Terwer Creek Off-Channel Pond Restoration:
If you build it, they will come…

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Introduction

In 2009, the NOAA Restoration Center awarded the Yurok Tribe $547,000 through the American Recovery and Reinvestment Act to improve in-stream and streamside river habitat of the Lower Klamath River tributaries to benefit threatened coho salmon as well as Chinook salmon and steelhead trout. Project activities included planting and restoring 200 acres of riparian buffers on Terwer and McGarvey Creeks, installing engineered log jams and 200 willow baffles on lower Terwer Creek and expanding native plant propagation. The highlight of this project thus far is the creation of 2 off channel ponds on lower Terwer Creek that began providing crucial overwintering habitat for Klamath River coho only months after the completion of the ponds.

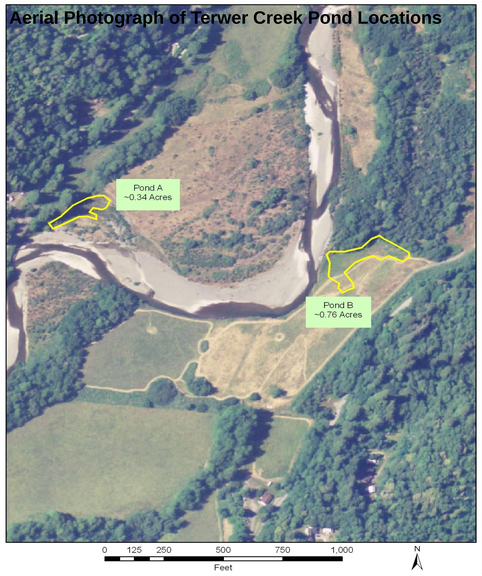
Floodplain habitats such as wetlands, sloughs, and off-channel features are important rearing areas for coho salmon. These habitats are particularly important rearing habitat for juvenile coho during winter months, providing velocity refugia during or following fall freshets and high winter flow events. Although projects to increase off-channel ponds are relatively new to California, many such projects have been built in western Washington and Canada.

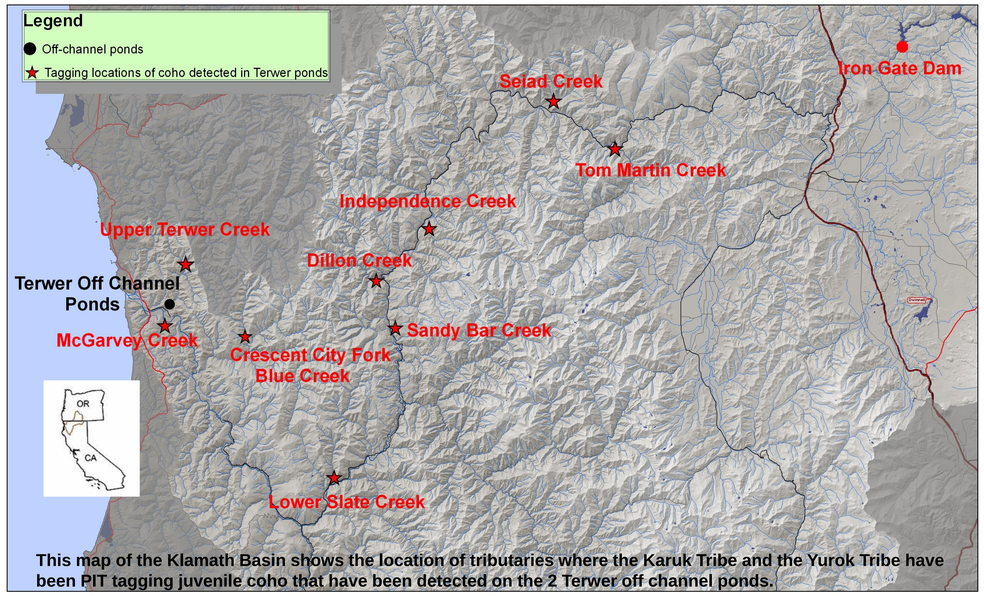
Recent sampling conducted by Mike Wallace (DFG associate biologist) on Martin Slough and Wood Creek, and sampling by the Yurok Tribe Fisheries Program (YTFP) in the lower Klamath River tributaries has documented juvenile coho moving into off-channel ponds in the late fall and leaving in the spring. When they migrate in the spring, coho that over-winter in these off-channel ponds tend to be much larger in size than those that that spend the winter rearing in the main stream channel.

The YTFP and the Karuk Tribal Fisheries Program (KTFP) initiated a collaborative study in 2006 to better understand juvenile coho salmon habitat use within the Klamath River mainstem corridor, which encompasses the main river channel and its side channels, off-channel habitats and the lower reaches of tributaries near the Klamath floodplain. Fish sampling efforts have included the use of fyke nets, beach seines, and electro-fishing. Fish marking techniques have been used to document fish movement patterns, estimate fish densities, and assess residence time in several off-estuary slough and lower tributary locations. Marking young-of-the year coho salmon with Passive Integrated Transponder (PIT) tags by KTFP and YTFP throughout mainstem and tributary habitats has enabled tracking movement and growth of individual fish between the time they are marked and subsequent recapture events. Results indicate that fish migrate substantial distances from natal tributaries and mainstem habitats into off-estuary sloughs and off-channel wetlands in the Lower Klamath River beginning with the onset of the first fall freshets.

NOAA recognized this project as an opportunity to monitor the biological response to the off channel habitat restoration and expand the Tribes' existing monitoring program in the Lower Klamath tributaries. NOAA provided additional funds to install and monitor 6 Passive Integrated Transponder (PIT) tag antennas in each pond in order to develop population estimates, document non-natal rearing, investigate micro habitat usage, and record growth rates within each pond.

Aerial Photograph of Terwer Creek Pond Locations





This map of the Klamath Basin shows the location of tributaries where the Karuk Tribe and the Yurok Tribe have been PIT tagging juvenile coho that have been detected on the 2 Terwer off channel ponds.

Methods

Terwer Creek pond estimate, Mark/recapture Methods

We used a method for mark-recapture fish surveys in pond environments utilizing the Lincoln-Peterson population estimator to quantify the trends and changes in the populations of the selected species. There were two trapping events in the Lincoln-Peterson model; each trapping event was fished for a 24 hour period with a cycle of two to three days between trapping events. The 2 trapping events occurred on January 14, 2011 and March 10, 2011 and there will be at least one more trapping event occurring within each pond before the 2011 smolting season ends.

The initial trapping event is the marking phase, where all captured fish of interest (coho) were anesthetized with MS222 enumerated and identified by species, measured to fork length, weighed, scanned with an Allflex handheld scanner for detection of passive integrated transponder (PIT) tags, and marked with a fin clip. Marked fish are placed in holding pens to recover and then returned to the sampling area after they resumed a normal swimming pattern. Block nets, or up/down oriented fyke nets with block nets are established at both of the ponds entrance/exit channels to close the population of the survey reach for the duration of the cycle.

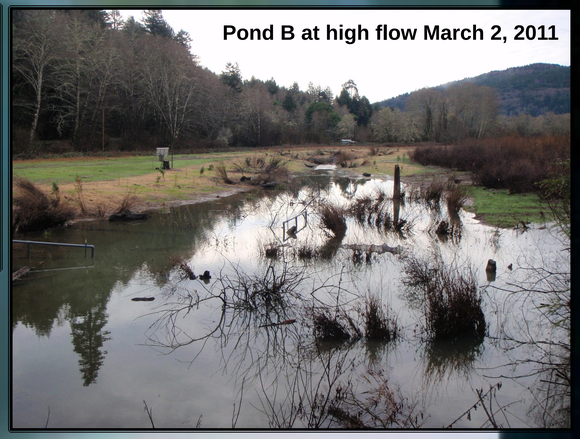
The second trapping event is the recapture event. Traps were deployed in the same areas as during the marking event. All target fish captured were anesthetized with MS222, enumerated, measured to fork length, weighed, scanned for a PIT tag, and checked for a fin clip. All fish captured with the appropriate mark from the marking cycle was recorded as a recapture. If no PIT tag was detected a 12mm, 134.2 kHz, Super Tag 2 PIT tag was applied. PIT tags where applied by making a small surgical incision to the underside of the fish, near the pelvic fin, using a stainless steel sterile surgical blade. Pit tags were sterilized in povidone/10% iodine hospital antiseptic solution before insertion into the body cavity of the fish. All PIT tags were scanned with the hand held scanner and recorded as a PIT tag mark. Fish that are sampled are placed in holding pens to recover and then returned to the sampling area after they resumed a normal swimming pattern.

Population estimates for coho were calculated using the mark-recapture data and the Bailey (1951) equation of the Lincoln-Peterson estimator. This mark-recapture method assumes:
Marked animals (those marked during the first trapping event) had time to mix into the population so that each marked individual has "equal catchablity" as any unmarked individual.
Marked and unmarked animals have an equal probability of being caught.

All marking must be done at the same time and the population size must remain the same between captures. The number of marked animals does not change between capture events (no loss of marks, no mortality of marked animals, and no migration of marked individuals).

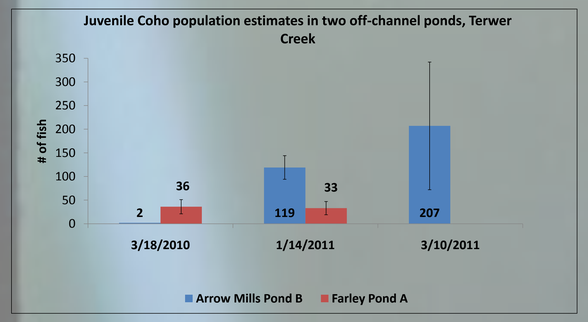
Pond A at high flow December 9, 2010 and PIT tag antennas

Coho juveniles captured in the Terwer ponds

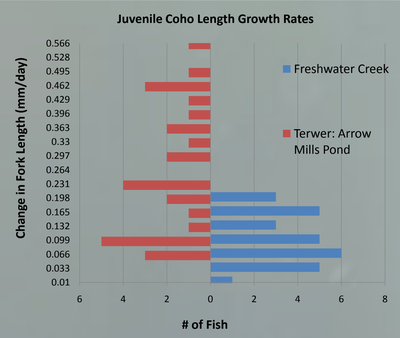


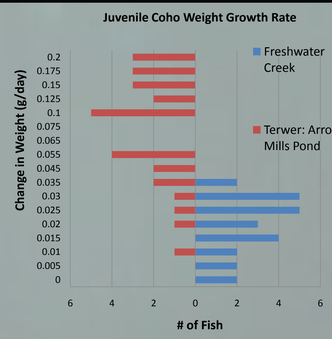
Pond B at high flow March 2, 2011

Terwer Population Estimates



Coho Juvenile Growth





Freshwater Creek Growth Data provided by Jenny Hauer (HSU masters student) and the Department of Fish and Game's Anadromous Fish Research And Monitoring Program measuring overwinter growth rates of 26 individually marked juvenile coho in headwater and tributary habitats at large for 70 to 124 days from September 20, 2010 through February 15, 2011. Growth rates in the Terwer Creek ponds were taken from fish that were at large in between population estimates for 34 to 99 days from December 1, 2010 through March 10, 2011.

Conclusion

Preliminary monitoring results indicate coho growth rates within the Terwer off channel ponds are greater than growth rates of coho juveniles within headwater streams of Freshwater Creek during the Winter /Springof 2010 and 2011. The Terwer and Freshwater comparison graphs show that the maximum amount of weight growth in the Terwer ponds is almost 6 times greater than the maximum amount of weight growth in the Freshwater Creek population. In addition, the maximum amount of length growth in the Terwer ponds is almost 3 times greater than the maximum amount of length growth in the Freshwater Creek population.

These data highlight the importance of slow water habitat and velocity refuge for coho during the winter months to ensure a viable size and condition before migrating to the ocean. Numerous studies show a positive correlation between salmonid marine survival and the size of the fish at ocean entry. Off channel habitats, such as the Terwer ponds, allow for coho to grow more rapidly than fish that overwinter in headwater/tributary streams lacking in velocity refugia.

The fact that these habitat types have been utilized by non natal fish that were reared over 125 miles away is a testament to how important velocity refuge is for coho and how it is lacking within the Klamath Basin. The NOAA Restoration Center and the Yurok Tribe should continue to identify appropriate areas within the Lower Klamath Basin to restore off channel winter rearing habitats for coho salmon.