distinct “cohort”, or different group of fish that are living on the same three year cycle together. Three cohorts live in San Francisco Bay Area streams: Cohort 1: born 2004, 2007, 2010, etc... Cohort 2: born 2005, 2008, 2011, etc... and Cohort 3: born 2006, 2009, 2012, etc... Having three distinct groups makes following coho population dynamics a bit tricky. The number of coho in a given year does not reflect what happened the previous season, or even the state of the entire population, but what happened three years ago. It also does not predict what will happen the following year, but instead what might be expected in three years.

**Figure 1 The lifecycle of a coho salmon born in 2011**

- **January 2011**
  In the winter, each female coho lays about 1500-3000 eggs in a shallow gravel redd (nest) in a freshwater stream.

- **February/March 2011**
  Out of that multitude of eggs, only about 200-300 juvenile coho will survive.*
  These vulnerable youngsters live in shallow areas of the stream where they hide among roots, rocks, and other debris and feed on insects and small fish.

- **December 2013 – January 2014**
  Three years after they hatched adults return to the creek where they were born to spawn. Unlike some other fish, coho only reproduce one time before they die.
  The original 1500-3000 eggs laid by each female coho may only yield 1-4 fish that survive to return as adults.

- **Spring 2012**
  About 50-100 of those juveniles will live to become “smolts” the next spring.
  As they migrate out to sea smolts lose the pattern of bars and dots that helped them hide from predators, and their gills and kidneys change so that they can process saltwater.

- **Summer 2012 - November 2013**
  Smolts mature out at sea for about 18 months.

*These numbers are estimated survival rates for coho in an average to good year. Numbers may be lower if big storms wash away eggs and juveniles, or poor ocean conditions make it difficult for adults to find food.
In 1997, NPS staff and volunteers began monitoring coho salmon in Redwood, Olema, Pine Gulch, and Cheda Creeks. The Marin Municipal Water District surveys Lagunitas and San Geronimo Creeks and Devil's Gulch. The Salmon Protection and Watershed Network monitors tributaries of San Geronimo Creek. Combined, these programs have provided critical information about the coho in these streams.

The NPS monitoring program is designed to address the following questions:
• What are the trends in coho abundance and distribution during their different life stages?
• Have the size and health of these fish changed over time?
• Is the park meeting their mandate for salmon habitat protection?
• How are habitat restoration efforts affecting coho recovery?

Year-round monitoring (below) captures coho population dynamics at each life stage, and also for each cohort over time. For example, comparing the number of juveniles to how many smolts migrate to the ocean the next year provides an estimate of juvenile survival rates. How many of those smolts return from the sea 18 months later to spawn gives a measure of ocean productivity and survival. Finally, counting the numbers of redds produced by these spawners indicates their level of reproductive success.

**Monitoring Program:** NPS monitors each cohort of coho salmon throughout their entire lifecycle to track population trends and evaluate the effects of restoration activities.

**Current Status:** Though each of the three cohorts and each of the monitored creeks show distinct population patterns, overall numbers of salmon on the West Coast are declining.

While there are many reasons for this decline, two of the largest contributors are stream and floodplain habitat loss, which affect eggs and young fish, and La Niña years that affect ocean conditions and reduce the amount of food available to adults. While there is not much NPS can do about what happens out at sea, they have undertaken a number of restoration projects to improve coho habitat on the lands that they manage. To learn more about these projects see [www.sfnps.org/coho/habitat_briefing](http://www.sfnps.org/coho/habitat_briefing).