Santa Rosa, CA

Coho Monitor

February 2010

Identification Tags Make Tracking Fish Movement Possible

For investors in stocks, good returns are essential to success. By carefully investing hard-earned funds in the right places at the right times and keeping an eye on market trends, investors can watch their portfolios grow, split and diversify, eventually seeing positive returns on their investments. Likewise, by carefully investing hatchery-reared fish in the right creeks at the right times and keeping an eye on environmental trends, broodstock programs can watch their "parr-tfolio" grow, smolt, and depart, hopefully seeing adult returns on their investments.

This is easier said than done, however. Instead of investing tens of thousands of dollars in the heavily-watched market, the Russian River Coho Salmon Captive Broodstock Program (Program) puts tens of thousands of young fish into habitat with high rearing potential so that later they can migrate to the ocean.

How do program partners keep track of all these fish, and how do we know if we've made a successful investment? There are a number of ways to monitor young coho as they grow up in Russian River tributary streams, as well as account for the adults that come back several years later. Through snorkel surveys, trapping, and electrofishing, we track the rearing juveniles and returning adults. These activities are, however, labor-intensive and potentially disruptive to the fish and their environment.

Two PIT tag antennas on Mill Creek are set up in series to estimate capture efficiency and determine which direction the fish is travelling.

A Coho's Journey: *a PIT tag reveals the life of a female Program coho*

- **5/16/07** - PIT tagged at Warm Springs Hatchery: 62mm, 3.2g.
- **6/6/07** - Released into the upper reaches of Palmer Creek.
- **9/26/07** - Captured during an electrofishing sample in upper Palmer: 75mm, 5.3g.
- **5/13/08** - Detected at PIT tag antenna at the mouth of Palmer.
- **5/17/08** - Detected at Mill Creek PIT tag antenna immediately upstream of smolt trap (2 km upstream of mouth).
- **5/17/08** - Captured in Mill Creek smolt trap: 100mm, 11.3g. Transported and released into Dry Creek due to mouth closure of Mill.
- **1/2/10** - Returned to Warm Springs Hatchery: 615mm, 2720g. Spawned with 4 jacks, one of which was also a returning program fish.

(25.14mm=1in, 1000g=2.2lbs)

As an alternative, our biologists are taking advantage of advances in technology, using tiny devices called Passive Integrated Transponders, or PIT tags. About the size of a grain of rice, these electronic battery-free tags are similar to the tags put into dogs and cats by veterinarians. When a tag passes by an antenna's electrical field, a transceiver detects and stores the unique PIT tag number and the time that the tagged fish passed through the field.

Prior to release, 4 to 5 month old program coho are weighed, measured, and receive tags at the Congressman Don Clausen Warm Springs Fish Hatchery. Spring-release salmon go out shortly thereafter, in June. In the fall, monitoring and hatchery personnel scan and re-measure the second release group of juvenile salmon just prior to their planting, recording changes in size and weight.

Throughout the year, biologists traverse program streams using hand-held antenna wands, similar to metal detectors, to tell us which fish have survived. In the spring, when the coho smolts head

out to the estuaries and ocean, they pass through fixed antennas spanning the creeks, which again record the PIT tag numbers (see photograph).

With the right conditions, a small percentage of the departing salmon will return as adults in two to three years. As they swim upstream to return to their spawning grounds, the same antennas will detect those fish with PIT tags, revealing their birth years and release streams. Using the ratio of tagged and untagged fish, we can make reasonable conclusions about the general population. Like stock market indices, these PIT-tagged salmon provide valuable information on the movements and survival of program fish, and let us know when we've made a successful investment.

Winter Activities in Full Swing

Winter is a critical time for coho salmon. Returning rains increase stream flows and provide access for adult coho to return to spawning streams. In efforts to document these returning fish, Program partners conduct spawner surveys and operate in-stream adult monitoring stations.

Spawner surveys:

With the onset of rains in November and December, field crews conduct spawner surveys of Program streams within the Russian River watershed, including Dutch Bill, Felta, Gilliam, Gray, Green Valley, Mill, Palmer, and Sheephouse Creeks. These surveys require monitoring crews to traverse miles of each stream weekly, searching for adult coho salmon and measuring and marking the locations of the redds (nests) they create for deposition and fertilization of their eggs. Crews also search for adult coho that have perished after spawning, which provides valuable information to the Program. PIT tags and coded wire tags collected from coho carcasses are used to determine the release stream from which they began their journey. In looking for coho adults, crews also verify if they are Program or wild fish. All Program coho salmon have the telltale clipped adipose fin, between the tail and the dorsal fin, while wild salmon have the adipose fin intact (see "Attention Anglers" for more on coho salmon identification).

Francis Hourigan checks the equipment during an early season spawner survey on Gray Creek.

The adult trap, with a resistance board weir, is able to ride out high flows and debris with minimal damage while providing a low-flow holding structure.

Adult monitoring with a resistance-board weir and trap:

Monitoring the return of coho salmon requires time, patience, and fish. Just as important, however, is durable equipment that stands up to winter storm conditions and provides safe refuge for studied fish. One option to catch adult salmon, as they move upstream, is with a fixed weir and trap. The weir, a grate-like structure spanning the creek, diverts large fish to a holding structure (trap box) in the water on the side of the stream. During the winter, however, the creeks running into the Russian River are often subject to flash flooding and highly variable changes in flow, sending large amounts of debris coursing downstream. While this debris increases habitat complexity and is beneficial to fish and the ecological stability of the stream, it can easily wipe out even the sturdiest of fixed weirs.

Fortunately, we can avoid the loss of equipment, time, and valuable information with a specialized resistance-board weir (see photograph). Instead of having a rigid design with a fixed height, this weir

A small coho jack which entered the holding box during the '08-'09 adult trapping season.

incorporates a PVC grate that moves up and down between two bulkheads. The grate is supported by a wall of perpendicular plywood boards as well as sealed PVC flotation tubes. As the volume of water passing through the weir increases, water pressure pushes the boards outward, which, along with the flotation tubes, drives the weir upward. The height of the weir is thus determined by the height of the creek. If a large log comes down the creek and hits the weir, the log will push the weir down and float past without damaging the weir.

When returning adult coho salmon swim into the trap, we measure length and girth, check for tags and apply a new, small, lanyard-like tag called a Floy tag. These tags go into the fish just below the dorsal fin, and embed in the muscle tissue in a similar fashion to the plastic t-tags that hold price tags on clothing. The exposed end of the tag has colored and numbered tubing, which we can see on spawning adults from shore during Spawner Surveys, and read on the spawned-out adults that have washed ashore.

Attention Anglers: "If the Mouth Has Black, Put It Back!"

As adult program coho return to the Russian River watershed to spawn, a new concern arises. Confusion occurs because of the fact that the Program coho have an adipose fin clip, much like hatchery steelhead which are legal to catch. Last year, this confusion came to the forefront when a local angler caught a female coho during a steelhead tournament, saw the adipose fin clip, and mistook the fish for a steelhead.

A campaign to inform local anglers of the returning coho, and how to distinguish them from steelhead, has recently been organized by Program partners. The campaign includes signage (see photograph below) at local fishing holes, posters and fish ID cards at tackle shops, and an education campaign through local media. The slogan for this campaign is, "If the mouth has black, put it back", which refers to the distinctive coloration of coho and Chinook salmon mouths. Steelhead mouths' are completely white, coho have a black mouth with a white gum line, and Chinook mouths' are completely black.

Not only is it important for anglers to be aware that endangered coho are returning, but also for landowners and creek visitors. Should you see a spawning salmon please do the following:

1) Avoid disturbing their activities
2) Make note of the location
3) Contact the UCCE coho monitoring team who can determine if they are program fish by calling 707-565-2621.

The new signage at Steelhead Beach in Forestville displays pictures and information in both English and Spanish.

Great Ocean Conditions Make for Hopeful Returns

Based on data from ocean conditions and adult returns over the past 40 years, oceanographers at the University of Washington's Climate Impacts Group have developed a model to predict marine survival rates for adult coho salmon. This model takes into account a number of environmental conditions that affect cohos' ability to thrive in the ocean.

Environmental markers that indicate strong coastal upwelling, and are correlated with high survival include: favorable winter conditions prior to outmigration and during the first winter at sea; cold ocean surface temperatures; appropriately-timed shifts in predominant alongshore winds; and low average sea level. Winter conditions must be right for outmigrating smolts to find appropriate habitat on their arrival, and for wintering adults to find enough food and avoid excessive predation. During the summer, infrequent storms mean that warmer surface waters don't mix with colder deep-sea waters, forming stratified thermal layers. Favorable winter conditions thus include frequent storms that churn up the water column, reducing thermal stratification. Colder sea surface temperatures indicate reduced thermal stratification, which, in combination with the right changes in alongshore winds, allows deep-sea coastal upwelling to bring nutrient-rich water to the surface and boost food web productivity. Sea surface temperatures serve as a proxy for strong upwelling and coastal currents.

Fortunately for the coho salmon, conditions have been much better this year than in past years. Spring sea surface temperatures over the past two winters have been among the lowest recorded in recent history, the timing of the shift in winds has been about average, and sea levels have been low. The model created by the Climate Impacts Group is thus predicting a good return for coho this year, with anticipated percent survival higher than for any return in the last 40 years. Of course, the actual number of fish to swim back upstream will be lower than historical returns for this endangered species, but a high rate of return is promising for future generations.

For more information, visit the Climate Impacts Group website at http://cses.washington.edu/cig/fpt/orcohofc.shtml.

Creative Breeding Strategies and Russian River Coho Survival

The Program strategy to increase coho abundance in the watershed is to spawn and release hatchery reared juveniles into Russian River tributaries and monitor their survival. The original broodstock of wild juvenile coho, reared in the security of the Congressman Don Clausen Warm Springs Fish Hatchery at Lake Sonoma, were collected primarily from Green Valley and Dutch Bill Creeks from 2001-2003. The first offspring from the Program were released in the fall of 2004. Since then, the number of wild coho encountered drastically declined, resulting in the use of captive fish as broodstock.

Hatchery biologists and geneticists determined that these low numbers of founding individuals in the Russian River meant that there was low genetic diversity among the source population. To counter this, during the winter of 2008-2009, the Hatchery team began outbreeding the Russian River coho broodstock with fish from a neighboring stream population to increase the genetic diversity. The broodstock used for outbreeding were captured from Olema Creek, which is part of the Lagunitas Watershed in Marin County, less than 100 miles south of the Russian River Watershed. The Lagunitas/Olema Creek population is

Hatchery staff use an ultrasound to check the development of a female coho's ovaries and eggs in preparation for spawning.

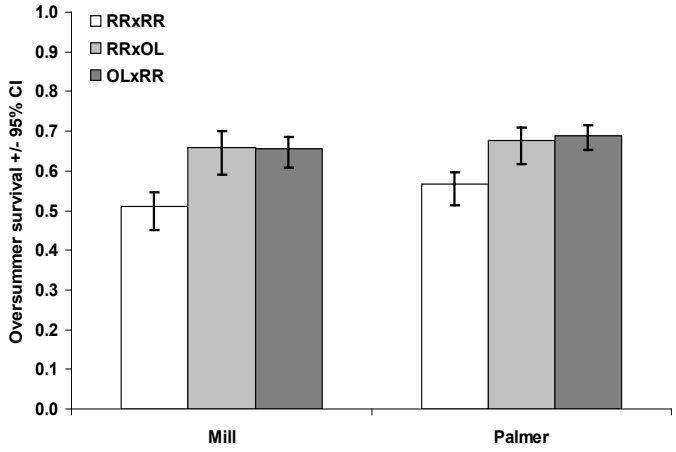


Figure 1: Oversummer survival of the three cross types stocked in Mill and Palmer Creeks: Russian x Russian, Russian x Olema, and Olema x Russian

among the last remaining wild runs of coho salmon in the Central California Coast ESU (Evolutionary Significant Unit).

Hatchery crews use a spawning matrix, provided by NOAA Fisheries geneticists, to preserve the integrity of the Russian River genetics while introducing desired diversity from the Olema Creek population. Approximately twenty-five percent of the 2008-09 offspring were from Russian River and Olema Creek crosses, with the majority coming from Russian River by Russian River spawning pairs. As a general practice, each female coho is spawned with four males. Olema Creek females were spawned with only Russian River males (OLxRR). Russian River females used for outbreeding were spawned with two Olema Creek males (RRxOL) and two Russian River males (RRxRR).

Offspring from each discrete spawning pair is kept in isolation for purposes of fish health and also to document early life-stage survival of the different lineages. Hatchery biologists have documented that, from the eyed-egg to hatch to swim-up stages, offspring of Olema Creek females had significantly higher early life-stage survival rates than Russian River female offspring. They also found that offspring of Olema Creek females had lower deformity rates. Once fish are released to program streams, monitoring team biologists use the individual identification provided by PIT tags (see "Identification Tags Make Tracking Fish Movement Possible") to continue the evaluation of the respective genetic groups. Results from in-stream evaluation indicate that juvenile over-summer survival of Russian River by Olema Creek cross-types is higher than pure Russian River cross-types (see Figure 1). These results point to the importance of genetic diversity in the survival of young coho and the beneficial role outbreeding can have to increase the success of coho recovery efforts.

Current Survival Rates are Encouraging

Since the inception of the Program, the question of suitable habitat has been a concern. Can current creek conditions sustain coho through the summer with months of no rain or the high flows of winter with few places to seek refuge? Can the goal of restoring a self-sustaining run be realized? After five years of monitoring coho in the creeks, there is hope that this goal can be reached.

Monitoring teams conduct year-round in-stream monitoring of released and wild coho to develop estimates of their over-summer and over-winter survival. These survival estimates are critical for understanding the seasonal, year-round, and long-term habitat suitability as it relates to the sustainability of future salmon runs.

Instream over-summer survival rates for the past four years have varied among streams and years, with the most consistently high rates in Palmer Creek, averaging approximately fifty percent even in years with low flows (2007-2009) (see Figure 2). Not surprisingly, over-summer survival has been highest in stream reaches with higher summer flows, cooler temperatures, pool habitat with woody debris, and dense canopy cover. This higher quality coho habitat is usually found in the upper reaches of the Program streams, often where habitat restoration projects have been completed. In contrast, during the low flow

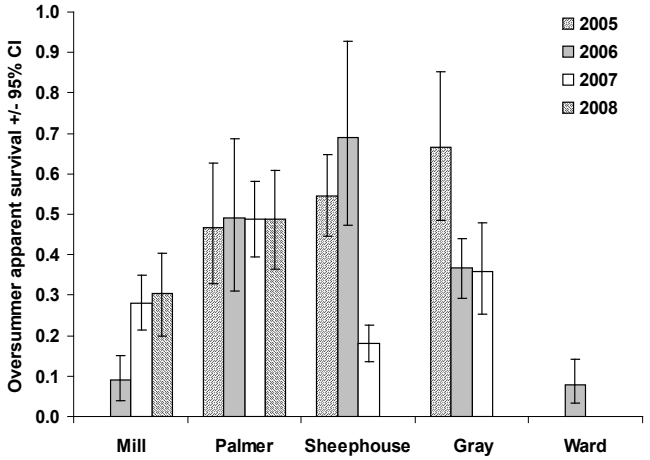


Figure 2: Oversummer survival for each creek from 2005 to 2008

years of 2007-2009, much of the lower reaches of the Program streams dried up or became otherwise uninhabitable because of high temperatures and low oxygen levels. Improving these stream reaches will be essential to the recovery of coho populations in the Russian River.

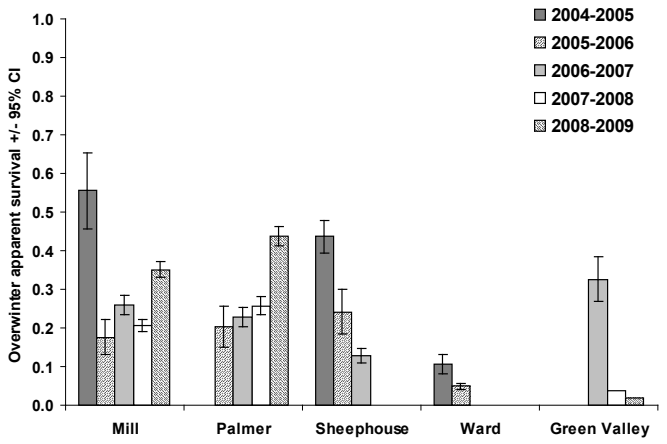


Figure 3: Overwinter survival for each creek from 2004 to 2009

The monitoring program has also found that over-winter survival varies by stream and year (see Figure 3). There are a number of factors that influence overwinter survival including amount and duration of precipitation, fish size, predation, stream gradient, and overwinter habitat (instream structure and backwater refugia). While over-winter survival rates have varied, in almost all years in all streams, they have fallen within the range found in wild coho populations north and south of the Russian River watershed. While the recovery of self-sustaining runs of coho will still require significant improvements in habitat quality, the encouraging news is that Program streams are capable of providing rearing areas for juvenile coho. As the Program grows, more and more smolts are leaving the tributaries each spring, with a record estimate of 17,978 coho smolts leaving monitored Program tributaries in 2009 (see Table 1).

Table 1. Estimated number of smolts leaving monitored tributaries each year.

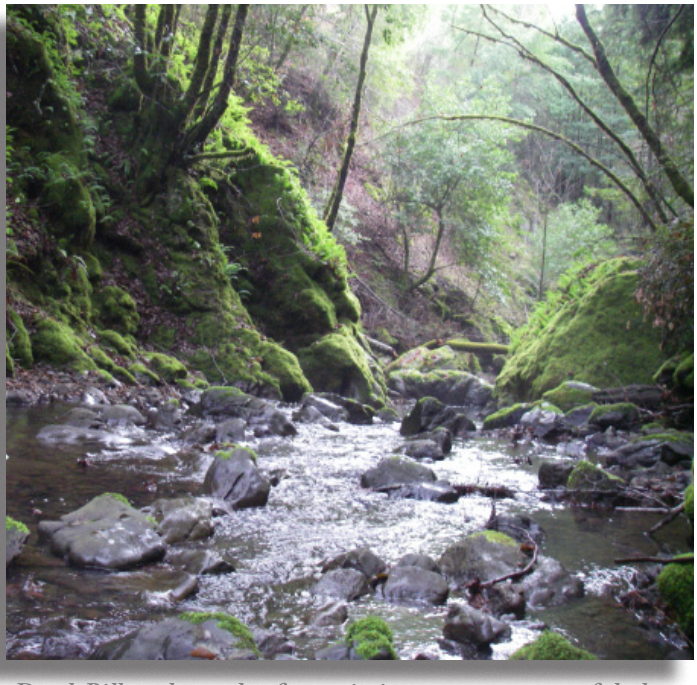
Smolt Year	Number of smolts +/- 95% CI
2005	2,512 +/- 424
2006	1,804 +/- 437
2007	4,791 +/- 600
2008	6,031 +/- 500
2009	17,978 +/- 1,813

Russian River Coho Water Resources Partnership

In response to the precipitous decline of coho salmon in the Russian River watershed, the Russian River Coho Water Resources Partnership (Partnership) has received funding from the National Fish and Wildlife Foundation to develop a systematic approach to improve streamflow and water supply reliability in five Russian River tributaries critical to the recovery of endangered coho salmon. The multi-disciplinary Partnership includes the Center for Ecosystem Management and Restoration, Gold Ridge Resource Conservation District, Occidental Arts and Ecology Center WATER Institute, Sotoyome Resource Conservation District, Trout Unlimited, University of California Research and Extension Center Hopland GIS Lab and UC Cooperative Extension.

Initial efforts will focus in five first-priority streams -- Dutch Bill, Grape, Green Valley, Mark West and Mill Creeks. The Partners will work with landowners to develop a science-based approach to identify the areas that have the greatest opportunity for implementing alternative water management strategies and to identify, study, permit, and finance solutions that improve conditions identified as limiting recovery of coho salmon. "Over 95% of the target watersheds are held in private ownership, and the guiding principal of this project is that water for both human uses and coho salmon can be secured through careful planning and water supply management" said Kara Heckert, Executive Director of the Sotoyome

Juvenile coho after being stocked into Mill Creek, a first-priority stream, and seen during over-summer survival estimate dive counts.



Dutch Bill creek, another first-priority stream, was one of the last creeks to sustain a returning population of coho.

Resources Conservation District.

Just as the Mediterranean climate of the Russian River watershed can place pressures during the dry season, it can provide opportunities to ameliorate those pressures during the rainy winter. Using a suite of tools ranging from innovative conservation strategies to increased storage opportunities for use during critical flow periods, the multi-disciplinary team of the Partnership is committed to working with landowners and water users to address complex issues related to salmonid recovery and provide well-developed, long-term solutions for communities and the environment. The long-term goals of the Partnership are to 1) restore a more natural flow regime for spring, summer and fall; 2) increase viability, and ultimately numbers of coho salmon in the Russian River watershed; 3) increase water reliability for water users in each watershed; 4) develop governance mechanisms to carry out these efforts; and 5) develop a template for others to follow.

To meet the needs of the landowners, the regulatory agencies, and the resources, a science-based approach is being employed to identify the areas that have the greatest opportunity for implementing alternative water management strategies and work with those landowners to identify and incentivize solutions that improve streamflow. The first year of the program will be focused on collecting information to lay a scientific foundation to develop streamflow and water use management plans for each watershed and working with the landowners and water users to identify tools and solutions to improve water reliability and flows. Projects identified for implementation in future years of the program will range from water storage such as residential roof catchment systems to agricultural reservoirs, and agricultural conservation practices that may include alternatives to frost protection and summer irrigation such as micro-sprinklers and fans.

For more information, please visit www.cohopartnership.org or contact your local Resource Conservation District; for Dutch Bill and Green Valley Creeks contact John Green, 874-2097, john@goldridgercd.org and for Mark West, Mill and Grape Creeks, contact Sierra Cantor, 569-1448 x107, scantor@sotoyomercd.org.

The Sotoyome RCD will be holding a Mill Creek watershed planning meeting, which will highlight the Partnership's efforts on February 27 from 10:00-12:00 at the Felta School. Please visit www.sotoyomercd.org or contact Sierra Cantor for more information.

- **Find out more about RRCSCBP, including Annual Reports at:** http://groups.ucanr.org/RRCSCBP/
- **Learn about the Russian River Coho Water Resources Partnership at:** www.sotoyomercd.org
- **Check out the KQED Quest video, "California's Lost Salmon" which features the RRCSCBP's efforts to restore ecosystem health by stocking Russian River creeks with hatchery-reared fish:** http://www.kqed.org/quest/television/californias-lost-salmon
- **Watch the Angler Outreach Program press release:** http://www.scwa.ca.gov/

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Watershed Planning Meeting held by Sotoyome RCD on Feb. 27, 10-12 at the Felta School. See page 7 for more info!

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Editors' Note

Welcome to the 2010 issue of the Coho Monitor. The Russian River Coho Salmon Captive Broodstock Program is possible because of its partnership and the contributions that each member makes. This is particularly true for the cooperation and participation of private landowners within the Russian River and its tributaries, where young coho are being released and monitored. Program partners have completed the fifth year of releases and winter and summer survival monitoring and are happy to share with you the improvements and gains the Program is making. We are learning even more about the habitat use of released fish through tagging technologies to identify and track movements of individual fish. Measured introduction of Olema Creek fish into the breeding program has lead to increases in early life-stage survival of program offspring. Measurements and models of ocean conditions documented strong upwelling and colder ocean surface temperatures during the last year, with anticipated increased ocean survival for salmon. Join us in reading about these developments and the promise they hold for recovering coho in the Russian River watershed.

In This Issue

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