Salmonid Restoration Federation's

27th Salmonid Restoration Conference

Elements of Watershed Restoration

March 4-7, 2009
Santa Cruz, CA

Co-Sponsors:

Alnus Ecological; American Fisheries Society Cal Neva Chapter; Americorps Watershed Stewards Project; Balance Hydrologics, Inc.; The Bay Institute; Big Creek Lumber Company; Bureau of Reclamation, Cal Trans; Central CA Area Office; California Conservation Corps; California Department Fish & Game; Cal Trout; California Hydropower Reform Coalition; City of Santa Cruz-Water Department; Coastal Conservancy; Coastal Watershed Council; County of Santa Cruz Environmental Health Services; County of Santa Cruz Fish and Game Advisory Commission; Department of Water Resources; D.W. Alley & Associates; East Bay Municipal Utility District; East Bay Regional Park District; Entrix; Fall Creek Engineering; Greening Associates; Guadalupe-Coyote RCD; HNTB; Kittleson Environmental Consulting Services; Marin County Public Works Department; Marin Municipal Water District; Marin Stormwater Pollution Prevention; McBain and Trush; Michael Love & Associates; NOAA Restoration Center; Northern California / Nevada Council Federation of Flyfishers; Pacific Coast Fish, Wildlife and Wetlands Restoration Association; Pacific Watershed Associates; Pacific Gas & Electric; Pacific States Marine Fisheries Commission; Philip Williams and Associates, Ltd.; Prunuske Chatham, Inc.; Restoration Design Group; San Francisco Estuary Institute; San Gregorio Environmental Resource Center; San Lorenzo Water District; Santa Clara Valley Water District; Santa Cruz Fly Fishermen; Santa Cruz Group of the Ventana Chapter of Sierra Club; Santa Cruz Resource Conservation District; Solano County Water Agency; Sonoma County Water Agency; Stillwater Sciences; Stoecker Ecological Consultants; Trees Foundation; Trout Unlimited; US Fish & Wildlife Service; U.S. Geological Survey; Winzler and Kelly

Welcome to the 27th Annual Salmonid Restoration Conference

"Elements of Watershed Restoration," since the conference will address environmental elements that affect salmonid recovery including fire ecology, global warming, hydrology and geomorphic response, as well as social and political issues that affect the restoration field.

In this era of climate change, a state budget crisis that has paralyzed the restoration field, and diminishing salmon returns, it is more important than ever for restorationists to gather together to share techniques, strategies and methodologies to restore habitat and recover wild salmon populations.

A generation ago, restoration pioneers created this salmonid restoration conference to serve the needs of the fisheries and restoration community. Each year hundreds of fishheads migrate to participate in this premier salmon restoration conference where leaders, on-the-ground and in-the-creek restorationists, and watershed stewards spawn innovative ideas about how to save salmon, steelhead, and trout.

The production and coordination of the annual conference is a fluid, dynamic process that engages Salmonid Restoration Federation's diverse Board of Directors, staff and co-sponsors who represent restorationists, fisheries biologists, educators, advocates, tribal members, and agency personnel from the Pacific Northwest, all dedicated to habitat restoration and recovery of salmonids.

Creating the conference agenda and events is a collaborative effort that involves dozens of people and the support of our co-sponsors. I would like to thank all of the presenters, session, field tour, and workshop coordinators for helping to craft an impressive agenda. Thank you to all of our co-sponsors for your time, ideas, donations, and your invaluable contribution to help make this salmonid restoration conference a reality.

SRF is excited to be hosting the conference in Santa Cruz, where there is a long history of restoration efforts to address legacy impacts of logging, development, and rapid population growth. The Santa Cruz region also contains a host of worthwhile projects and watersheds to visit and to learn about collaborative restoration efforts.

SRF will also be offering a host of other technical education trainings in 2009 including the 4th Annual Spring-run Salmon Symposium on the Salmon River, the 12th Annual Coho Confab on the Mendocino Coast, a Bioengineering Field School on the Central Coast, and a Roads Maintenance and Erosion Control field school on the North Coast.

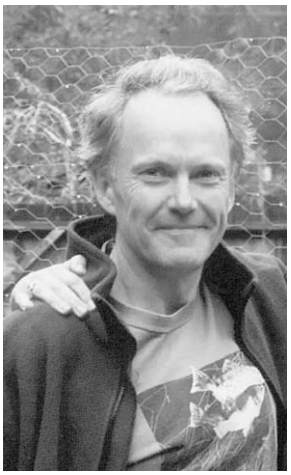
Please join us in our efforts to enhance the art and science of restoration and ultimately restore wild salmon populations.

In the spirit of Celebrating Salmonid Recovery,

Dana Stolzman

Agenda Coordinator
Executive Director
Salmonid Restoration Federation

Elements of Watershed Restoration



By Don Allan, SRF Board President

As SRF prepares for its 27th annual salmonid restoration conference, the restoration community is feeling the effects of the financial woes that are spreading through the world faster than a flu virus. As our funding sources have grown and become more diversified, we have seen the emergence of a restoration "industry." Yet, as Dr. Mark Baker of Humboldt State University illustrated in his study of the economic impacts of watershed restoration in Humboldt County, restoration funding has created what might be considered an "industry cluster." Thousands of jobs state wide have been created through voter-approved bonds in support of watershed restoration. Many watershed groups have emerged and become focal points within their communities—providing jobs to everyone from planners and engineers to heavy equipment operators and materials suppliers. The multiplier effect of dollars circulating through our local economies helps support our communities in ways that we don't see and often don't think about—generating sales and income tax that support local governments; paying permit fees for regulatory agency review that support staff positions within local and state agencies. So, from a purely economic point of view, restorationists, with the support of our legislators and voters, have created an "industry" dedicated to reversing the damage done by more traditional industry and development in general. And, just like many traditional industries, we are vulnerable to the fluctuations in the world's financial markets.

While there are economic benefits associated with our industry, we can't overlook the intangible benefits of salmon restoration—giving people meaningful employment in economically depressed rural areas; bringing communities together to discuss common problems and issues; creating a sense of environmental stewardship through our education and outreach efforts. On the more tangible side, we have seen the benefits of our "industry" through salmon and steelhead returning to habitat that has been unavailable for decades as we replace barrier culverts, and we've seen juvenile salmon using the habitat created by restored channels and placed woody debris. We see roads producing less sediment as abandoned roads are decomissioned and poorly designed and maintained roads are upgraded and storm-proofed. I know I am preaching to the choir, but we need to keep in mind the successes we have had as we face the threat of program cuts and reduced funding, so we, as a federation of restorationists, are prepared to fight to retain programs like the California Conservation Corps and habitat restoration funding.

As we forge ahead into 2009, the restoration community finds itself inextricably tied to State bond funding and, as we are learning, that bond funding is subject to the effects of the State's budget crisis. In this information age most of us are painfully aware of how the State's economy is linked to the economic crisis that is spreading throughout the world. The old adage, "think globally, act locally," has taken on a new meaning, only in a reverse kind of a way. Global events trickle down to affect us in our every day lives. It would be easy to fall into a state of despair as we read the news, but if there is anyone who has remained upbeat and positive in the face of overwhelming challenges, it's the restoration community. Think of how many times you have seen a presentation at an SRF conference where a watershed group faced seemingly insurmountable challenges, only to band together in the face of adversity to make a last stand to save their watershed or the last run of native fish.

So let's look on the positive side. The new federal government is acting swiftly to stimulate the economy, and some of the economic stimulus package will flow into habitat restoration. The Obama administration will be directing more funding toward alternative energy sources and reducing greenhouse gas production, and as we are all learning, global warming is as big a threat to salmon as habitat destruction. Some of the federal economic stimulus package will go to states to help them with their financial problems, and as federal dollars flow to the states we will see funding restored to restoration projects so we can get back to work.

As we gather for our 27th conference, I like to think of an old Mamas and Papas song, and the line "the darkest hour is just before dawn." We are definitely in a dark hour, but light is just over the horizon. So let's celebrate our successes, learn from our mistakes, and share what we have learned. Let's take the elements of watershed restoration back to our home watersheds and apply them as we continue our quest to recover salmonid populations and watershed health.

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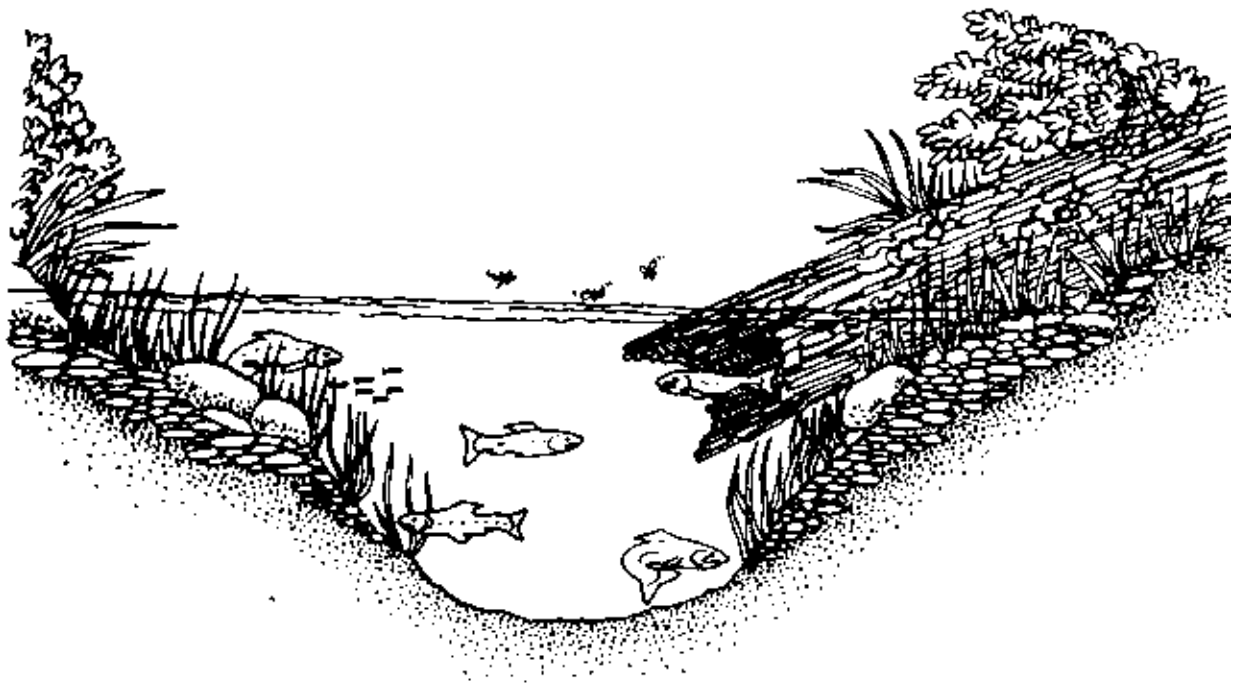

Wednesday, March 4

Workshop Coordinators*: Gillian O'Doherty and Leah Mahan, NOAA Fisheries*

There has been a recent increase in interest in restoring estuarine environments as part of salmonid recovery in California but the limited amount of data on salmonid use of estuarine environments and estuarine ecology in general poses a challenge to restoration practitioners. Estuaries are complex and dynamic systems that are particularly vulnerable to human impacts and that provide ecosystem services to a very wide range of species, many protected by law or of cultural importance. They are also areas that are heavily used by people and physical alterations are often controversial and expensive.

This workshop focuses on methods of assessing California estuarine ecosystems with the goal of identifying and designing restoration opportunities that will benefit salmonids and improve overall ecological functioning. Topics to be covered include methods for assessment of physical, chemical and biological functions, design considerations, monitoring and adaptive management, permitting and funding considerations and public outreach and education.

Pescadero Marsh Restoration: Identifying Problems and Exploring Solutions

Jill Marshall, P.G., *Engineering Geologist, San Francisco Bay Regional Water Quality Control Board and* ***Joanne Kerbavaz,*** *Senior Environmental Scientist, California State Parks*

Pescadero Marsh, an approximately 340 acre (138 hectares) coastal wetland in San Mateo County, provides habitat for a wide variety of wetland and estuarine species, including anadromous fish. The marsh, with its bottom-of-the-watershed location, is an integrator of watershed and local scale changes over time. Historical impacts, common to many Central Coast estuaries, include conversion of marshland to agriculture, channel realignment, and changes in both flow patterns and sediment fluxes. For over 20 years, scientists and resource managers have used their understanding of historic patterns and desired conditions to restore and manage Marsh acreage and function.

Pescadero Marsh forms a seasonal lagoon that typically breaches after winter storms. For eight of the last 12 years, when the lagoon opens, there has been a die-off of fish and invertebrates, including steelhead trout (*Oncorhynchus mykiss*). In response to the die-offs, coupled with the Marsh's high ecosystem value, the California Coastal Conservancy helped create the Pescadero Marsh Working Group, a group of agency representatives tasked with utilizing collaborative science-based planning to explore problems and recommend solutions.

The naturally dynamic nature of coastal lagoon systems, such as Pescadero Marsh, combined with multiple anthropogenic changes, makes it difficult to identify appropriate actions to restore the marsh. Despite over twenty years of studies (on individual species, historical changes to marsh bathymetry and habitat units, pre-restoration designs, post-restoration analysis, and marsh water quality), critical uncertainties remain on the individual and cumulative impacts of change in sediment supply, in-marsh modifications and upstream influences. In December 2008, Pescadero Marsh Working Group convened a group of researchers and restoration practitioners to discuss the resources, processes, and functions of the Marsh. The purpose of this one-day forum was to assist the Pescadero Marsh Working Group to establish a shared conceptual model, and recommended restoration goals and objectives for Pescadero Marsh.

We will present the results of this forum, with a discussion of the issues raised, and the challenges to restoration. These issues and challenges will be relevant to restoration projects throughout the region.

Estuary Enhancement in the Humboldt Bay Watershed —Can Adaptive Management Reduce Design and Permitting Costs?

Don Allan, *Co-Director, Natural Resources Services Division, Redwood Community Action Agency*

The focus of fisheries restoration on the North Coast of California has been an exercise in adaptive management. In the 1980s restoration funding was narrowly focused on the stream and its riparian corridor. In the 1990s legislation was passed to provide funding to a much broader range of projects, including planning projects to complete watershed assessments to identify key watershed issues and develop restoration approaches based on these issues. Funding went to studying erosion and sediment production in upper watersheds, identifying and fixing fish barriers, restoring floodplain, riparian, and instream habitats. More recently a lot of attention has been focused on the estuary portion of the watershed. Fish sampling conducted by the California Department of Fish and Game to identify fish abundance and usage has provided important information about distribution of coho salmon as well as other salmonids in the lower stream reaches and former estuaries on the fringes of Humboldt Bay.

Estuaries are essential components of salmon habitat that serve several important purposes. A key estuary function for salmon is the osmotic regulation that anadromous fish undergo in the estuary as they transition from freshwater to saline water and vice versa. Estuaries are also highly productive environments where juvenile salmonids can spend the summer putting on size, which translates to increased ocean survival.

In the late nineteenth and early twentieth centuries, estuaries were diked, drained, and tide gates were installed to keep out the salt water. The salt and brackish marsh were converted for grazing and the first and second order slough channels were filled in. Over 90% of the tidal marshes around Humboldt Bay were converted to other uses.

There are currently at least seven projects around Humboldt Bay that are in various stages of design, permitting, or implementation. The Natural Resources Services division of the Redwood Community Action Agency is involved with four of those projects, two of which are designed and permitted, and two of which are in the design/ permit phase. These projects range from relatively small projects such as the Wood Creek Estuary Enhancement Project to the Martin Slough Enhancement Project. As the projects increase in size, the complexity of design, complying with CEQA, permitting, and implementation efforts also increase.

This talk will be a discussion of several design and permitting issues that have arisen during the development of these enhancement projects. Specifically—how much should we invest in pre-project modeling and analysis? Can an adaptive management approach be used to reduce the investment in data collection and modeling, and put that money into implementation, performance monitoring, and adaptive management? How do you mitigate for loss of agricultural land and placing fill in a wetland?

Lessons from Pescadero: Assessing Restoration in a Central California Coast Lagoon

Rebecca Sloan, *Associate Biologist, TRA Environmental Sciences, Inc.*

In the early 1990s the Pescadero Marsh restoration project was implemented to relieve upstream flooding, restore the tidal prism, and maximize aquatic habitat quality for rare species. Thirteen years later, Pescadero Lagoon suffers from chronic bottom water anoxia during sand barrier formation, fish kills upon breaching (with *Oncorhynchus mykiss* mortality), and low-tide hypoxia in the days following tidal reconnection. The anoxic and hypoxic conditions are caused by stored chemical and biological oxygen demand in backwater channels. Oxygen demand is primarily controlled by eutrophication and density stratification; however, the relative contribution of each is poorly understood. I will use five years of water quality data to evaluate the contributions of eutrophication and stratification to poor water quality; illustrate how lagoon morphology exacerbates and/or controls eutrophic and stratified conditions; and broadly discuss restoration implications for West Coast lagoons.

Assessment of Hydrologic and Geomorphic Constraints on Estuarine Restoration

Conor Shea, *U.S. Fish and Wildlife Service, Conservation Partnerships Program*

Successful estuarine restoration projects require assessment of site potential and of site constraints in combination with developing clearly defined restoration objectives. Hydrologic and geomorphic assessments are used to identify the range of physical possibilities for enhancing or restoring an estuarine system. Equally important, is identifying natural and anthropogenic constraints that might limit restoration options or potential. Successful site assessments help develop an understanding of the physical and biological processes that are responsible for creating and maintaining existing conditions. Using assessment results, project proponents should cleary identify feasible objectives for developing estuarine restoration projects that are consistent with site potential and site constraints.

This presentation will discuss methods for assessing site hydrology and geomorphology with a focus on developing an understanding of the range of possible outcomes, and how to use this information to develop project objectives. Methods to be discussed include assessing site hydrology, identifying hydraulic controls, interpreting landscape features, and understanding the interrelationships between hydrology, geomorphology, and biological response.

The Susceptibility of California Coastal Lagoons to Eutrophication

Nicole Beck, Ph.D., 2nd NATURE, LLC

In many coastal California lagoons the primary impairment limiting lagoon condition is eutrophication. The susceptibility of California Coastal lagoons to eutrophication is influenced by the availability of the limiting nutrient in the system, typically nitrogen. The relative availability of N is significantly influenced by water temperature, light availability, and the relative nutrient loading rates. The physical, chemical and biological characteristics of specific coastal lagoon configurations can increase water temperatures and light availability during critical summer sand bar closure conditions. Borrowing from a multitude of data collection and analyses efforts from Central California lagoons, a collection of reliable metrics are recommended to evaluate lagoon condition, i.e. the relative susceptibility of the lagoon to eutrophication. The recommended metrics are based on quantitative information about the biogeochemical function of coastal lagoons and can focus the identification of clear enhancement opportunities for specific lagoons. The link between process and existing conditions can lead to clear, quantifiable goals, metrics and targets for enhancement actions, which also facilitate the quantitative measure of post-enhancement performance. While long-term watershed nutrient source control efforts should be a priority to improve coastal lagoon condition, a number of enhancement opportunities exist to reduce the susceptibility of a coastal lagoon to summer eutrophic conditions by modifying characteristics that link directly to the measurable metrics that are expected to respond in a predictable manner to successful enhancement efforts. Decisions to modify existing lagoon conditions and continue improvements through adaptive management will then be based upon measurable parameters that have a documented physical, chemical or biological functional relationship to the broader project goals, rather than the implementation of enhancement actions that rely on qualitative opinions of priority actions.

Today 2NDNATURE (*www.2ndnaturellc.com*) assists resource managers in design, implementing and evaluating effective ecological enhancement strategies throughout California. 2NDNATURE strives to link science with policy and provide resource agencies with valid and cost-effective tools to improve, define and track the relative condition of the natural aquatic systems.

Restoration in a Restless Society —Working with Stakeholder Groups in Coastal California

Brannon Ketcham, *Hydrologist, Point Reyes National Seashore*

The last two decades have brought increased interest in the protection and direct restoration of watershed and ecosystem processes. At the state and federal levels, there is an interest in working with and through stakeholder based groups to address identified issues at the watershed scale. In the central California coast, there are a large number of examples of stakeholder based approaches to protection and restoration activities. Approaches that have been tried, and have worked, in this area are as unique as the watershed itself. Under any scenario, it is important that all stakeholders are committed to a long-term process, and that process must be receptive to all sides of the issue.

What is common to all of them is a genuine energy and interest on the part of the stakeholders to remain committed. A number of examples will be used to contrast how different watersheds have approached this common problem. Generally, where a common vision amongst all of the stakeholders exists, progress can be made. Active stakeholder groups and councils have been successful across the state with the assistance of competitive grants, typically through state bond measures. Identifying realistic timelines and achievable goals, and recognizing success as it occurs, are important to sustaining these collaborative approaches in the long term. Emphasis will be placed on those approaches that have worked successfully.

Hang Fin! Sustainable Agriculture and Salmonids in Surf City, U.S.A. Workshop & Tour

Workshop & Tour Coordinator: ***Kent Reeves,*** *Yolo County Department of Parks & Natural Resources*

The classroom portion of the workshop will address the challenges of sustainable agriculture with an emphasis on water quality and riparian habitat restoration in the Monterey Bay Area. Following the morning classroom session we will visit two farms and a ranch where riparian restoration, Integrated Pest Management, hedgerow planting for insectaries and sustainable grazing practices will be viewed and discussed. The day will end at a local winery with wine tasting from area vineyards that are implementing land management that benefits fish and wildlife.

Water Quality and Riparian Habitat Improvement Using Conservation Grazing in Central Coastal California

Kent Reeves (Presenter), *Yolo County Parks & Resources Department,* ***Joseph Morris,*** *T.O. Cattle Company, and* ***David Amme,*** *East Bay Regional Park District*

The T.O. Cattle Company (TOCC) has been practicing conservation grazing to restore native grasses in Central Coastal California since 1993. Conservation grazing is the planned management of livestock to mimic natural disturbance of native ungulates on the landscape. Three species of native ungulates historically (1700-1900) occurred throughout the grassland/savanna region of California and exerted critical influences on ecosystem dynamics. Tule elk, pronghorn, and mule/black-tailed deer populations have changed dramatically, contributing to negative changes in ecosystem processes. TOCC implemented conservation grazing to mimic historic disturbance regimes of native ungulates. This includes amalgamation of livestock, their rapid movement timed to prevent overgrazing, and changing livestock behavior with dogs, herding, and temporary fences to mimic wild ungulates in the presence of predators. Results from monitoring transects include: increased numbers, age diversity, and vigor of native grasses and oaks; increased vegetative cover of streambanks; recruitment of riparian plants; wetland expansion; improved water quality; rapid breakdown of dung; and longer grassland growing season. In 1998 the stocking rate and stock density were increased to accelerate positive changes in ecosystem processes. In 1998 grasses were 40.0 % of perennial plant types and average distance from transect line to perennial species was 4.8 meters. In 1999 41.5% of perennial plant types were grasses with an average distance from transect line to perennial species of 4.4 meters. In 2000 grasses were 49.75% of perennial plant types with an average distance of 3.5 meters between plants. Perennial grass density increased overall with a decrease in spacing between plants. Creeping wildrye, *Leymus triticoides*, saltgrass, *Distichlis spicata,* and purple needlegrass, *Nasella pulchra,* were the most common grasses that increased in density and percentage of perennial species.

Making the Case for Conservation-Based Agriculture

Jo Ann Baumgartner (Presenter), Wild Farm Alliance and Dan Imhoff, Watershed Media

With agriculture's dominant footprint on the landscape, it has a unique ability to support wild nature. As more farmers become familiar with the many regulations in place to protect our water, soil, native species and ecosystems, and as conservation funds increase, changes are happening on the ground. Both organic and conventional agriculture are profiting from and providing for biodiversity conservation. The federal organic rule, which affects over 2.3 million acres, requires biodiversity conservation on the farm. A continuum of easy to more-involved farm practices, such as timing farming practices, controlling invasive species, managing water needs, and protecting and restoring habitats, are being installed by organic farmers to meet the rule. California's mandate for good water quality leaving the farm is also translating into a spectrum of practices from the use of native grasses in ditches, to the planting of structurally diverse habitat along ponds, creeks, and rivers.

Since 1985, Farm Bill conservation dollars have been flowing into agriculture, benefiting at first waterfowl, and later wetlands, sensitive species, and other natural resources. With payments now ballooning toward $90 billion per year ($8 billion for conservation), the Farm Bill largely impacts the country's rural economies, health and nutrition, national security, and biodiversity. Rising energy prices and imminent scarcities of fossil fuel-based inputs, widespread obesity, escalating federal budget deficits, geographic and demographic inequities in subsidy payments, and the ever-increasing demands for conservation incentives are raising the profile and public scrutiny of farm policies. The Farm Bill—legislation that literally shapes our food system, our bodies, and our future—has the promise to help bring conservation-based agriculture more significantly to those conventional and organic farmers who care about the land and its inhabitants.

Farmscaping: Design Considerations, Techniques, Issues

Sam Earnshaw, *Community Alliance with Family Farmers*

Hedgerows, grassed waterways, filter strips, and riparian restoration projects are increasingly being planted on farms and can have multiple functions: they can serve as habitat for beneficial insects, pollinators and other wildlife; provide erosion protection and weed control; stabilize waterways; serve as windbreaks; reduce non-point source water pollution and groundwater pollution; increase surface water infiltration; buffer from pesticide drift, noise, odors, and dust; act as living fences and boundary lines; increase biodiversity; and provide an aesthetic resource. Many plants attract native bees and other pollinators, and some hedgerow and windbreak plants, such as citrus or other fruit trees and herbal plants, can have economic returns. As with any planting, problems and issues can be dealt with through management practices. Most growers use plants that they individually like, and most report that they are pleased with the benefits that farmscaping brings to their farms.

Understanding the Environmental Toxicology of Pesticide Exposures to Salmon

Christopher A. Pincetich, *Salmon Protection and Watershed Network (SPAWN)*

Pesticide pulses in rural and urban watersheds originating from stormwater discharges and non-point source aquatic pollution can have both short and long-term effects on salmonids at all life-stages, and understanding the combined toxic effects of these exposures over the life of a salmon are critical to managing their recovery. Pesticide exposures can last from a few hours to days and weeks, and often co-occur with the presence of migrating adults and sensitive early life-stages in freshwater systems. Three pesticides currently used in the Sacramento Valley, which has historically supported the majority of California's Chinook salmon (*Oncorhynchus tshawytscha*) spawning grounds, were chosen to model the exposure of salmon during embryo development to storm-water discharges. The results of static-renewal (96 h) exposures of dinoseb, diazinon, and esfenvalerate to eyed eggs and alevins resulted in acute toxicity, abnormal development, and significant changes in metabolism. Esfenvalerate exposure resulted in development of lordosis, or myoskeletal abnormality, and the young fish did not respond to stimulus or exhibit normal swimming behavior. Other studies detailing the effects of environmentally relevant concentrations of diazinon show the disabling of the salmonids' olfactory organ, which is critical to migration success, and mortality of entire communities of native pelagic micro-organisms that salmon early life-stages depend on for food. The combined effects of co-exposure to pesticides can be additive or synergistic, resulting in the underestimation of the environmental effects of complex pesticide exposures, especially to salmon already under temperature or parasitic stress. The Salmon Protection and Watershed Network (SPAWN) is currently working on educating retailers and consumers about the harmful affects of specific classes of pesticides to salmon, and advocating the application of current scientific knowledge and regulatory policy governing pesticide applications towards providing increased protection for the endangered coho salmon in the Lagunitas Watershed of West Marin, California.

Coho Salmon and Steelhead Enhancement Projects on Santa Cruz County's North Coast Tour

Wednesday, March 4

Field Tour Coordinator*: Kristen Kittleson, Fishery Resource Planner, County of Santa Cruz*
Filed Tour Leader*: Matt Baldzikowski, Mid-Peninsula Regional Open Space District*

This field tour will visit a number of successful restoration and enhancement projects on the beautiful and rugged North Coast of Santa Cruz County. These projects share stream channel rehabilitation to improve stream function for steelhead and coho salmon. Sites in the Waddell, Scott and San Vicente Creek watersheds will be included in the field tour.

The Wilder Creek and Queseria Creek projects included both channel rehabilitation and improved passage. The Lower San Vicente Creek project improved passage and function into an off-channel pond that provides rearing habitat for juvenile coho salmon. On San Vicente Creek, large woody material structures were installed to improve habitat within one mile of stream.

Southern Coho Streams: Research and Recovery Tour

Wednesday, March 4

Field Tour Coordinator*: Kristen Kittleson, Fishery Resource Planner, County of Santa Cruz*
Field Tour Leader*: Sean Hayes, NOAA Fisheries*

This field tour will visit sites important to research and recovery of coho salmon in Santa Cruz County, which is the most southern distribution of the population on the West Coast. NOAA's Southwest Fisheries Science Center (SWFSC) in Santa Cruz began a long term research project on Scotts Creek in 2002 to study many aspects of central coast salmon biology. The watershed is inhabited by endangered southern coho salmon (*O. kisutch*), providing an excellent natural laboratory to study life history characteristics. This includes questions relating to adult return rates, juvenile production, growth and habitat use, population genetics, adult reproductive strategies, instream movements (monitored with Passive-Integrated-Transponder tags), marine survival of fish with PIT tags and archival data loggers, avian predation, and interactions between naturally-spawned and hatchery-produced salmonids.

The SWFSC works in collaboration with the Monterey Bay Salmon and Trout Project (MBSTP), which operates a hatchery on Scotts Creek and produces coho to supplement natural spawning. Many of the project research goals are achieved through data collected with adult and juvenile fish traps and PIT tag readers installed in Scotts Creek on sections of Cal Poly's Swanton Pacific Ranch.

The SWFSC also started a captive broodstock program for Central California coho salmon in 2002. Populations at the southern margin of the Central California ESU (Evolutionary Significant Unit) are considered to be at high risk of extinction. All coastal streams south of the Golden Gate have lost their natural runs of coho except

Scotts and Waddell Creeks in Santa Cruz County. The populations in Waddell and Scotts Creeks would be in even greater jeopardy without supplementation from artificial propagation provided by the MBSTP. Today coho salmon are kept in captivity throughout their life cycle at the SWFSC to ensure there are coho to be spawned at the hatchery in the event that fish fail to return to spawn, as can happen in drought years and extremely wet years. In recent years, the collection of broodstock has been facilitated by the installation of the fish traps on Scotts Creek. Another benefit of the program will be to increase our knowledge and understanding of the physiological and ecological requirements and genetic structure of southern coho through the use of broodstock progeny in laboratory research.

Dams and Daylighting: Success and Opportunity on San Francisquito Creek Tour

Wednesday, March 4

Field Tour Coordinator*: Matt Stoecker, Stoecker Ecological and Beyond Searsville Dam*

Just over the hill from Santa Cruz, San Francisquito Creek provides critical habitat to one of the last, wild steelhead runs in the south San Francisco Bay. Over the past couple of decades watershed stakeholders have removed or modified more than a dozen fish passage barriers to improve access to once blocked steelhead habitat. We are fortunate to get permission to visit Stanford University's private Jasper Ridge Biological Preserve. At this over 1000 acre private preserve we will meet with the director and tour the over century old Searsville Dam to discuss future challenges and opportunities with the nearly sediment-filled reservoir and major steelhead migration barrier. The tour will also visit a small, obsolete flashboard dam that was modified to allow upstream steelhead passage while preserving the downstream pool habitat and protecting adjacent properties. Another stop will look at a mid-1990s fish ladder modification project at Stanford University's Felt Lake Diversion Dam, hear why that design didn't work well for fish passage and water diversion, and discuss what is being planned to fix it. We will visit the Town of Portola Valley's brand new LEED certified green Town Center project, where we will observe the first year of flow along the newly daylighted and restored Sausal Creek, which now flows through the Town Center, instead of underneath it in a concrete culvert. Time permitting, we will also take a short hike along Corte Madera Creek upstream of Searsville Dam to observe the habitat conditions where ancestral steelhead, in the form of native rainbow trout, still occur and where steelhead could once again return in the future.

Fish Passage at Road Stream Crossings: Design, Planning, and Implementation Workshop and Tour

Thursday, March 5

Workshop and Field Tour Coordinator*: Mike Love,* ***Mike Love and Associates***

Road-stream crossings are one of the most prevalent types of blockages to movement of fish and other aquatic organisms, causing population fragmentation. These blockages include low-water crossings (fords), concrete and metal culverts, and undersized bridges. Through regional planning efforts, many of these impediments to fish movement are being addressed using a variety of approaches and funding sources. In some cases the crossings are replaced with structures that have natural stream channels running through them. In other situations crossings are retrofitted using a variety of hydraulic design approaches, such as culvert baffles, fish ladders, rock weirs, and roughened channels. This workshop will explore through both in-class presentations and a field trip the different design approaches used in recently completed fish passage projects and the planning efforts involved in bringing them to fruition.

The morning portion of the workshop will begin with a presentation by Michael Love on the newly completed California Department of Fish and Game Fish Passage Design Manual, which is the most recent addition to the state's Salmonid Stream Habitat Restoration Manual. Other presentations will include an overview of regional planning efforts that have addressed numerous fish passage problems in Santa Barbara, Santa Cruz, and Marin Counties. These presentations will also give detailed descriptions of completed projects, with an emphasis on lessons learned.

The afternoon portion of the workshop includes a field trip to four recently completed fish passage projects in Santa Cruz County. All four are retrofits of existing road-stream crossings, with each using a different approach to address passage. The projects are located on Valencia Creek, Corralitos Creek, and Shingle Mill Creek. Project types include rock weirs, culvert baffles, roughened channel, fish ladders, and modifying the floor of an existing culvert. At each site workshop participants will be provided with details regarding the project objectives and constraints, the planning, engineering design, permitting process, and lessons learned.

New California Department of Fish and Game Fish Passage Design Manual

Michael Love, *Michael Love & Associates*

The California Department of Fish and Game's Salmonid Stream Habitat Restoration Manual is being updated to include contemporary design approaches and implementation techniques for providing fish passage at existing and replacement stream crossings, small dams, and other instream structures. The primary authors, Michael Love and Kozmo Bates, have recently completed the new sections, which will be Part XII of the Restoration Manual. The new material covers:

- Pre-design, including establishing goals and objectives, geomorphic site characterization, and hydrologic considerations
- Establishing the project profile and alignment
- Geomorphic design approaches for new and replacement stream crossings, including stream simulation culverts and fords
- Approaches for controlling the channel profile, including roughened channels, rock chutes, and rock, log and concrete weirs
- Retrofit of culverts with baffles
- Traditional fishways, including pool-and-weir, pool-and-chute, and vertical slot fish ladders

In developing Part XII, all literature referenced in the new sections have been digitally compiled and will be made available on the FishXing and Department of Fish and Game websites for download, as copyright permissions allow. This will allow designers to easily obtain and review the original source materials.

This presentation will provide an overview of the materials covered in the manual and how they may affect design of new projects. Copies of Part XII are expected to be available on CD at the workshop, as well as available for download.

Restoring Steelhead in Carpinteria Creek, Santa Barbara County

Mauricio Gomez (Presenter) and Andrew Raaf, South Coast Habitat Restoration

In 2002, Carpinteria Creek was reported as having the highest steelhead recovery priority along the South Coast of Santa Barbara County from Jalama to Rincon Creeks. Since this report was published, there has been a community based effort towards removing the major barriers to steelhead migration in this watershed. In 2008, four barriers to steelhead migration were removed/modified, moving the restoration of this watershed one step closer towards reality. An overview of the planning, permitting, grant funding, demolition, and construction will be presented in order to share information on the barriers encountered along the way.

Carpinteria Creek is an average-sized watershed, approximately 15 square miles, along the Southern Coast of Santa Barbara County. The watershed is oriented in a northerly/southerly direction, is bordered by the Santa Ynez Mountains, and has an elevation of 4,638 feet. These conditions contribute to the flashy nature of the watershed and present some of the difficulties in designing fish passage projects. The watershed has a total of ten moderate to impassable anthropogenic barriers. All of these barriers are located on private property, except for two barriers owned by the Santa Barbara County Flood Control District. The barrier types are: low flow concrete crossings, box culverts and debris basins. Of the four barriers removed/modified in 2008, three were low flow concrete crossings and the fourth was a debris basin.

The success of these projects has been in large part due to the participation of the Carpinteria Creek Watershed Coalition (CCWC). The CCWC is a non-incorporated community based watershed organization comprised of local landowners, community residents, local non-profits and local, state and federal agencies. The mission of the CCWC is to restore steelhead trout in the watershed.

Steelhead recovery along the Southern Coast of Santa Barbara County is slowly making its way upstream. The four projects in the Carpinteria watershed as well as a small number of other projects in the region are slowly making progress towards steelhead recovery along the Southern Coast of Santa Barbara County. In order to increase efforts throughout the region, steelhead recovery must be implemented in a strategic manner in order to maximize the use of limited resources. Carpinteria Creek has the potential for having the remaining major barriers removed or modified in the next five years in order to allow steelhead access to all of the historic spawning grounds in the watershed.

The Santa Barbara County Flood Control District managed the modification of the debris basin while a local non-profit organization, South Coast Habitat Restoration, managed the other three steelhead restoration projects.

Seasonal Juvenile Portable Fish Ladder Boxes on Zayante Creek, Felton, California: Design, Implementation, and Adaptive Operation and Management Plan Lessons Learned

Peter Haase, P.E. (Presenter), and Robyn Cooper, P.E., Fall Creek Engineering

Fish passage structures have been designed and implemented throughout the west coast for decades. The management of fish passage structures can be fine-tuned to meet evolving fish passage criteria with the use of overflow and bypass structures. This presentation will provide the lessons learned with the design and implementation phase, as well as the adaptive operation management plan for one recently installed fish passage structure located on the central coast of California.

Fall Creek Engineering, Inc. (FCE) designed and implemented a juvenile portable fish ladder box system for a seasonal dam on Zayante Creek located in Felton, California. The seasonal dam is installed to create a recreational impoundment and consists of a permanent concrete abutment and wooden flashboards that are installed from June through October. The dam is situated on a four foot high shale stone step, and in its pre-project condition created a natural fish barrier that is impassible to upstream migration of juvenile steelhead during low flow conditions.

The goals for the project were to improve the passage of adult and juvenile fish in high and low flows, respectively. FCE designed a permanent concrete step-pool structure that included two weir boxes, each with a permanent concrete weir to allow for adult fish migration. The weir boxes were also constructed with slots to allow for additional temporary weirs to be installed, reducing the jump height to accommodate juvenile passage. In addition to the step pool structure, eleven portable wood fish (way) boxes were designed to be installed during summer months when the flashboard dam is installed.

During the initial phase of the implementation process it was decided that the weight and shape of the boxes would result in a cumbersome seasonal installation and dismantling process. FCE and the project owner decided to pursue a lighter weight and less cumbersome material for use in the construction of the seasonal boxes. Fiberglass boxes were constructed, which proved to be lightweight, durable, and easy to assemble. Additionally, FCE sought to reduce costs by having a more uniform box configuration and a more uniform concrete base structure.

Now, in the fish ladder's second year of use, FCE has been involved in an adaptive operation and management plan. In the summer 2008 season, FCE performed several site visits to test velocities and jump heights in the step pools and fish boxes. Modifications and adjustments were made to the bypass structure to reduce velocities and to the flashboard dams to adjust the jump heights. Although, at the initial site visits it was determined that the velocities and jumps heights were both slightly higher than called for in the designs, several fish were observed in the step pools, boxes, and jumping between the two. FCE found that by integrating screened bypass valves into the design allowed for the flows through the structures to be adjusted, thus improving fish passage.

Vanquishing Barriers in Marin County —Project Based Experience and Lessons Learned from the Field

Kallie Kull, *Marin County Public Works Fish Passage Program*

Central California Coastal Counties have made the commitment to replace and retrofit aging infrastructure that pose barriers to salmonid migration, using state-of-the-art fish passage designs. This talk will focus on the fine art of balancing the needs of endangered salmon populations with the challenges of getting fish passage projects designed, approved, funded and built. Coho salmon lifecycle needs and conditions suitable for migratory passage will be reviewed, in particular the need to provide passage for juvenile fish during critical low flow and high flow periods. Examples of completed projects within the Lagunitas Creek watershed in Marin County will be presented, with an emphasis on lessons learned during planning and construction. Outcomes from post-project monitoring of seven roughened ramp designs installed in the field will be presented.

Coho Use of Off-Channel Habitat Workshop

Workshop Coordinator*: Kit Crump, NOAA Restoration Center, National Marine Fisheries Service*

Several studies throughout the Pacific Northwest document the use of off channel habitat features as salmonid rearing habitat. Off-channel habitat features were common when floodplain habitat was present in salmonid watersheds but are rare now due to the high degree of destruction and alteration of floodplain habitats by agriculture, urbanization and roads. Coho Salmon seem to have the highest degree of dependence on off-channel habitat features and so the protection and restoration of these habitat types address a key limiting factor throughout their range. This is particularly true for the Central California Coast (CCC) coho Salmon population, which is the most critically endangered population of coho anywhere in western North America, with the watersheds south of the San Francisco Bay at the greatest risk of extinction. Off-channel habitat features, like lagoons and estuaries, increase the survival of ocean migrating juveniles by increasing their size and health before they enter the ocean.

The focus of this workshop will be to present examples of coho use of off-channel habitat and restoration techniques that directly support the creation and maintenance of off-channel habitat features as a key recovery action for CCC coho. The workshop will present talks on habitat use, various approaches to restoring off-channel habitat features and some of the obstacles to carrying out these kinds of projects. The session will conclude with a focus on a newly proposed off-channel habitat project to benefit CCC coho in northern Santa Cruz county as a case study of a local off-channel habitat project specifically designed to benefit coho. Participants of this workshop will participate in the decision process for designing this project and are invited to view this project as part of a separate tour of Santa Cruz watershed projects associated with this conference.

Overview of Off-Channel Habitats and Their Use by Coho Salmon

Kit Crump, *NOAA Restoration Center, National Marine Fisheries Service*

Coho use a variety of rearing habitats outside of the main channel of a stream or river. In addition to lagoons and estuaries, coho use a variety of off-channel habitats as rearing habitat including side channels, ponds and wetted floodplains. These can be artificial structures such as remnant agricultural ponds or natural structures like side channels. Some of these habitats function as summer rearing habitat, winter rearing habitat or both, with their function depending on their size, shape, depth and proximity to the ocean, as well as the channel forming processes in the watershed. There are certain off-channel habitats that are critical to the smolt life stage, as they function like a lagoon or estuary in providing a deep, cool and stable environment that produces large fish that are well suited for ocean survival. Other species such as Chinook salmon and steelhead also use off-channel habitats.

Currently the use of off-channel habitat has been well documented for Pacific salmonids in the northern part of their range. Even in California, there is more knowledge and recognition of the value of these habitats in the northern part of the state. Restoration of these unique habitats will require a detailed understanding of the different habitat requirements of multiple life stages of coho, as well as a detailed understanding of the fluvial geomorphic and hydrologic processes that create, support and maintain these unique habitats. The recently published State of the Salmon report by UC Davis indicated that loss of floodplain habitat has made the need for creating instream habitat complexity greater than ever. The same argument can be made for off-channel habitats, as they also address a key limiting factor for coho salmon in California and elsewhere.

History and Coho Use of Off-Channel Habitats on San Vicente Creek

Mike Podlech, *Independent Fisheries Biologist*

The San Vicente Creek watershed, located in northern Santa Cruz County, supports populations of federally and state-listed endangered coho salmon (*Oncorhynchus kisutsch*) and federally threatened steelhead (*O. mykiss*). Historically, a number of on- and off-channel ponds were used and maintained as agricultural water diversion and storage ponds along San Vicente Creek. However, between 2000 and 2002, several of the ponds were dismantled because the property owner did not have water rights to divert San Vicente Creek streamflow. One of the ponds, located immediately east of Highway 1 near the mouth of San Vicente Creek, remained, but water diversions from the pond were discontinued. Following a survey and fish relocation effort in September 2002, it became apparent that hundreds of coho salmon and steelhead were present in the remaining pond. Due to concerns that these fish may be trapped and may be harmed by continued water diversions, The National Marine Fisheries Service (NMFS) requested that Coast Dairies & Land Company (CDLC), a subsidiary of the Trust for Public Land (TPL) and the interim owner of the Coast Dairies property, discontinue water diversions from the pond, implement a water quality monitoring program, assess and possibly improve fish passage conditions in the pond's outlet channel, and conduct a smolt outmigration study. The smolt outmigrant study was conducted from March 8 through June 15, 2003. Average lengths and weights of both coho salmon and steelhead smolts exiting the pond during this study were found to be significantly higher than those of smolts that had reared in the main channel of San Vicente Creek. The findings of this study suggest that off-channel habitat restoration and creation, even in the form of artificial features such as ponds, may provide an important tool in the recovery of coho salmon stocks.

Design and Construction of Habitat-Enhancement Measures, San Vicente Creek, Santa Cruz County, California

Brian Hastings, *Balance Hydrologics*

Balance Hydrologic's hydrologists and geomorphologists worked with NOAA Fisheries, California Department of Fish and Game and the Santa Cruz County Resource Conservation District to design off-channel habitat-enhancement features at a site on lower San Vicente Creek. This coastal stream is designated critical habitat for two federally-listed salmonid species, coho (*Oncorhynchus kisutch*) and steelhead (*Oncorhynchus mykiss)*. Both species were discovered during a recent survey of an abandoned off-channel irrigation pond, which also provides habitat for another listed species, the California Red Legged Frog (CRLF). The inlet from the creek to the pond was in poor condition, intermittently blocked by sediment following storm events, effectively isolating the fish. Balance geomorphologists intensively studied the channel and pond hydrology, then developed designs for a more stable inlet to provide better fish access, minimize sedimentation and maintain year-round flows to the pond.

Our design included a porous rock-weir structure in the main channel to create a more stable pond inlet while maintaining fish passage upstream. The pond was enhanced through construction of shallow and deep pools to increase habitat complexity for both fish and CRLF. The design was constructed in October 2008. Balance provided construction oversight and guided construction practices to minimize construction impacts. Post-construction monitoring began in November 2008. Balance works closely with the County of Santa Cruz to evaluate effects of design on channel changes, using repeat cross-sectional and longitudinal surveys. In addition Balance hydrologists measure flow in both San Vicente Creek and the inlet channel to develop an inlet operation and maintenance plan.

Planning and design for an additional habitat enhancement project on San Vicente Creek is currently in progress. Lessons learned from the first enhancement project and input from local agencies and the greater scientific community will be used to guide design and habitat goals.

Permitting Challenges for Coho Pond Projects: A Case Study from the Central Coast

Jim Robins, *Alnus Ecological and IWRP Project Coordinator*

Balancing water diversions and fisheries recovery is a challenge faced by nearly every entity working in streams and rivers across the West Coast. In California's Central Coast, this challenge has never been greater or more pressing. Over the past five years, the regulatory community and agricultural community along the steep coastal watersheds of the Central Coast have been struggling to find common ground and develop new technologies and techniques to balance agricultural water demands and fisheries resource needs. A pilot project in San Mateo County, led by the San Francisco non-profit Sustainable Conservation, worked to develop a template for designing new off-channel water storage that would allow agricultural users to capture and store winter runoff, while significantly reducing the need for summer diversions. To date, these efforts have met with little success due, in large part, to significant regulatory challenges associated with permitting off-channel ponds for agricultural use. This lack of traction has been amplified by our burgeoning understanding of the critical role that off-channel habitats (ponds, marshes, ox-bows, etc) may play in supporting productivity of juvenile coho salmon. The link between off-channel storage, agricultural water diversions, and instream flows has never appeared more critical than it does today with the Central California Coast coho salmon populations in the midst of a perilous decline. Our case study focuses on the first coho pond project to be completed in the Central Coast and the implications from this experience for completing more complicated projects elsewhere in the Central Coast.

The story of San Vicente Creek and the San Vicente Pond began in 2000, when as part of a large land transaction Coast Dairies & Land Company (CDLC) was forced to dismantle several agricultural ponds in a number of coastal watersheds due to a lack of proper water rights for the associated diversions. Furthermore, the National Marine Fisheries Service (NMFS) and the California Department of Fish and Game (DFG) expressed concerns that coho salmon and steelhead could become trapped in these ponds leading to "take" as water quality quickly diminished in the summer and fall months. One of the ponds, located immediately east of Highway 1 near the mouth of San Vicente Creek is our case study. The physical footprint of the pond as well as its inlet and outlet were left intact, but water diversions from the pond were discontinued in 2002. That year, NMFS discovered that a large population of coho salmon and steelhead occupied San Vicente Pond. NMFS was concerned for the long-term fate of these fish and ordered CDLC to conduct extensive studies in order to ascertain the effects of the pond on salmonids. Results of these studies indicated that the pond was continually providing exceptionally productive rearing habitat, particularly for coho salmon. This realization forced NMFS to rethink their prevailing view of ponds and led to a number of years of tinkering with the existing inlet to maintain adequate flows in the pond to support coho rearing. In January of 2008, NMFS/NOAA Restoration Center staff, in coordination with the Santa Cruz County Integrated Watershed Restoration Program (IWRP) and DFG fisheries staff, began the process of designing, permitting, and constructing a new inlet and reshaping the existing pond as the first coho-focused fisheries restoration project south of the Golden Gate. This presentation will detail the arduous and frantic path to permitting this project and provide a list of lessons learned for other practitioners eager to construct, reconstruct, or restore off-channel habitats for coho.

Steelhead and Chinook Salmon Use of Two Engineered Side Channels in the Central Valley: a Look at Pros and Cons of Design Implementation

Walter Heady, *University of California Santa Cruz, Ecology and Evolutionary Biology Department, Long Marine Laboratory*

The lower Mokelumne River (LMR) includes approximately 54 km of regulated river between Camanche Dam, a complete barrier to anadromous fish, and the Sacramento–San Joaquin Delta. The riparian areas of the Mokelumne River historically supported a diverse and dynamic ecosystem of oxbow lakes, seasonal wetlands, side channels and extensive forested floodplains. Much of this has been lost due to extensive anthropogenic alterations including mining, agriculture, forestry, water diversions, levee and dam construction. Since 1927, approximately 190,000m^2 of side channels have been eliminated in the 14.5km extent of remaining salmonid spawning habitat (Edwards et al. 2004). Historically, side channels provided high-quality rearing habitat for juvenile Chinook salmon and steelhead.

In 2005, the East Bay Municipal Utilities District (EBMUD) engineered 1,915m^2 of side channel habitat in the LMR, constructed to flow at dam releases above 14.5m^3sec^{-1}. EBMUD monitored the side channels to determine if they provided juvenile salmonid rearing habitat; i.e. 1) appropriate physical habitat characteristics, 2) aquatic macroinvertebrate prey, and 3) evidence of juvenile salmonid habitat and prey use. To quantify these three criteria, structural characteristics, water depth and flow, benthic and drift invertebrate prey species composition and abundance, and salmonid habitat use and diet samples were collected on a monthly basis. Side channels provided appropriate structural characteristics, water depth and flow for rearing juvenile salmonids. Aquatic macroinvertebrates rapidly colonized the benthos and abundance, and taxonomic richness increased dramatically over the monitoring period. While there was no spatial difference in aquatic macroinvertebrate community structure, it changed as a whole over the monitoring period. This change in community structure through time was driven by abundances of different taxa of varying life history in this early successional stage of the engineered habitats. Benthic and drift macroinvertebrates from within the side channels provided preferred diet items for juvenile salmonids. Juvenile salmonids were found in the side channels at high densities with full stomachs. There appeared to be some niche partitioning among juvenile steelhead and Chinook salmon. The increased habitat heterogeneity provided by these engineered habitats provided the potential for predator avoidance for rearing juvenile salmonids as well as a suite of ecological benefits.

Lateral expansion of rearing habitat may be of great benefit to sensitive species in degraded systems that are linearly limited by complete barriers such as dams. Monitoring results indicate rapid benefits to local salmonids from such restoration efforts. While the monitoring period was one of the wettest years in recent history the two years since have been low rain years and the side channels have not been inundated. In regulated systems such as the Mokelumne River, hydrograph manipulation will increase the benefit of such engineered habitats. In natural or regulated systems, the variability in the hydrograph needs to be considered when designing the inundation characteristics of off-channel habitats.

Coho Salmon Use of Off-Channel Habitat in the Lower Klamath River

Dan Gale, *Yurok Tribal Fisheries Program*

Coho salmon (*Oncorhynchus kisutch*) populations have experienced significant declines over the past 50 years, resulting in their 1997 listing within the Klamath Basin as threatened under the Endangered Species Act. Substantial effort has been focused since this listing on developing and implementing restorative measures throughout the Klamath and Trinity Rivers to aid in reversing this population decline. Coho salmon use of off-channel habitat in and around the Klamath estuary has been poorly understood, resulting in minimal focus on the importance of these non-natal habitats to the growth and survival of coho salmon from throughout the basin.

The Yurok Tribal Fisheries Program (YTFP) and the Karuk Tribe Department of Natural Resources (KTDNR), with assistance and funding from the U.S. Bureau of Reclamation (BOR), initiated a collaborative study in 2006 to better understand coho salmon habitat use in the Klamath River and adjoining refuge and off-channel habitats. YTFP initiated an assessment of off-estuary tributary and wetland habitats throughout the Lower Klamath River Sub-Basin, followed by extensive fish sampling in areas identified as high quality habitat. Fish sampling efforts to date have focused on the use of fyke nets and specialized fish marking techniques to document fish movement patterns, estimate fish densities, and assess residence time in several off-estuary sloughs and tributary locations.

In addition, YTFP has undertaken extensive marking of young-of-the-year coho salmon with passive integrated transponder (PIT) tags throughout mainstem and tributary habitats in the Lower Klamath Sub-basin. These uniquely numbered electronic tags allow YTFP to track the long-term movement and growth of individual fish between the time they are marked and subsequent recapture events through our various sampling efforts. In addition, the KTDNR and the California Department of Fish and Game (CDFG) have been implanting PIT tags in young-of-the-year coho salmon in mainstem and tributary habitats of the Middle Klamath River Sub-Basin. BOR has also provided assistance in PIT tag marking juvenile coho salmon throughout the Trinity River Basin. These additional tagging efforts have provided YTFP with the opportunity to assess the relative use of off-estuary habitats by coho salmon emanating from throughout the basin.

YTFP has documented extensive off-channel habitat use in the Lower Klamath by non-natal juvenile coho salmon. Fish are migrating from mainstem habitats into off-estuary sloughs, tributaries, and wetlands beginning with the onset of the first fall freshets. The most used habitats appear to be beaver ponds or similar open-water wetlands. Juvenile coho rear in these types of open-water ponds throughout the winter and spring before emigrating in late spring or early summer. Growth rates of coho rearing in these habitats are substantially greater than those of fish sampled over the same time frame in free-flowing tributary habitats, revealing the rearing advantage these still-water habitats have over winter habitat conditions in natal streams. To date PIT-tagged coho from throughout the basin are consistently captured in these types of off-channel habitats, indicating that off-channel wetlands are playing a key role in the growth and survival of coho salmon from throughout the Klamath Basin.

Future efforts will focus on expanding our sampling efforts to quantify population numbers and related temporal and spatial trends between the various off-channel habitats in the Lower Klamath River Sub-Basin. This will allow us to better understand their specific habitat preferences and in turn design and implement off-channel habitat restoration projects best suited to meet their needs. In addition, YTFP is working to expand PIT tag marking efforts throughout the watershed and in turn continue to refine our recapture sampling throughout the off-estuary habitats to better understand relative abundance and habitat use patterns for coho populations from throughout the Klamath River Basin.

Visions And Goals: Tracking Success of Off-Channel Salmonid Restoration Projects

Joseph E. Merz, Ph.D., *Cramer Fish Sciences and Institute of Marine Sciences, UC Santa Cruz*

The difference between where we are (current status) and where we want to be (vision) is what we do (target objectives and action plans). By defining a restoration project under these parameters we can clarify suitable goals for ecological restoration. By developing an appropriate monitoring plan we can critically examine the worth of specific restoration techniques for achieving these goals at a given site.

In this presentation we discuss three California Central Valley projects under various stages of development that were designed to restore off-channel salmonid habitat. We examine why techniques were chosen, demonstrate how well specific goals were met, and discuss success, shortfalls and possibilities for adaptive management. Examples from Murphy Creek and the Mokelumne and Stanislaus rivers will be discussed.

Juvenile Coho Use of a New, Artificial Off-Channel Pond in the Scott River, Siskiyou County, California

Mark Pisano (Presenter) *and* ***Mary Olswang,***|
California Department of Fish and Game, Northern Region

Juvenile coho salmon generally prefer low velocity habitats for rearing such as sloughs, side channels, beaver ponds and estuaries. The more productive rearing habitats are located in smaller streams with low gradient alluvial channels and deep pools formed by instream structures such as large woody debris. Since coho salmon generally rear an entire year in freshwater, these habitats provide over-summering rearing opportunities and protection from high scouring flows in winter. In the Scott River Watershed of Siskiyou County, coho salmon rearing habitat has been considerably reduced through a variety of land management practices, drought and global climate change. Additionally, high summer water temperatures and water withdrawals for agricultural purposes continue to suppress quality rearing habitat in the watershed.

Since before the listing of coho salmon under the California's Endangered Species Act (CESA) in 2005, the California Department of Fish and Game (CDFG) has been working with the Shasta-Scott Coho Recovery Team to develop a programmatic implementation process that would help recover coho salmon while providing for the *incidental take* of coho during the conduct of otherwise lawful activities such as diverting water from the stream for agricultural uses. A number of avoidance, minimization and mitigation measures have been proposed to avoid, decrease and offset potential take. Among these are physical habitat improvement measures such as spawning gravel enhancement, the addition of instream structures and riparian planting. Although not a specific requirement of the proposed Incidental Take Permit, an opportunistic off-stream pond project was recently initiated to assess the potential benefits of this type of habitat improvement project to coho salmon survival. This presentation will describe the physical attributes of the so-called "Farmers Pond," and changes in water quality over time, and will summarize salmonid usage to date. Recommendations for continued use of Farmers Pond as off-channel rearing habitat for juvenile salmonids, as well as whether or not to expand this type of habitat improvement project to other areas, will be discussed.

Watershed Monitoring and Assessment Workshop

Thursday, March 5

Workshop Coordinators*: Armand Ruby, Coastal Watershed Council and* ***Chris Choo,*** *Marin County Department of Public Works*

The workshop will be a working session for managers, planners, scientists, and resource agency staff to share and discuss watershed monitoring, management tools and assessment methods. With increasing regulatory pressure and monitoring requirements, guidance is needed to determine how to approach watershed and resource management. As we move forward, we need to better utilize our monitoring and data to evaluate work and adaptively manage future projects. A holistic watershed approach is needed to deal with complex problems and solutions, yet most of our tools and assessment methods haven't been able to manage for watershed health. Most groups and agencies have years of data collection and project implementation and as we try to move forward, we are faced with evaluating our work for success and with adaptively managing future projects.

Legacy Pesticides in Central Coast Rivers: the Land-Sea Connection

Dane Hardin, *CCLEAN/Applied Marine Sciences*

The Central Coast Long-term Environmental Assessment Network (CCLEAN) has been measuring loads and effects of contaminants being discharged from wastewater treatment plants and major rivers in the Monterey Bay area since 2001. Approximately 8 kg of legacy organic contaminants (e.g., chlorinated pesticides and PCBs) and 40 kg of petroleum hydrocarbons are discharged per year from rivers, predominantly the Pajaro and Salinas rivers. Discharges of contaminants from wastewater treatment plants average less than 5% of those from rivers. Numerous exceedences of water quality criteria and human health alert levels for concentrations of contaminants in shellfish have been related to these discharges. Continuing discharges of these contaminants from rivers reflect historic use patterns and ongoing landscape modifications.

Impacts of Agricultural Pesticides in Central Coast Rivers and Estuaries: Practices to Reduce Concentrations of Organophosphate and Pyrethroid Pesticides

Brian Anderson (Presenter), Bryn Phillips, John Hunt, Catherine Siegler, Ron Tjeerdema, Jennifer Voorhees, and Sara Clark, Marine Pollution Studies Laboratory—Granite Canyon; Department of Environmental Toxicology, UC Davis

Coastal rivers and estuaries are among the most ecologically important and critically threatened habitats world wide. Along California's Central Coast, the three largest watersheds drain to coastal estuaries that provide essential habitat for early life stages of commercial marine fish species, threatened anadromous fish species, migratory birds, and other wildlife. Each of these watersheds contains year-round, intensively cultivated agricultural land that supports a $5 billion/year industry producing most of the nation's lettuce, artichokes, and cruciferous crops. This paper provides an overview of monitoring studies that have identified the primary pesticides of concern in central coast watersheds, illustrates ways these pesticides may impact salmonids, and describes recent studies evaluating on-farm pesticide treatment practices. Recent monitoring in the Salinas, Pajaro, and Santa Maria River watersheds has demonstrated that agriculture runoff in these watersheds contains toxic concentrations of organo-phosphate and pyrethroid pesticides. The primary pesticides of concern are the organophosphate pesticides diazinon and chlorpyrifos, and a number of pyrethroids. Pesticides have been detected at concentrations sufficient to have direct effects on migrating salmonids. In addition, these pesticides can have secondary effects by impacting macroinvertebrates, including salmonid forage species. Recent monitoring in the three coast estuaries has demonstrated temporally variable instances of water toxicity associated with diazinon and chlorpyrifos. On-going research is being conducted to assess impacts of pesticides in these estuaries using a combination of water and sediment toxicity testing, macroinvertebate community assessment, contaminant measurement in fish and invertebrate tissues, and associated biomarker studies. To address increasing concerns over tainted runoff, farm groups are implementing management practices to reduce pesticides. Research in the Salinas Valley suggests that vegetated treatment systems offer a cost-effective method for treating runoff. For example, recent studies have shown that grass-lined drainage ditches are effective at reducing turbidity and concentrations of pyrethroid pesticides in agriculture tailwater runoff. These studies have also shown that incorporation of the enzyme system Landguard OP-A into on-farm vegetated treatment systems eliminates diazinon and chlorpyrifos in runoff. These results suggest that multi-compartment treatment systems incorporated into agriculture tailwater ditches and ponds offer a practical solution to reduce pesticide runoff.

Presence and Impacts of Current-Use Pesticides in Coastal Watersheds

Armand Ruby, *Coastal Watershed Council*

Rachel Carson published *Silent Spring* in 1962, documenting the far-reaching ecological consequences of widely-used pesticides. Half a century after she began her research, approved pesticides used in *legal applications* are still causing widespread ecological effects. Today, residues from pyrethroid pesticides legally applied in urban areas are carried by urban runoff into storm drain systems and urban creeks, where they can cause toxic effects to aquatic organisms. Similar processes are occurring in agricultural areas.

Though the full extent of the ecological impact is not known, current scientific evidence documents in startling fashion the presence and impacts of pyrethroid pesticides within California waters. Summary information has been compiled for available monitoring data involving pyrethroids in surface waters and sediments in urban areas, including chemical testing, toxicity testing, bioassessments, and tissue analysis.

Key summary points include:

- There is an expanding diversity of research currently being undertaken or planned on the environmental presence and effects of pyrethroid pesticides in California.
- Earlier (pre-2000) environmental research on pesticides effects focused principally on agricultural areas, but that has been changing in recent years. Dozens of recent studies focus on pesticides in urban areas within California alone. Much additional monitoring and research is planned.
- Evidence of the presence of pyrethroids in urban waterways and their effects on aquatic biota is widely distributed geographically throughout California.
- Pyrethroids are present in both water and sediment in urban waterways—and in marine as well as freshwater environments. With improvements in field collection and laboratory analytical protocols has come improved detection of pyrethroids, particularly in water.
- Effects of pyrethroids on aquatic organisms are widespread, as documented in studies involving water column toxicity testing, sediment toxicity testing, bioassessments (field surveys of benthic macroinvertebrates), and tissue analysis.
- Local agencies have little or no jurisdiction over sales or use of these pesticide products, and are therefore unfairly tasked with loading reductions in resulting Total Maximum Daily Loads (TMDLs). An effective regulatory solution therefore must occur at the state and federal levels.

Using Watershed Stewardship Planning Efforts in Marin County to Inform Stormwater Program Activities, Monitoring and Watershed Assessment

Terri Fashing, Marin County Stormwater Pollution Prevention Program

The Marin County Stormwater Pollution Prevention Program (MCSTOPPP) assists all municipalities in Marin County to comply with the National Pollutant Discharge Elimination System (NPDES) Phase II General Stormwater Permit. The permit does not require water quality monitoring, however, MCSTOPPP established a biological and physical/habitat assessment program in 1999 to achieve the following goals: 1) provide baseline information on the macroinvertebrate assemblages within the Arroyo Corte Madera Creek, Corte Madera Creek, Miller Creek and Novato Creek watersheds; 2) determine the biotic condition for all sampling sites within the Novato Creek (16 sites), Corte Madera Creek (13 sites), Arroyo Corte Madera Creek (5 sites) and Miller Creek (6 sites) watersheds; 3) evaluate the relationship between biotic and habitat condition scores for all sites within the four watersheds; and 4) make recommendations to guide future diagnostic analysis and potential management actions for all sites within the four watersheds and make recommendations for future assessment monitoring plans for Marin County streams. While the biological and physical habitat data do provide some information on urban watershed health, additional information is needed to effectively guide stormwater program activities. Therefore, MCSTOPPP is reevaluating the utility of our current monitoring program. We are participating in the Marin County Department of Public Works (MCDPW) Watershed Stewardship Planning effort in order to explore scientifically defensible, cost-effective methods of assessing watershed health. The goal is to determine whether and what additional monitoring will provide data that can help direct stormwater program activities. Specifics on past bioassessment monitoring results and on how MCSTOPPP plans to implement recommendations from current Watershed Stewardship Planning will be presented. This will be contrasted with the programmatic, permit-driven approach to establishing program activities in order to protect watershed health.

Marin County Watershed Stewardship Planning: Getting to Realistic Targets and Habitat Goals

Chris Choo, *Marin County Dept. of Public Works and* ***Lauren Hammack,*** *Prunuske Chatham, Inc.*

Marin County Department of Public Works (MCDPW) is in the process of developing a Watershed Stewardship Program to guide their flood management and stormwater programs, as well as promote partnerships for protecting and enhancing Marin's watersheds. A recent trend in watershed assessment and planning efforts utilizes the concept of watershed health indicators to evaluate the level of ecological impairment and guide enhancement actions. But what if you have limited data and few specifics on historic habitat conditions? What do you choose as indicators that are relevant to your region, and then how do you set accurate, realistic targets for those indicators? How do you deal with the fact that most indicators of watershed health are influenced by multiple factors and cumulative effects? How do you best utilize existing data to support watershed health evaluation, and what types of monitoring efforts are required to support evaluation in the future? What are efficient methods to coordinate the varied monitoring needs to best assess watershed health and support enhancement actions?

MCDPW has been grappling with these questions during the construction of a Marin County Watershed Stewardship Plan (Plan). MCDPW wanted a product that would result in a current assessment of conditions, provide feedback for completed projects, and support opportunities for restoration within an urban watershed. We will discuss the Plan development and our decision to approach the concept of watershed health evaluation and enhancement from a hydroecological process impairment perspective, rather than assessment of specific indicators. We believe that this approach will be more effectual in achieving the goals of the Plan, which are to 1) provide a framework to integrate flood protection, creek and wetland restoration, fish passage and habitat enhancement, and water quality improvements, 2) address both regional and local issues, 3) uncover opportunities for integrated watershed management, 4) identify specific, prioritized, multi-benefit projects, and 5) function as an educational tool for both the public and resource management professionals. Specifics on the evaluation of watershed health and hydroecological process impairment will be given, and an example of how it translates to implementation, program development and monitoring will be shown, using the Novato Creek watershed.

How Healthy is Your Watershed? Recent Progress on Developing Indicators of Ecological Health and the Potential Applications in the San Francisco Bay Area and Beyond

Kat Ridolfi (Presenter), Thomas Jabusch, and Rainer Hoenicke, San Francisco Estuary Institute

A common question that perplexes watershed managers is: how healthy is this watershed? Assessing the condition of a large, complex watershed like the San Francisco Estuary is one of the largest challenges facing managers today. Recent efforts attempt to develop and analyze indicators of ecological health, building off of the framework developed by the EPA's Science Advisory Board (SAB). This Watershed Assessment Framework (WAF) defines the essential ecological attributes and provides the structure for organizing indicators into seven categories: Landscape, Hydrology/Geomorphology, Socioeconomic, Biotic, Chemical/Physical, Ecological Processes, and Natural Disturbance. These indicators can be used to design a system to assess, then report on the environmental condition of a watershed. The framework relates the goals and objectives of programs such as the San Francisco Estuary Project and other management efforts to the ecological conditions of the watershed. Information from specific measurements is aggregated into indicators which describe the condition of the watershed ecosystem. These attributes are interdependent but when considered together, demonstrate the environmental condition of the ecosystem, and can be used to evaluate program goals, objectives and progress. This presentation will report recent progress in developing indicators for the San Francisco Estuary, and a related project that focuses only on the North Bay watersheds that drain to San Pablo Bay. It will also present examples of how to use these indicators to develop or improve water quality or stormwater monitoring plans, in addition to tracking progress on other watershed management plans.

An Improved Understanding of the Causes of Aquatic Life Use Impacts in Urbanized Streams: Lessons Learned Through Monitoring in Lower South San Francisco Bay

Chris Sommers, *EOA, Inc.*

Aquatic life uses in California urban creeks and rivers (e.g., cold and warm water fishes and benthic organisms) can be adversely impacted by a variety of anthropogenic stressors, such as contaminants, low dissolved oxygen, degraded physical habitat, migration barriers, sediment and temperature. Through the issuance of National Pollutant Discharge Elimination System (NPDES) permits to wastewater treatment plants, industries, construction site operators, and municipalities, federal and state agencies have focused on reducing the impacts of contaminants. Additionally, the State of California has attempted to reduce impacts from agricultural and rural areas through the implementation of its non-point source (NPS) program. In general, the successes of these programs have been questioned, due to lack of demonstrable improvements in the condition of aquatic life uses in many of our creeks and rivers.

This presentation will provide information on the lessons learned through biological, physical, chemical and toxicological monitoring of creeks and rivers in the Lower South San Francisco Bay with regard to the identification of the causes of aquatic life use impacts. Specifically, conclusions from municipal stormwater program long-term monitoring activities, fisheries limiting factors analyses (LFAs), water body assessments, and other pertinent water quality monitoring and assessment programs will be discussed.

Towards a Comprehensive Monitoring Strategy for the Sonoma Valley Watershed

Lisa Micheli (Presenter), Deanne DiPietro, and Rebecca Lawton, Sonoma Ecology Center

Sonoma Valley provides a valuable case study of how to build on watershed assessments to create a meaningful long-term monitoring program that includes a plan for dissemination to local citizens and stewards. The Sonoma Ecology Center, in partnership with numerous local agencies, has served as the technical lead on Clean Water Act Sediment TMDL assessments, including a Limiting Factors Analysis for salmonids (2005) and a Sediment Source Analysis (2007). These analyses help identify key parameters for ongoing watershed monitoring. Presently we are engaged in formalizing a set of indicators in partnership with other North Bay watersheds capable of tracking potential changes in baseline conditions for flow, sediment loads, stream temperatures, groundwater, benthic macroinvertebrates, land cover, and fish and wildlife populations. Biological monitoring has traditionally been the most difficult to fund; presently we are working on a regional salmonid monitoring strategy with the North Bay Watershed Association and the Center for Ecosystem Management and Restoration (CEMAR) to take to foundations. Challenges include matching a monitoring station network to the scale of watershed restoration projects and distinguishing a signal of restoration impacts in the midst of large natural variability. We will discuss how to integrate restoration project monitoring into an overall monitoring framework and opportunities to utilize local stream stewards as volunteer monitors. We will also present plans to disseminate results via a user-friendly watershed scorecard and online map, and data servers hosted by a North Bay Conservation Commons.

Resource Management for Steelhead and Coho Salmon Conservation in Santa Cruz County: San Lorenzo River and Soquel Creek Projects Tour

Thursday, March 5

Field Tour Coordinators*: Chris Berry, Water Resources Manager, City of Santa Cruz, and* ***Kristen Kittleson,*** *Fishery Resource Planner, County of Santa Cruz*

In the San Lorenzo River and Soquel Creek watersheds, multiple agencies including the County of Santa Cruz, City of Santa Cruz and the City of Capitola regulate land use and manage natural resources. The conservation and enhancement of threatened steelhead and endangered coho salmon populations will depend on addressing conflicting needs of riparian and aquatic habitat protection with existing homes and infrastructure, water use and flood control. This tour will visit and discuss efforts to balance flood control and resource management in the urban lagoons of San Lorenzo and Soquel watersheds. In addition, site visits will highlight and discuss the management of large woody material, efforts to reduce erosion from public and private roads, and policies that protect riparian corridors.

Santa Cruz County has had a long history of proactive management in their Public Works, Planning and Environmental Health operations—starting well over 100 years ago when the Board of Supervisors declared the San Lorenzo River "dead"—but in more recent times with the designation of the first State Protected Waterway (the San Lorenzo River), the founding of one of the first local water resource management offices, and implementation of many anadromous fisheries restoration projects. What are lesser-known—but perhaps have as much impact on watershed functions—are the flood control and riparian protection policies that the County has implemented over time. The County is challenged with stream corridors that had already been mostly developed at the time of the implementation of modern planning codes, as well as watersheds which were fundamentally impaired by the industrialization of the late 1800s, and the subsequent urbanization which followed that initial disturbance.

The cities of Santa Cruz and Capitola have similarly challenging resource management issues. Built within the floodplains of the San Lorenzo River and Soquel

Creek (respectively), and—in the case of the City of Santa Cruz—receiving the bulk of their drinking water from the San Lorenzo River, these municipalities have had complex relationships with their respective waterways over time. Due to the two municipalities being so tied to the processes at work upstream in the County jurisdiction, these are perfect examples of the importance of "thinking like a watershed." Correspondingly, partnership amongst upper and lower watershed stakeholders—primarily between the County and cities of Capitola and Santa Cruz—is a common (and necessary) occurrence in these watersheds.

In that vein, the cities and county will once again partner and lead this tour of the San Lorenzo River and Soquel Creek. Specific issues to be explored include policy and operational challenges and future planning for management of flood control and water resources; not only as they regard public health and safety, but also recovery of coho and steelhead. Particular emphasis will be placed on management of urban estuaries/ lagoons, riparian corridors, large woody material, sedimentation, water quality, and instream flows.

Thursday, March 5

Field Tour Coordinator*: Michael Wellborn, California Watershed Network*

The tour of the Carmel River will focus on restoration efforts—current, past and future—that have improved the opportunities for the native steelhead trout. The tour will visit three sites and include presentations on the flooding and drought regimes, the dams and channel constraints, river mouth manipulations, as well as the recent fires and resulting sediment issues. There is much to see and discuss about this watershed in both the technical and the policy arenas. The tour will provide a diverse update from the expert river guides and explore the challenges in an interactive setting.

The Carmel River tour will visit the controversial and sediment-filled San Clemente Dam upstream of Carmel Valley Village, where presenters will give an overview of some of the history of the San Clemente Dam and how it has affected the channel downstream. Presenters will address the issues of the seismic safety project and discuss the proposed excavation and new channel to connect with San Clemente Creek. The tour will also highlight regulatory aspects of lagoon management, monitoring, beach management, and the proposal for developing a long-term management plan; fisheries enhancement, beach management, and augmenting lagoon volume in the dry season. Presenters and participants will discuss planning floodplain alternatives for the lower Carmel River and working with local property owners to develop a solution to reduce flooding and improve the aquatic habitat for steelhead.

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Thursday, March 5, 7:30-9:30pm
Civic Auditorium

Wild & Scenic ENVIRONMENTAL FILM FESTIVAL on tour

The Last Descent

Kathryn Scott, Charlie Center, Scott Ligare

World Premiere

Join a group of world class whitewater kayakers to some of the worlds most amazing rivers...descending them possibly for the last time. The Marsyangdi River of Nepal, the Brahmaputra River in India and the White Nile River in Uganda are all threatened or are in the process of being destroyed by large scale hydroelectric projects. The film closes in California with the Tuolumne River and the growing movement to restore Hetch Hetchy Valley in Yosemite National Park. (US, 2009, 35min, EA) *www.thelastdescent.com, www.internationalriver.org*

Red Gold

Lauren Oakes, Travis Rummel, Ben Knight

Norcal Premiere

The headwaters of the Kvichak and Nushagak Rivers in Bristol Bay, Alaska, are home to the two largest remaining sockeye salmon runs on the planet. And at that same spot, mining companies Northern Dynasty and Anglo American have proposed to extract what may prove to be the richest deposit of gold and copper in the world. The filmmakers spent more than two months in Bristol Bay, documenting the tension between native fishermen who oppose the dam and mine officials who say they will build a 'clean' mine that will leave the salmon's habitat untouched. This exquisite film goes beyond the conflict, offering a portrait of a unique way of life that wouldn't exist if the salmon didn't return with Bristol Bay's tide. Audience Choice Award, Director's Choice Award, Telluride MountainFilm (US, 2008, 55min, E) *www.redgoldfilm.com, www.savebristolbay.org*

State of California Salmonids: Reasons for Pessimism, Reasons for Optimism

Peter Moyle, Ph.D., *Department of Wildlife, Fish, and Conservation Biology and Center for Watershed Sciences, University of California, Davis and* ***Joshua Israel, Ph.D.,*** *Department of Animal Science, University of California, Davis*

Perhaps nowhere in the world are the diversity of salmonids and their problems more evident than in California. The state not only marks the southern end of the range of all anadromous species, but its dynamic geology and climate has resulted in the evolution of many distinctive inland forms, such as the three golden trout subspecies of the Sierra Nevada. The diversity of salmonids is also the result of California's large size (411,000 km2 in length, spanning 10° of latitude), and being adjacent to the California current region of the Pacific Ocean. We evaluated the status of 32 California salmonid taxa (genetically and ecologically distinct groups) in the context of their geographic distribution, demographic threats, societal threats, genetic threats, biocomplexity, and climatic vulnerability. Many are in high demand by sports and commercial fishers; all have high economic value. Anthropogenic threats, both direct and indirect (e.g. climate change) create scenarios where 65% of California's salmon and trout stocks are threatened with extinction within the next 25 to 100 years. California salmonid populations have shown great resilience in the past, seeing them through difficult periods, so there are reasons to be optimistic about the potential for conservation and restoration. However, the statewide downward trends show that we are at a turning point in salmonid science, restoration, and policy in California. If present trends continue, we pessimistically conclude that California will eventually have only 'museum' populations of a few remaining salmon and trout species, maintained with very high effort for display purposes (to remind people what has been lost). Ultimately, wild salmon and trout will persist only if the per capita demand for water declines dramatically and we humans learn to live lighter on the land.

Climate Intensification: More Extreme Extremes of Floods, Droughts, Heat Waves, and Windstorms —Evidence, Uncertainties, and Implications for Salmonid Conservation

Michael J. Furniss, *Hydrologist, Pacific Northwest and Pacific Southwest Research Stations, Redwood Sciences Lab, Arcata, CA*

Warming atmospheric conditions bring more energy and water vapor into the global climatic system. Among the myriad consequences of this are increases in climatic extremes, referred to as "climate intensification." More frequent and more extreme flooding; longer, dryer droughts; hotter and longer heat waves; and stronger and more frequent windstorms have already been observed and are expected to worsen through the 21st century. These effects create cascades of disturbance and change and often compound each other, and interact with other climatic changes and land use to produce cumulative effects to salmonid habitats. Adverse effects can be expected to overwhelm positive effects. The degree of current and potential climate intensification is impossible to precisely define at present, but it is prudent to expect substantial changes in the magnitude and frequency of habitat-forming and destroying events, and a gradual or rapid "ramping up" of disturbance regimes in virtually all watersheds. How can we best reckon coming changes and adapt to prevent or limit effects to salmonids? This presentation will discuss ongoing and potential intensification, what evidence we have, the important uncertainties, and what we can do to respond wisely as we continue our efforts to conserve and recover Pacific coast salmonids.

Challenges in the Coastal Zone: Salmonids as Indicators of Ecosystem and Economic Health

Astrid Scholz, Ph.D., *Vice President, Knowledge Systems, Ecotrust*

On the West Coast of North America, salmonids are the ultimate indicator species—not just for healthy ecosystems, but also for human communities that have thrived here for millennia. As environmental conditions decline on land and in the ocean, there are both direct and indirect effects on the regional economy. Salmon fishermen, suburban gardeners, and electricity rate payers are all linked by the rules and regulations that govern how we manage resources, use water and generate electricity. Recent global environmental and economic change of unprecedented proportions serves as a reminder how disconnected we have become from the values and assets that really matter. We are now faced with the opportunity and the challenge to make the transition to a green economy. Salmon restoration is part of a larger imperative to rebuild our regional economy for all its inhabitants.

Founded in 1991 and based in Portland, Oregon, Ecotrust's mission is to inspire fresh thinking that creates social, environmental, and economic value. We work in the bioregion from Alaska to California. We work locally, but in ways that can be replicated globally. For nearly two decades, Ecotrust has conceived, catalyzed, created, capitalized, and communicated innovative ways to protect and restore environmental conditions while creating economic opportunity for indigenous peoples, local residents, and small businesses. Salmon are an important indicator for measuring progress towards that mission.

Status of Restoration Efforts in Central California Coastal Watersheds

Robert Curry, Ph.D., *Professor Emeritus, Watershed Institute, California State University Monterey Bay*

There are at least 63 named watersheds that drain directly to the Pacific Ocean between Pacifica, just south of San Francisco, and the Big Sur River, about 150 coastline miles south. With few exceptions, all of these are nominally perennial in their lowermost reach, with a riparian corridor and substrate that could support fish and other aquatic organisms. All but about 10 are accessible to anadromous and/or catadromous fish.

I know of no one who is aware of all of the restoration activities in all of these watersheds. I am aware of some of the fish-friendly efforts in but 37 of these basins.

Some of the watercourses require diadromous fish to swim up or down seasonal streams across shingle beaches while others provide rearing and resting habitat in lagoons and estuaries. Some estuaries remain open much of the summer, while most streams and estuaries close seasonally with a bay-mouth bar. Central California is transitional between the dominantly closed Southern California systems and the dominantly open systems north of San Francisco Bay. Reservoir construction coupled with reduced sediment output from logging and agriculture in the last 130 years in these coastal watersheds has resulted in changed coastal access for fish populations. In my opinion, the largest single impediment to anadromous fish restoration remains conflicting coastal lagoon management.

Session Coordinator*: Darcy Aston, Program Director, FishNet 4C*

Coho salmon are listed as an endangered species by state and federal agencies. In response to these listings, both the Department of Fish and Game and NOAA National Marine Fisheries have labored to develop coho recovery plans. The state plan was released in 2004, while the federal plan is slated for completion in early 2009. While planning provides an important framework for actions and can set targets for recovery success, on-the-ground projects are crucial to the recovery of coho salmon populations in California.

This presentation will review the key points of the state and federal recovery plans, as well as highlight efforts at the local level to improve habitat conditions for coho salmon. Local agencies and organizations are implementing innovative and effective projects to improve water quality and habitat, protect instream flow, remove fish migration barriers, and improve agency coordination.

Lagunitas Creek—Long Term Monitoring and Enhancement

Gregory Andrew, *Fishery Program Manager and* ***Eric Ettlinger,*** *Aquatic Ecologist, Marin Municipal Water District*

Lagunitas Creek, a coastal stream, supports one of the largest and most stable populations of coho salmon (*Oncorhynchus kisutch*) in California, with an average annual run of about 600 spawners. It also supports steelhead (*O. mykiss*), and a large population of endangered California freshwater shrimp (*Syncaris pacifica*). Between 1997 and 2007, the Marin Municipal Water District implemented a 10-year program on Lagunitas Creek to monitor population trends and to implement projects to enhance habitat for these species. The conclusion of this 10-year period marks a milestone in salmonid restoration for the watershed. The presentation will review the major findings and conclusions from this long-term effort. The program offers insights into how long-term monitoring can enlighten restoration and management efforts. The monitoring effort dates back to the late 1970s, representing one of the longest data sets for coastal California fisheries. The District's program includes: maintaining stream flows, instream enhancement through large woody debris (LWD), erosion control projects to reduce sedimentation, biotechnical bank stabilization, and riparian revegetation. The monitoring effort has expanded, over the years, to include annual juvenile, spawner, and smolt surveys so that all life stages in the creek are being evaluated to help understand the population dynamics of the coho and steelhead. Coho and steelhead populations have shown an upward trend over the past decade but have fluctuated from year to year. The LWD structures have enhanced habitat and are utilized by juvenile salmonids, however, we have not been able to make a direct link between this habitat enhancement and the population increases. Sediment loading has been reduced but the streambed monitoring efforts have not detected streambed sediment changes resulting from this work; other forces appear to be driving streambed sediment conditions. A limiting factors analysis has pointed to winter and spring storm events being the single most important condition effecting salmonid populations, with flow refuge being the limiting factor. There is a negative correlation between salmonid populations and high spring flows, when the newly emerged fry are lost. Thus, future management efforts should strive to enhance flow refuge habitat and provide floodplain habitat protection. Flow refuge also appears to be a habitat element that may help maintain and enhance the freshwater shrimp population.

Barrier Removal and Coho Enhancement Actions in the Lagunitas and Redwood Creek Watersheds

Kallie Kull, *Senior Planner, Marin County Public Works Fish Passage Program*

This presentation will feature an overview of Marin County's fishery restoration projects, with the ultimate objective of recovering the last potentially viable runs of coho salmon on the Central California Coast. A compilation of projects by multiple entities all add to a unified effort to restore these watersheds during this critical time for salmon. The talk will move beyond specific project implementation to make the connection between fish passage restoration and the broader context of coho restoration. The recent study, Lagunitas Limiting Factors Analysis for Coho Salmon and Steelhead (2008), illustrates the connection between juvenile salmon survival and ability to access key tributary refugia during high winter flow events. Use of studies such as this can help to guide fishery restorationists to implement projects with the greatest opportunity for aiding in coho salmon recovery.

Passenger Pigeons, Dodo Birds...Condors and Coho? Central California Coast Coho Salmon and our Last Chance to Save them from Extinction

Charlotte Ambrose, Recovery Coordinator, Santa Rosa, CA

Central California Coast (CCC) coho salmon are critically at risk of becoming extinct in the near future. NMFS listed this species as threatened under the Federal Endangered Species Act in October 1996. The population continued to plummet towards extinction and they were re-listed as endangered in June 2005. A coordinated, strategic and range-wide effort must begin immediately or we face the loss of an iconic species. The federal recovery plan for CCC coho salmon is targeted for public release in March 2009. Population data and criteria, developed by the NMFS Southwest Fisheries Science Center, set the foundation for the recovery scenario. To assess current instream conditions and threats, data was gathered from all possible sources willing to provide their information including the public, stakeholders and agencies (especially the California Department of Fish and Game).

NMFS' preliminary findings indicate:

- CCC coho salmon populations are at critically low levels, or no longer exist (e.g., extirpated), in all but a few watersheds south of the Navarro River.
- CCC coho salmon survival through, and between, life stages are poor due to impaired habitats for egg survival and emergence, juvenile summer and over-winter rearing and smolt out-migration. Generally, poor habitats are the result of a region-wide lack of complex pools/off-channel/floodplain habitats, high summer water temperatures and excessive instream sediment. Habitat impairment has been linked with roads, timber harvesting and conversion, channel modification, water diversion and impoundment, climate change and agricultural practices.
- Poor ocean conditions also have a prominent role in the species' decline, and are acting in synchrony with poor instream conditions. Coho have evolved under fluctuating conditions for centuries, but the rate of change in the freshwater systems (due to human activities) has accelerated habitat impairment and, thus, population declines. A year or two of poor marine survival has different implications for the population in a watershed that produced 200 smolts versus one producing 20,000 smolts.

The federal recovery plan immediate goals for CCC coho salmon are to:

- Prevent extinction by protecting all existing populations and their habitats;
- Maintain current populations and expand them through focused and prioritized restoration actions in critical areas;
- Prevent degradation of existing high quality habitats across the historical range (especially areas that have supported populations within the last four generations);
- Restore habitat conditions and watershed processes across the range; and
- Control and abate future threats to provide for their long-term survival and recovery.

The top ten priority actions to attain these goals are:

- Implement a Statewide Coastal Monitoring as soon as possible;
- Target restoration funds to critical areas and needs (e.g., current watersheds with CCC coho salmon persisting, emphasizing LWD and floodplain/off-channel areas);
- Improve and enforce water resource regulations;
- Work with key counties on general plans, ordinances and LWD retention programs;
- Promote improvements in all local/State/Federal policies and practices for roads;
- Encourage State Board of Forestry to develop no-take rules or apply for a Statewide HCP;
- Provide incentives to retain forestlands and reduce forest conversions;
- Conduct outreach on climate change and encourage all local/State/Federal planning to account for anticipated droughts and climate change;
- Create incentives to promote immediate species protection and habitat enhancement;
- Ensure continuous funding for the CCC coho salmon Russian River Captive Broodstock Program; and
- Immediately create a coho strike team to respond to issues, conduct outreach and develop multidisciplinary groups to work on preventing CCC coho extinction and facilitate recovery implementation.

Coastal Streamflow Stewardship Project—Trout Unlimited

Brian Johnson, *Trout Unlimited*

California's current system of water right administration is broken: it fails to protect either water users or salmon and steelhead habitat, and it actively discourages innovative efforts to restore and protect stream flows.

Through the Coastal Streamflow Stewardship Project (CSSP), Trout Unlimited (TU) is working with landowners in 4-6 coastal watersheds from the Klamath River down to the Santa Barbara area to develop water management tools and identify projects to protect and reconnect stream flow, including coordinating diversions and implementing rotation schedules, storing winter water for summer use, and improving irrigation efficiency.

CSSP pushes restoration beyond physical projects: the new approach will establish benchmarks based on stream characteristics and habitat needs, install instruments to track actual conditions, and cooperatively manage diversions to achieve better (and more cost-effective) results than any water user could achieve alone. CSSP will ensure that participating water users meet established instream flow levels, and use scientific, technological and legal tools to ensure monitoring, compliance, and long-term management solutions.

By developing physical and management solutions to stream flow problems, and taking joint actions to improve habitat at the most critical locations in the watershed—for example, by coordinating diversion schedules to maintain flows at particular points on a stream—CSSP will increase protection for aquatic species dependent upon instream flows and provide water users a more cost-effective and reliable way to meet their needs.

Working with our science-based non-profit partner, the Center for Ecosystem Management and Restoration (CEMAR), we are identifying initial partners and selecting pilot watersheds that can serve as models in a broad range of coastal watersheds. Pilot stream selection is based on several criteria: (1) feasibility of salmonid restoration, (2) degree of impairment of stream and estuary by diminished flows, (3) critical mass of landowners interested in collaboration, and (4) a diverse combination of characteristics including water supply, water rights ownership, and geography. In our first three candidate watersheds -- the Mattole River, San Gregorio Creek, and Grape Creek—we have begun installing gauges and discussing potential projects with landowners. This year we plan to identify three more pilot watersheds where local efforts are already underway, and where the combination of local efforts and our scientific and legal capacity could have significant benefits for fish and water users.

To date, no individual or organization has successfully accomplished wide-scale stream flow restoration in California. The solutions and opportunities that CSSP present are unprecedented, and state agencies have embraced the program. Both the Department of Fish and Game and the State Water Resources Control Board have expressed their support. Moreover, the California Coastal Conservancy awarded TU $600,000 to implement CSSP. To date, we have raised hundreds of thousands of dollars in project match.

TU has been working on water rights reform and streamflow matters in California for 20 years. TU was the principal architect of landmark legislation for progressive water reform along the North Coast and has a proven track record in stream restoration partnerships with private landowners.

Testing Biological Effectiveness with the Little Browns Creek Migration Barrier Removal Project

Christine Jordan, *Assistant Program Manager, Five Counties Salmonid Conservation Program (5C)*

Little Browns Creek (LBC) is a tributary to Weaver Creek, which in turn is a tributary to the Trinity River. The LBC Migration Barrier Removal Project at Roundy Road was ranked as one of the highest priority County-maintained stream crossings in need of replacement within the 5C Program area. This ranking was based on the 5C criteria including FishXing results, historic and existing species and life stages utilizing the stream, the condition and sizing of the culverts, the quantity and quality of upstream habitat, and the fact that lower reaches of LBC dry up during critical summer months, making upstream areas prime refugia for rearing juveniles. Completion of the LBC project in October 2007 marked the 51st barrier removal project constructed in the 5C area since 2000.

LBC was designated as critical habitat for Southern Oregon Northern California Coast (SONCC) coho up to the crossing, prior to project construction (NMFS, 1997). The CA Coho Recovery Strategy (CDFG, 2004) identifies Weaver Creek and LBC (tributary to Weaver Creek) as a priority watershed due to the consistent presence of coho and steelhead, the high ranking for risk of coho extinction, and high potential for restoration of habitat. Coho salmon and steelhead utilize LBC for spawning and rearing (CDFG, USFS) and had been observed up to the crossing on Roundy Road, but were never observed above this point.

The Trinity River Total Maximum Daily Load Allocation Sediment Indicators and Targets also called for physical and ecological restoration of streams in this reach of the Trinity River (EPA, 2000). The channel upstream of the undersized culverts was severely aggraded and braided for ~300 feet, resulting in subsurface summer flows. The channel below the project has been straightened, is down-cutting and lacks large wood. The three 48" culverts were replaced with a bridge, the 300-foot long aggraded channel was excavated (1,400 cubic yards) and a roughened channel constructed to reduce upstream headcutting. Bioengineering and large wood placement were utilized for streambank stabilization.

Even with abysmal flows in 2007 and 2008, one salmonid was observed in a pool in the project site in August 2008, indicating successful passage at the site. In an effort to gauge the effectiveness of passage projects that are complete barriers, the LBC project was granted a NOAA Open Rivers grant to include a substantive post-project monitoring effort. The monitoring plan consists of collecting data on physical channel modifications in response to construction of the roughened channel, as well as monitoring flows and temperature. The biological response is being assessed through presence, absence, spawning surveys, and out-migrant trapping. The first stream flows after the project were not recorded until December 4, 2007 and no channel forming flows occurred during HY 2008. HY 2007 and 2008 are also listed as the ninth driest two-year period in 88 years of record (DWR). The LBC project will have been monitored for two seasons in spring 2009 and the methodology, results, and lessons learned will be highlighted in the presentation. See www.5counties.org for more detailed information on this project and the 5C Program's elements and other projects.

Restoration of Coho Salmon in California —Where are We and Where Do We Want to Go?

Stephen Swales Ph.D., *Coordinator Coho Recovery Plan, Fisheries Branch, California Department of Fish & Game*

The Recovery Strategy for California Coho Salmon was published in February 2004 by the California Department of Fish & Game in response to a directive from the California Fish & Game Commission. Coho salmon are federally listed as threatened in the Southern Oregon Northern California Coast (SONCC) ESU and endangered in the Central California Coast (CCC) ESU. Coho salmon populations have experienced a significant decline in the past 40-50 years, from San Francisco to the Oregon border, and currently are thought to be 6-15% of their abundance during the 1940s. Recent abundance trend information for several stream systems along the central and north coasts indicates an overall declining trend throughout California, with many populations being either extinct or facing extinction in the near future.

The primary objective of the Recovery Strategy is to return coho salmon to a level of sustained viability, while protecting the genetic integrity of both ESUs so that they can be de-listed. A second objective of the Recovery Strategy is to achieve harvestable populations of coho salmon for tribal, recreational and commercial fisheries, which are so important to the cultural and economic well-being of California. Improving coho salmon populations and habitat are considered to be the primary means to achieve these two objectives.

This presentation will discuss the current status of coho salmon recovery efforts in California and where we would like to go in the future. In particular, the discussion will focus on efforts to restore coho habitat in streams and rivers under the Fisheries Restoration Grants Program and changes in policy and procedure to protect coho salmon. The main difficulties facing implementing the Recovery Strategy will be discussed and possible methods to circumvent such difficulties outlined.

Dam Removal and Modifications for Salmonid Recovery

Friday Afternoon Concurrent Session 2

Session Coordinator*: Matt Stoecker, Stoecker Ecological and Beyond Searsville Dam*

With the largest planned dam removal and river restoration project in the world recently announced for the Klamath River, we are at a pivotal turning point in the history of dams in our country. With the era of large dam construction behind us and obsolete small dams being torn down at a rapid pace, we are now moving into the exciting chapter of removing large dams and dramatically reversing decades of damage to our watersheds and fisheries. Large and small, the removal or modification of these structures will improve watershed health and restore native species to historic habitat as well as revive recreational opportunities and the communities that live within these basins. Presenters in this session will educate us on the most recent dam removal projects in California, as well as discuss some dam removals currently in the planning phases and other future opportunities. Come join this great line up of damolitionists as they present multimedia, inspirational talks on some amazing recently completed dam removal and modification success from Alameda Creek, Whites Gulch on the Salmon River, Giacommini Wetlands at Pt. Reyes, Carpinteria Creek, and others from around the state. Hear about the impressive plans for removing the four dams on the upper Klamath River and obsolete San Clemente Dam on the nearby Carmel River. Finally, consider complex sediment issues and dam removal opportunities for Searsville, Rindge, Matilija, York, and San Clemente Dams and what Professor Matt Kondolf describes as coastal California's "Big Five" dam removal opportunities. It's going to be a dam good time!

The Big Five: Commonalities and Differences Among Proposed Dam Removals in the California Coast Ranges

Clare O'Reilly (Presenter), Sarah Richmond, and Matt Kondolf, University of California, Berkeley

Dams on Malibu Creek, Matilija Creek, Carmel River, San Francisquito Creek, and York Creek have all filled (or nearly) with sediment, as expected for small water supply reservoirs in high sediment-yield catchments. Among the major issues with decommissioning these structures is managing accumulated sediments. We contrast the five case studies, emphasizing the challenges of managing the sediment, the studies undertaken, and (for those far enough along) the alternatives chosen.

Up Your Creek—Dam Removal and Fish Passage Projects in Alameda Creek

Jeff Miller, *Alameda Creek Alliance*

Efforts are underway to restore steelhead trout to the Alameda Creek watershed in southeastern San Francisco Bay. A consortium of over a dozen agencies is pursuing fish passage projects including dam removals, construction of fish ladders at instream barriers, and installation of fish screens at water diversions. Four dams have been removed from Alameda Creek since 2001 and the first fish screens were installed in 2007. Agencies plan to construct a fish ladder at the major barrier to anadromous fish migration in the lower watershed by 2010. Removal of a rubber dam, construction of an additional fish ladder, and two more fish screen projects are scheduled to be completed in the lower creek by 2012 or 2013. Two more fish passage projects are being pursued in the middle watershed at barriers in the Niles Canyon and lower Sunol Valley reaches. None of the three major dams in the watershed currently have minimum flow requirements for fish populations downstream. Calaveras Dam, which blocks the Calaveras Creek sub-watershed, is scheduled to be rebuilt by the City of San Francisco by 2012. The Alameda Creek Alliance and state and federal regulators are pushing for adequate flow releases and dam operations to allow for restoration of steelhead below the dams. The Alameda Creek Alliance is also advocating for the removal of the 32-foot high Alameda Diversion Dam from upper Alameda Creek, which would restore natural stream flow and hydrology to upper Alameda Creek. Currently planned fish passage projects will make up to 25 miles of potential spawning and rearing habitat accessible to ocean-run fish.

Let the River Run Free: Dam Removal on the Klamath River

Michael Belchik, *Senior Fisheries Biologist, Yurok Tribal Fisheries Program*

A milestone agreement has been reached to remove the lower four dams on the Klamath in what will be the largest dam removal project in the history of the United States. This agreement was the result of a long and carefully calculated path that resulted in the company, PacifiCorp, making a business decision to fund dam removal. Despite this milestone, significant work must be done to reach and implement a final agreement. Dam removal will have significant benefits to the fishery, but will also pose risks in the form of sediment releases. The effects to the Klamath River will depend on the details of dam removal: how the dams are removed, the sequence of removal, and even the time of year that they are removed. Our experience to date on the Klamath, while acknowledging that much work must be done to effect the final agreement and dam removal, may provide insights to others hoping for a similar result.

Geomorphic Stability and Fish Passage Potential for the Proposed San Clemente Dam Bypass Channel

Andy Collison (Presenter), and Matt Wickland, Philip Williams & Associates and Sharon Kramer, HT Harvey & Associates

Constructed in 1921, the San Clemente dam blocks steelhead migration and coarse sediment transport from the upper 125 square miles of the Carmel River watershed, and is now largely filled with sediment. The Coastal Conservancy and CalAm Water are planning to remove the dam in the next few years. The project will leave the sediment in place, diverting the Carmel River around the reservoir through a tributary, San Clemente Creek, in effect simulating a geological river capture. Diverting the Carmel River down this much smaller and steeper tributary poses a geomorphic and fish passage challenge. In order to assess potential fish passage issues the consultant team used fisheries data to develop a behavioral understanding of how steelhead currently migrate up the passable reaches of the river (e.g. the range of flows under which fish currently migrate). We then constructed a continuous hydrodynamic model of a geomorphically-based diversion channel and tested the ability of fish to migrate up the new channel.

The results suggest that provided a stable step-pool system can be sustained, fish passage through the new channel should be possible under almost all conditions where migration currently takes place in natural reaches.

It's About Dam Time! Lessons Learned in Dam Removal

Leah Mahan (Presenter), *NOAA Fisheries and* ***Marcin Whitman,*** *Department of Fish & Game and* ***Thomas Dunklin,*** *videographer*

Each year an increasing number of small dam removal projects are implemented throughout California to restore natural riverine processes, and improve passage for aquatic organisms. As more and more dam removal projects are completed, we are building a wealth of tools and knowledge about how to effectively plan, implement and monitor these small dam removals. This information is essential to expedite future projects, and avoid common pitfalls we have encountered in the past. This presentation will discuss some common challenges that communities and restoration practitioners face with dam removal projects, and how we can learn from others' solutions to these challenges. In addition, the speakers will review dam removal projects completed in California during the field season of 2008, and will provide monitoring updates on select dam removals from preceding years.

Going Tidal—Restoring Natural Hydrologic Dynamics in Point Reyes National Seashore, Marin County, CA

Brannon Ketcham (Presenter), *Hydrologist, Point Reyes National Seashore,* ***Lorraine Parsons,*** *Wetland Ecologist Point Reyes Station, and* ***Mark Cederborg****, Hanford Applied Restoration and Conservation*

The fall of 2008 represented the culmination of multiple projects that cumulatively have restored natural tidal and floodplain dynamics to more than 575 acres of habitat within the Point Reyes National Seashore. Two earthen dams were removed to restore tidal process and fish passage to two streams within the Drakes Estero watershed. At the head of Tomales Bay, more than three miles of levee were removed to restore natural floodplain and tidal dynamics at the confluence of the Bay with Lagunitas and Olema Creek. These projects have restored connectivity between estuarine and floodplain habitats and are important to the expansion and enhancement of salmonid overwintering and smolt outmigration habitat.

Completion of the Giacomini Wetland Restoration has resulted in the reintroduction of tidal and floodplain dynamics to more than 550 acres at the head of Tomales Bay. A "Wetland of International Importance," Tomales Bay and its largest tributaries Lagunitas and Olema Creek support five federally threatened or endangered aquatic species, including the southernmost stable population of coho salmon. More than two-thirds of the Bay's fresh water flows through the project area. Historically, levees constrained most of these flows to Lagunitas Creek, funneling them directly into the Bay. Removal of levees, tidegates, and other hydrologic impediments resulted in the restoration of hydrologic connectivity, reduction in local flood elevations, an increase in floodwater retention, and potentially a decrease in the delivery of sediment and pollutants to the Bay. More than 150,000 CY of material was handled within the project area, with 2/3 managed onsite, and another 1/3 hauled offsite and used to restore abandoned quarries in other areas of the seashore. The return of natural tidal and floodplain dynamics to the estuarine transition zone at the confluence of Lagunitas Creek and Tomales Bay will have long-lasting physical and ecological benefits to Tomales Bay and may play a key role in the long-term viability of coho salmon in the watershed.

The details of construction sequencing and water management associated with the levee and dam removal projects within actively tidal areas will be summarized.

Humility or Hubris—Restoration at the Crossroads

Session Coordinator*: Felice Pace, Klamath Forest Activist*

In this presentation, one of the pioneers of the restoration economy investigates the historical roots and modern practice of fisheries, watershed and habitat restoration, and sounds a wake up call about the future of restoration. The author believes that support for restoration will evaporate unless non-performing and boondoggle projects are eliminated and positive results are demonstrated.

Examples of the Restoration Economy, drawn from the Klamath River Basin, the 2002 Farm Bill, the Northwest Forest Plan's Jobs-in-the-Woods Program and the National Restoration Science Synthesis, are presented and analyzed in order to demonstrate the failure to apply standards and require positive results. Objective data on the condition of forests, watersheds and fisheries are presented to support the premise that, while restoration programs have proliferated and funding has increased, the promised restoration benefits have generally not been forthcoming.

The efforts of scientists and others to develop and implement restoration standards for river, forest and watershed restoration and to institutionalize effectiveness monitoring are discussed as are the politics influencing restoration funding decisions. Farm Bill conservation programs and the forces driving the future of these programs are described, and the political processes by which Farm Bill conservation programs are stripped of their conservation benefits and turned into political pork are discussed.

The presenter believes that the lack of standards and results evaluation, the collaborative structure of most restoration efforts and the fact that politicians and others often equate successful restoration with the establishment of programs and the funding of projects, rather than with results, are identified as major obstacles to effective restoration. Restorationists are urged to champion standards and accountability within watershed councils and other collaborative groups. They are also urged to get involved in the political processes when restoration programs are authorized, funding is appropriated by federal and state legislatures and when restoration program policies and procedures are established or changed by government agencies.

The presenter argues that restoration scientists, specialists and supporters should become strong and involved champions of restoration standards and accountability because that is in their interest and critical to the future of their industry. He recommends that restorationists create or empower state-wide and industry-wide organizations to work with state and federal legislatures and the agencies which oversee and distribute restoration funding in order to advocate for, establish and institutionalize restoration standards and accountability procedures.

Restoring a Rangeland Watershed & its Endemic Rainbow Trout in the Face of Climate Change: Eagle Lake Rainbow Trout and Pine Creek, California

Lisa Thompson (Presenter); *and* ***Craig Fergus,*** *Wildlife, Fish, and Conservation Biology Department, University of California Davis;* ***David F. Lile,*** *University of California Cooperative Extension, Lassen County;* ***Peter B. Moyle,*** *Wildlife, Fish, and Conservation Biology Department, University of California Davis;* ***Kenneth W. Tate,*** *Department of Plant Sciences, University of California Davis;* ***Teresa E. Pustejovsky,*** *Wildlife, Fish, and Conservation Biology Department, University of California Davis;* ***Karen Vandersall,*** *US Forest Service, Eagle Lake Ranger District, Lassen National Forest; and* ***Gerard Carmona Catot,*** *Wildlife, Fish, and Conservation Biology Department*

The endemic Eagle Lake rainbow trout (ELRT, Oncorhynchus mykiss aquilarum) has been denied access to critical spawning and rearing habitat for over 50 years. Over 100+ years of modifications of Pine Creek watershed (e.g., overgrazing, timber harvest, passage barriers) have decoupled the ELRT from its stream habitat and brook trout (Salvelinus fontinalis) now dominate historic rearing areas in the upper watershed. Passage barriers were constructed on Eagle Lake tributaries to prevent ELRT from spawning in degraded habitat. Since 1950 the lake fishery has been maintained by artificial spawning. Offspring are reared in hatcheries and released into Eagle Lake. Since 1987 changes in grazing management, reconstruction of culverts, and other conservation projects have resulted in marked improvement of habitat, although ELRT have been not allowed to attempt their natural spawning migration. Their ability to migrate has been questioned, and concerns led to a petition for listing under the federal Endangered Species Act. Climate change may also impact ELRT migration, since Pine Creek flows are dependent on spring snowmelt, and often the creek is connected from its headwaters to Eagle Lake only during the snowmelt period. In summer only the upper six miles of the creek has water, so spawners must reach this area in order for their offspring to rear successfully. If climate change affects the accumulation of snowpack, or the timing of its melt, the ability of ELRT to migrate may be compromised.

We report on an ongoing study to track the migration of ELRT spawners in Pine Creek, and to relate migration to environmental factors and potential impacts of climate change. Since 1999 samples of ELRT spawners have been radio-tagged and released into Pine Creek, and their upstream migration distances tracked. In 2006 we piloted a switch to passive integrated transponder (PIT) tags, a less invasive tagging method. In spring 2008 we used PIT antennas to track the upstream movement of ELRT spawners. We captured a sample of ELRT at the barrier near the mouth of Pine Creek during the spring spawning migration period. The fish were anesthetized, surgically implanted with PIT tags, and released upstream of the passage barrier. Upstream migration of ELRT was monitored in the lower, middle, and upper sections of Pine Creek with five channel-spanning stationary PIT antennas. Stream flow was low and erratic in 2008, and ELRT migrated less than 2 miles upstream, far short of the 22 miles necessary to reach areas with perennial summer flows.

In order to relate ELRT migration to environmental factors and potential impacts of climate change, we assembled historical data for stream flow, snowpack, air temperature, and fish migration distances (the furthest distance an ELRT swam up Pine Creek in a given year). Migration distance was positively related to seasonal average stream flow, total days of flow, and April snowpack. April air temperature did not help in interpreting the effect of snowpack and melting patterns. However, only monthly average air temperature data were available. In future, more detailed temperature data that show heat wave patterns may be useful.

The California Advisory Committee on Salmon and Steelhead Trout: an Epic of Stymied Good Intentions

***Barbara J. Stickel, M.A. Candidate**, California Polytechnic State University, Department of History, and Commercial Fishing Representative on California Advisory Committee on Salmon and Steelhead Trout*

The California Advisory Committee on Salmon and Steelhead Trout (CAC) was originally created in 1970 as an advisory body to the California Legislature and the Department of Fish and Game. The CAC was expected to operate autonomously, helping ensure the political will needed to restore California's declining salmon runs. However, since the early 1990s the CAC has been neither funded nor staffed to conduct the studies and other activities necessary to fully comply with their directive to oversee California's salmon restoration program. Likewise, although annual reporting, accompanied by proposed legislative changes, as needed, was originally anticipated, it has been twenty years since the last full CAC report to the Joint Legislative Committee on Fisheries and Aquaculture was prepared.

Although the intent of this paper was to demonstrate the CAC's continuing value, it also reveals a consistent lack of political will to fund and aggressively enforce the Fish and Game Code and legislative mandates as the limiting factors in restoring California's salmon, in general, and in CAC operation, in particular, with apparent political tampering facilitating events which have cost taxpayers millions of dollars while benefiting a select few. In addition, the state's failure to adopt CAC recommendations, coupled with the CAC's inability to maintain staff, has compounded the current West Coast salmon disaster and furthered salmon declines. Salmon restoration suffers incessantly from shortages in funding, enforcement, monitoring, oversight, habitat protection and political will. CAC staff and reporting would alleviate many of the difficulties encountered. Moreover, CAC staffing could potentially have saved taxpayers millions of dollars and helped avoid the 2008 collapse of the Sacramento River Fall Run Chinook. Californians should be outraged that billions of taxpayer dollars have been spent on restoration, with no end in sight, and little if any relief provided to their salmon. They should demand to be heard through their CAC.

A Triage Approach to Restoring Key Steelhead Streams of the California Coast

Gordon Becker (Presenter) *and* ***Andrew Gunther, Ph.D.,*** *Center for Ecosystem Management and Restoration*

To even casual observers, it must be clear that existing processes related to steelhead restoration planning for the California coast are at best deliberate and underfunded. At worst, they may be said to be opaque and incapable by their nature of treating all aspects of recovery. We have developed an approach based on field observations of steelhead resources that can quickly establish critical geographic focus for the region needed for restoration planning in the face of fiscal constraints. Existing watershed assessments and expert opinion then are used to determine the most promising restoration opportunities for the study area, consisting of a set of projects to address passage barriers, riparian/riverine corridor health, and instream flows. In some watersheds, additional data collection and development of collaborative capacity and commitment among stakeholders are necessary prerequisites. With increased public support and participation in a context of focused funding, or approach is intended to produce a biological response (i.e., increasing steelhead populations) within a reasonable time frame. This response, verified by monitoring in representative streams, is the fundamental outcome required for continuing support for proactive steelhead restoration efforts. The perilous state of steelhead, particularly in the southernmost portions of the species range, demands that a novel and effective approach to restoration planning is adopted immediately.

Headwater Tributaries of the Upper Lagunitas Watershed: Important Coho Spawning and Rearing Habitat?

Paola Bouley (Presenter), Todd Steiner, and Chris Pincetich,
Salmon Protection and Watershed Network

The upper portions of the Lagunitas Creek Watershed (the San Geronimo sub-watershed) contain the vast majority of human development including 1500 residential parcels with many developed right up to (and over) the creek, failing septic systems, large areas of impervious surfaces in the riparian zone, lack of instream woody debris, migration barriers (for both spawners and juveniles) water diversions, pesticide use, invasive species and other human-induced impacts commonly associated with suburbanization.

Yet this sub-watershed still supports +30% percent of the total spawning coho population in the Lagunitas Creek Watershed. Additionally, the smaller tributaries to San Geronimo Creek support 8-30% of the total spawning population even though they represent a disproportionately small percentage of available stream area compared to the mainstem of San Geronimo and Lagunitas Creeks.

While the rearing potential of these smaller tributaries is not well understood, they appear to be winter refuge habitats for juvenile salmon. These smaller tributaries have long been overlooked as important habitat and are being impacted from ongoing development pressures that are effectively reducing habitat quality and compromising recovery efforts for this endangered run of coho salmon.

The authors will discuss the current understanding conditions on these tributaries in detail while highlighting current and future studies that seek to answer vital questions about coho salmon productivity in these reaches. Lastly the authors will describe recent regulatory and educational efforts to protect and restore coho habitat in these headwater regions, in particular a moratorium on streamside development, a cumulative impact analysis, a riparian-zone protection ordinance, and community-based stream monitoring and restoration programs.

Navigating the Restoration Money Maze: Plotting a Course for Funding Support

Mel Kreb, *former District Director, California Conservation Corps-Northern Service District and* ***Michelle Rankin,*** *Center Director, California Conservation Corps-Fortuna Center*

The California Conservation Corps is a workforce development program that hires young adults between the ages of 18 and 25 to spend a year of their lives engaged in conservation and restoration work throughout California. During their one to two year tour in the Corps, CCC corpsmembers develop a strong work ethic and marketable job skills while learning responsibility, self-discipline, teamwork, self-care, and good work habits. Corpsmembers also reap the rewards of becoming part of something bigger than themselves, achieving a sense of commitment to community and a responsibility to society as a whole. In the process, the CCC improves the ecology of California's lands and rivers.

The CCC receives approximately 30% of its funding from the State General Fund and the remainder comes from the reimbursement dollars earned by crews of corpsmembers completing environmental restoration projects throughout California. This 70% funding gap puts the CCC in a unique situation for a State Department that is similar to that faced by non-profits and community based organizations everywhere – how to find the money you need to keep your operation moving forward.

Mel and Michelle will share their experiences in navigating available funding for fisheries restoration and other environmental projects, and will offer their thoughts on:

- Knowing your organization's strengths and challenges and sharing those in a way that will interest potential funders.
- Striking the balance between finding money that will support your work and changing your work to find the money.
- Developing your grant application – does it really matter if your proposal is bound correctly and your staples are in the right place?
- And the #1 secret to finding the funds you need….It's not about money at all, it's about relationships!!

Come hear from two experienced fundraisers about the joys and challenges of the grant game.

FishNet 4C: A Regional Approach to Salmonid Protection and Recovery

Darcy Aston, FishNet 4C

FishNet 4C is a County-based salmon protection and restoration program that brings together the Central California Coastal Counties of Sonoma, Marin, San Mateo, Santa Cruz and Monterey. In light of the Endangered Species listings of coho salmon (1996) and steelhead trout (1997), County Supervisors took a proactive approach and formed FishNet 4C. Since its inception in 1998, FishNet has provided the coordination for the Central California Coastal Counties to move forward with programs for salmon and fishery restoration.

The focus of the FishNet program is on implementing on-the-ground restoration projects, employing best management practices during maintenance activities, and incorporating aquatic habitat protections into land use regulations and policies. This poster confab will feature an overview of FishNet 4C's decade of program development, as well as posters from each of the five counties highlighting on-the-ground projects that are contributing to salmonid recovery.

Water for Fish and Farms—Providing Real-Time Flow Data and Biological Context to Water Users

Jonathan Koehler (Presenter), B.E. Zlomke, C.W. Edwards, F.N. Knapczyk, and P.D. Blank, Napa County RCD, and J.S. Kobor, DHI Water & Environment

This project studied the relationships between water use, stream flow, and steelhead populations in the Napa River watershed. The Napa County RCD worked with farmers and biologists to examine low flow conditions for steelhead trout in three Napa River tributaries to determine whether the timing of water withdrawals could be modified to improve habitat conditions. Three study streams (Carneros, Redwood, and York Creeks) were selected based on presence of agriculture and steelhead populations. We established six telemetric stream gauging stations (two per stream) at key locations, to provide real-time low flow information to water users via telephone and internet. We built a comprehensive hydraulic model for the Carneros and Redwood creek watersheds to explore changes in timing of surface water withdrawals. The model was used to explore three scenarios to quantify the effect of current creek pumping practices and the effects of possible changes in timing of withdrawals.

Fisheries monitoring and modeling was used to explore the relationship between incremental flow changes and fish habitat. A PHABSIM model of each creek was used to quantify the habitat value associated with various low flow levels. We are working with a technical and community advisory committee, consisting primarily of fisheries biologists and land/water management practitioners, to conduct community outreach. A webpage was constructed to display the data and allow water users access via the internet.

Our preliminary conclusions are that the current timing of withdrawals for agricultural use is concentrated in the rainy season and appropriately so, since springtime flows are uncertain. We did not see a significant effect on springtime flows from agricultural pumping during winter. Rural residential riparian use may be more significant for fish during low flow periods and will be addressed in project outreach.

S T R A W: Students and Teachers Restoring A Watershed, Student Driven Restoration of Riparian and Marsh Habitat

Emily Allen (Presenter), Laurette Rogers, John Parodi, and Crystal Sanders, STRAW, The Bay Institute

The STRAW Project coordinates and sustains a network of K-12 teachers, students, and community members as they plan and implement watershed projects leading to habitat restoration. The STRAW Project works with technical professionals in the North Bay to restore the watersheds through action and education. In the 2007-2008 school year, almost 90 teachers and 1,900 students received training and support in environmental project-based learning, watershed curriculum, bird research and aquatic insect monitoring, restoring 8,248 linear feet of creek bank. Since 1993, more than 15,000 students have participated in over 270 STRAW restorations on rural and urban creeks, planting over 27,000 native plants and restoring approximately 95,000 linear feet of creek banks or almost 85 acres. STRAW has the following goals: to empower students, to support teachers, to restore the environment, and to reconnect communities.

STRAW completed 29 restoration days this year, with over 75 classes participating. Fifteen of these restorations occurred on ranches with Prunuske Chatham, Inc. (the ecological consulting firm that helped to found the Shrimp Project, the precursor of STRAW) facilitating the preparation and training for restoration. STRAW students are trained to create biotechnical restoration structures such as willow wattles and willow walls to address more severe erosion problems. Seven restoration projects were facilitated by the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) in more developed or urbanized areas, where students plant native species and also remove non-native, invasive vegetation that has destroyed habitat and damaged the food web of native species.

The STRAW network consists of many committed, long-term partners, including the Marin Resource Conservation District, PRBO Conservation Science, Conservation Corps North Bay, San Pablo Bay National Wildlife Refuge, and more. With our partners, we support a variety of watershed studies and implement and design restoration activities. For example, PRBO monitors many of the restoration sites, finding that the restored sites had an increase in species of birds. For example, at one project site in Marin County, the unrestored area had 8 species of birds while the restored area had 22 species.

California Department of Fish and Game Fisheries Restoration Grant Program Coastal Restoration Monitoring and Evaluation Program (CRMEP)

***Florence Consolati** and **Nicolas Bauer**, Fisheries Biologists, Pacific States Marine Fisheries Commission, CDFG Coastal Restoration Monitoring and Evaluation Program*

Since 1981, the California Department of Fish and Game (DFG) Fisheries Restoration Grant Program (FRGP) has annually funded coastal watershed restoration projects which focus on conserving and restoring watershed conditions and processes which affect the health of salmon and steelhead inland habitat. Funding is provided by the State of California and the NOAA Fisheries Pacific Coastal Salmon Recovery Fund (PCSRF). Project types supported by the FRGP include: habitat protection and restoration, watershed planning and assessment, research, monitoring and evaluation, outreach and education, and salmon enhancement. The FRGP began monitoring and evaluating post-project effectiveness in 1993. Then in 2004 the Coastal Restoration Monitoring and Evaluation Program (CRMEP) initiated monitoring both project implementation and effectiveness. The information collected by the CRMEP is used to assess both the accomplishments of the FRGP and the effectiveness of the restoration activities it supports.

Habitat restoration projects implement one or more distinct on-the-ground treatments that construct physical features intended to interact with the environment to help conserve or improve anadromous salmonid inland habitat. The CRMEP conducts or supports three types of qualitative restoration project monitoring: implementation, effectiveness, and validation. FRGP implementation and effectiveness monitoring is primarily project-treatment specific. Individual FRGP funded projects are selected and then the features constructed in the project work sites are monitored to assess how well they were implemented and how effective they are in meeting their intended habitat objectives. Validation monitoring is intended to evaluate whether the hypothesized responses of habitat, watershed processes, and/or populations to watershed restoration activities are correct. At this time the CRMEP is primarily focused on implementation and effectiveness monitoring.

The Coastal Restoration Monitoring and Evaluation Program (CRMEP) addresses three main adaptive management questions:

- What has the FRGP accomplished?
- Are habitat restoration activities effective?
- Has there been a positive response to restoration efforts?

The 2004-2007 accomplishments of the CRMEP will be presented, while addressing the three adaptive management questions.

Improved Strategies for the Design, Installation, and Maintenance of Effective Rolling Dips

Tom Leroy and *William Weaver*, *Pacific Watershed Associates*

Rolling dips have been employed across the landscape as road surface drainage structures on roadways ranging from county roads to back-country jeep trails. They have seen a significant resurgence of use on thousands of miles of forest, ranch and rural subdivision roads in northern California over the last decade, as a tool to improve water quality and because their use can significantly reduce road wear and maintenance costs for the landowner. The appeal of rolling dips is obvious as they are relatively cheap and easy to install and maintain and, when employed correctly, are highly effective at rapidly draining the road tread and ditch. Although the basic concept of utilizing rolling dips to drain roads are generally known and employed by many road maintenance practitioners, we propose a slightly more effective approach to rolling dip design, construction, and placement that would provide many additional benefits for little or no additional cost.

We identify four broad design parameters which are typically under-analyzed when designing road surface drainage utilizing rolling dips, and the proposed modifications to rolling dip placement, design and construction that will improve their effectiveness. These parameters include: 1) Understanding and incorporating rolling dip design standards according to the design vehicle and level of use a given road will experience, 2) Understanding and factoring in local hydrologic variables on both the road surface and adjacent hillside when determining dip design and placement, 3) determining the locations and spacing of rolling dips to maximize both water quality protection and trafficability, and 4) utilizing non-standard dip configurations, such as insloped dips and dips which drain the road surface only, to fit rolling dip performance to site conditions. Each of these parameters has many nuances which strongly influence the drivability, effectiveness of environmental protection, and cost of construction and maintenance.

Regional Land Use Planning for Water Quality in the Pismo Creek Watershed: Recommendations on Policy and Regulation

Nicole Smith, *Central Coast Salmon Enhancement*

To ensure effective fisheries restoration, local and regional land use policy and regulation must be developed to reflect recovery and management goals. These policy and regulation changes are as important as on-the-ground projects for protecting instream habitat, riparian buffers, water quality, and water quantity. Land use, whether agricultural, urban or other, has direct implications for surface and near shore ocean water quality. A strong body of literature supports connections of land use to stormwater runoff, pollutant loading, sedimentation, nutrients, and loss of riparian areas.

The goal of this document is to inform decision-makers in the Pismo Creek watershed, California (the County of San Luis Obispo and the City of Pismo Beach) of the connections between land use and water quality, and potential policy and regulatory solutions to improve and protect water resources. Existing policies and regulations were evaluated at the watershed and site scales. Land management on a watershed scale was evaluated using three land use strategies for water quality protection: land preservation, critical ecological area protection, and minimized land disturbance. A code and ordinance worksheet developed by the Center for Watershed Protection was used to evaluate the municipalities' management of land use and stormwater at the site scale. Findings were used to develop recommendations on policy and regulation in conjunction with the best management practices of other municipalities.

Recommendations relied on two assumptions: (1) that conventional urbanization and suburbanization of lands negatively impacts water quality, and (2) that a watershed approach to land use planning can improve water quality. Based on the critical issues facing the Pismo Creek watershed, recommendations focus on further protecting riparian habitat, reducing fecal coliform sources, and increasing stream flows. Based on findings from the watershed protection worksheet, recommendations focus on decreasing impervious cover, and more effectively managing and protecting open space and riparian buffers. Based on findings from the land use strategies for water quality, recommendations would fill in policy and regulatory gaps in land preservation, the protection of critical ecological areas, and the minimization of land disturbance. Each recommendation is framed by the water quality standard or objective addressed and its benefit. Recommendations range from the adoption of a Memorandum of Understanding to developing or amending policy to developing a Standards Manual for Best Management Practices. Positive actions toward water quality taken by other municipalities were used to illustrate the wide range of planning tools available.

These policy and regulation recommendations, framed in terms of benefits to fisheries, would improve water quality by reducing sediment and pollution, protect riparian areas for decreased water temperatures, and manage development and groundwater recharge for increased water flows.

2008 Fish Passage Projects for Southern Steelhead on the Lower Santa Ynez River, Santa Barbara County

Timothy H. Robinson (Presenter), Scott B. Engblom, and Scott J. Volan, Cachuma Project Water Agencies

As part of the ongoing fisheries monitoring and habitat enhancement project initiated by the Cachuma Water Agencies on the Lower Santa Ynez River (Santa Barbara County), two fish passage projects were built in 2008. The first was a 61-foot long fishway installed on El Jaro Creek which is a known steelhead tributary to the Santa Ynez River near the City of Lompoc. The eight foot barrier is now passable at low, moderate, and high flows for juvenile and adult southern steelhead/rainbow trout (*Oncorhynchus mykiss).* The fishway has a low and moderate-high flow configuration to accommodate the variable hydrologic regime of the area, plus an auxiliary watering system to assure at least 10% attraction flow exiting the ladder throughout the range of fish passage flows.

The second project removed a damaged low flow crossing and temporary bridge for Refugio Road over Quiota Creek, tributary of the Santa Ynez River. The facility was replaced with a 48-foot prefabricated bottomless-arched culvert with four rock weirs for grade control and habitat creation. Juvenile and adult steelhead/rainbow trout now have free passage at all flows through the site and new pool habitats created by the weirs were holding fish shortly after the project was completed. This is the first of nine scheduled projects of similar magnitude for Quiota Creek which will be an ongoing effort for several years to come.

A Regional Perspective on the Ecology and Management of Steelhead in San Francisco Bay Area Streams

Frank K. Ligon (Presenter), *Stillwater Sciences;* ***Matthew R. Sloat,*** *Stillwater Sciences and Oregon State University;* ***Anthony J. Keith,*** *Stillwater Sciences;* ***Bret C. Harvey,*** *USDA Forest Service, Redwood Sciences Laboratory; and* ***Neil Lassettre,*** *Stillwater Sciences*

Using case studies in coastal and San Francisco Bay Area streams, we describe a physical process-based limiting factors analysis (PPLFA) that links physical habitat and the life history of steelhead to identify potential factors that limit these anadromous populations. For both historical and current conditions, the PPLFA will first assess how the hydrologic, geomorphic, and vegetation characteristics of a particular watershed create or influence the amount and quality of habitat for different life-stages of steelhead. It will use a multi-stage stock production model to estimate carrying capacities and density-independent mortality at different life stages, with the goal of reaching a mechanistic understanding of which life-stage is limiting within a given watershed or reach. Depending on the interaction between physical processes and land use history, different watersheds may have different limiting life-stages, key habitats, and even different life-history strategies. Key findings of our investigations in several coastal and Bay Area watersheds are: (1) Density-dependent mortality that might result from redd superimposition or density-independent mortality resulting from redd scour and poor gravel quality (among other factors affecting the survival of eggs or alevins) usually does not affect smolt production because, despite these sources of mortality, far more fry are typically produced than can be supported by the available rearing habitat. (2) Because individuals tend to have much higher survival to adulthood if they outmigrate as age-2+ or older smolts, it is critical that a watershed provide conditions suitable for two years of freshwater rearing or have an estuary capable of providing high growth rates for juvenile steelhead. (3) Either winter rearing for age-0+ steelhead or summer rearing for age-1+ steelhead can limit freshwater production of age-2+ smolts, depending on the geomorphology of a watershed. Winter survival generally depends on the presence of a cobble-boulder substrate whose interstices the juvenile steelhead use to take refuge from high winter flows. Watersheds lacking adequate amounts of shelter in cobble-boulder substrate will likely be winter habitat limited. Conversely, for watersheds that produce plentiful cobble-boulder substrates, steelhead are likely limited by the frequency of deep pools that steelhead use for summer rearing. (4) Non-lethal, high summer temperatures (approximately 22°C) do not adversely affect annual growth or abundance of rearing juvenile steelhead. Therefore, streams where temperatures are high but not lethal (>25°C) should not be discounted as potentially important producers of steelhead. A steelhead PPLFA investigation will result in site-specific management recommendations that vary from watershed to watershed.

Central and South Coast Steelhead: Biology, Genetics and Recovery Strategies

Saturday Morning Concurrent Session 1

Session Coordinator*: Dougald Scott, Northern California/Nevada Council Federation of Flyfishers*

The once thriving steelhead populations of California's Central and South coast are presently threatened with extinction. In 1996, the National Marine Fisheries Service (NMFS) recognized three evolutionarily significant units (ESUs) from this region for protection under the Endangered Species Act. The following year NMFS officially listed two of the ESUs (Central California Coast, and South-Central California Coast) as threatened, and the remaining Southern California ESU as endangered. In 2006, in response to the Alsea decision and several listing and delisting petitions, the ESU designations were changed to Distinct Population Segments (DPSs). However, the listing status of each remained unchanged.

The Endangered Species Act requires NMFS to develop and implement recovery plans for the conservation and survival of listed species. Recovery planning for the three steelhead DPSs of the Central and South coast of California is well underway and recovery outlines for each have been published.

According to NMFS guidelines, a successful recovery plan must "delineate those aspects of the species' biology, life history, and threats that are pertinent to its endangerment and recovery." Thus the success of these recovery efforts requires a thorough understanding of the biology and life history of the steelhead from these DPSs. Ongoing research in these areas will be presented in this session. Topics will include:

- Genetic relationships of steelhead populations in the Central and South Coast
- Investigations into factors influencing juvenile steelhead to adopt an anadromous life history pathway, or remain in the stream as resident trout
- The role of coastal lagoons in steelhead survival
- The ecology population dynamics of steelhead populations along the Big Sur Coast
- Watershed analysis of the San Luis Rey River Basin, the third largest in the San Diego region, with respect to steelhead recovery
- The recovery status of steelhead populations in the South-Central and Southern California DPSs
- Central and South Coast Steelhead: Biology, Genetics and Recovery Strategies

Population Genetic Structure of Coastal Steelhead in Space and Time

John Carlos Garza (Presenter) *and* ***Devon E. Pearse,*** *National Marine Fisheries Service, Southwest Fisheries Science Center, University of California Santa Cruz*

Fish from the species *Oncorhynchus mykiss,* known as steelhead when anadromous and rainbow trout then they are not, have the southernmost distribution of the salmonids and live in the greatest range of environmental conditions. Central and Southern California are the current southern extent of the natural distribution of the anadromous form of the species. This region is now heavily impacted by water development, barriers to anadromy and habitat degradation. Steelhead populations are fragmented and have very low abundance. However, numerous populations of *O. mykiss* exist in this region in the resident form, many above dams and other barriers.

We present an overview of genetic population structure for coastal steelhead in this region, examining spatial patterns of ancestry and origin at various scales, from regional to stream reach, including analysis of populations above dams and in ephemeral habitats in the southernmost part of the state. We also present genetic data on a unique set of steelhead population samples taken from the region in 1897 and 1909 by J.O. Snyder, a student of David Starr Jordan and the founder of the Smithsonian Institute's Ichthyology collection. This museum collection allows a direct examination of the effects of fragmentation on coastal California steelhead.

The Role of Lagoons in Steelhead Survival on the Central California Coast

Morgan Bond (Presenter), *University of Washington, School of Aquatic and Fishery Sciences,* ***Sean Hayes, Alison Collins, Jeff Harding, Arnold Ammann, Bruce MacFarlane,*** *NOAA Fisheries, and* ***Ellen Freund,*** *Biology Department, University of San Diego*

Steelhead populations in coastal central California have been in decline for decades, and have been ESA (Endangered Species Act) listed as threatened since 1997. Recent studies focused in Scott Creek indicate that lagoon habitat, although highly altered from its historic state, is important to steelhead marine survival. In our ongoing research, which began in 2002, we have determined through scale analysis and tagging efforts that there are strong size selective processes on steelhead in the ocean, such that larger juveniles (>150 mm FL) are far more likely to return as adults than smaller individuals. Nearly all juvenile steelhead in Scott Creek migrate out of the upper watershed at age one or two. A variable but small subset remains in the stream until lagoon formation, while the remainder appear to enter the ocean before lagoon closure. Those individuals that remain in the lagoon experience enhanced growth relative to other areas of the watershed, although growth in most years is strongly density dependent. During the fall prior to lagoon opening, many lagoon fish (>45%) move back upstream and remain in the upper watershed for several months before moving back downstream and entering the ocean in the spring. In fact, nearly all of the large spring downstream migrants were lagoon residents the prior summer, and enter the ocean at nearly twice the length (195.9 mm FL) of fish that do not use the lagoon (102.2 mm FL).

Tagging efforts in other central California watersheds with lagoons indicate that Scott Creek is not unique. Growth rates in nearly all lagoons are elevated above what would be expected for upstream habitats, although growth varies widely among lagoons and years. In addition, stable isotopes of carbon and nitrogen indicate that within Scott Creek, productivity of the lagoon habitat is driven by input of marine nutrients, possibly through the introduction of algal detritus during larger swell events. This connectivity with the marine environment may be necessary for small lagoons to support abundant steelhead populations. It is likely that steelhead population sizes in rivers along the central coast are driven by the size and health of the lagoon. Unfortunately, nearly all lagoons in central California have been fundamentally altered from their historic state through agriculture, coastal development, and the construction of California highways. Also, many receive inadequate flow due to upstream diversions.

Population Dynamics and Ecology of Steelhead Populations of the Big Sur Coast

Dave Rundio (Presenter), Tommy Williams, Steve Lindley, Kerrie Pipal, *and* ***Heidi Fish****, NOAA National Marine Fisheries Service, Southwest Fisheries Science Center*

We started a series of studies in 2004 to gain a better understanding of the population dynamics and ecology of threatened steelhead (*Oncorhynchus mykiss*) in basins along the Big Sur coast. Occupancy rates and juvenile densities are relatively high in streams in Big Sur; however the dynamics and viability of these populations are unknown. While several factors appear to make stream habitat favorable (e.g., relatively low development and land use, and summer stream temperatures and flow moderated by the geology, topography, and strong marine influence), the small basin sizes and relatively high rates of natural disturbances such as fire and landslides would be expected to lead to large variability in population dynamics and frequent local extirpations over ecological and evolutionary time scales.

Our core project is a multi-year population study in the Big Creek basin, where since 2005 we have been using biannual mark-recapture sampling, PIT tagging, and stream-width and backpack PIT tag antennas to track the fates of individual fish throughout 2.7 km of stream habitat and passage to and from the ocean. Big Creek provides a relatively pristine watershed to study a natural population of *O. mykiss* where anadromous and resident life-history forms co-occur. We are applying multi-strata robust design models to these data to estimate abundance, survival, recruitment, and transition rates among various strata (age or size classes and different habitats) comprising the population. We will use these empirical estimates as the basis for parameters in a stage-structured population model that will allow us to evaluate population dynamics, effects of environmental variation such as stream temperature and flow, and the importance of resident and anadromous life history strategies to overall population viability.

In related studies from 2004-2006, we have investigated the food web ecology of *O. mykiss* in Big Creek and other streams in Big Sur. These studies have revealed seasonal fluctuations in abundances of aquatic and terrestrial invertebrate prey; variation in abundance and structure of stream invertebrate communities across Big Sur streams related to habitat conditions, including seasonal travertine crusts that form in some streams; that terrestrial invertebrates provide about half of the energy consumed by trout during the year; and that non-native terrestrial isopods are a dominant prey item in *O. mykiss* diets.

Steelhead Recovery in South-Central and Southern California

Mark H. Capelli, *South-Central/Southern California Steelhead Recovery Coordinator, National Marine Fisheries Service*

The National Marine Fisheries Services (NOAA Fisheries) listed two Distinct Population Segments (DPS) of steelhead (*Oncorhynchus mykiss*) within the southern half of coastal California in 1997: a threatened sub-population along the south-central coast and an endangered sub-population along the south coast. In 2002 a range extension of the southern sub-population was extended to the U.S.-Mexico border.

NOAA Fisheries Science Center and a Technical Recovery Team (TRT) has characterized the historic populations of steelhead from the Pajaro River to the Tijuana River, and developed viability criteria for the recovery of these two distinct sub-populations of *O. mykiss* within the southern half of coastal California. The TRT identified two different types of viability criteria: 1) prescriptive and 2) performance-based.

Prescriptive criteria are derived from the precautionary principal, and are purposefully set high, but may not be necessary to achieve biological viability, or be biologically unachievable. A number of the prescriptive population criteria (e.g., run-size, anadromous fraction) are uncertain, and are subject to refinement based upon further research and monitoring. Performance-based criteria are based on formal quantitative risk assessment and decision analysis. The advantages of performance-based criteria are scientific rigor, and potentially a greater scope of innovative solutions, but they require data-gathering which is both time-consuming and expensive.

Whether prescriptive or performance based, viability criteria must address issues such as specific mean annual run size of individual populations; ocean cycles affecting marine survival and growth; spawner density; the anadromous fraction of an *O. mykiss* population complex; the number of populations per biogeographic region; protection of drought refugia; geographic separation of populations within biogeographic regions; and preservation of life-history diversity (fluvial anadromous, freshwater resident, lagoon anadromous).

Recovery Plans for these sub-populations will lay out the basic structure of a recovered DPS and identify recovery actions to achieve this structure. NOAA Fisheries TRT has divided the northern DPS into four biogeographic regions, and the southern DPS into five biogeographic regions, based on a suite of hydrologic, geologic, and climatic conditions. Recovery of the endangered South-Central and Southern California Coast Steelhead DPSs will require recovery of a sufficient number of viable populations (or sets of interacting trans-basinal populations) within each of the biogeographic regions to conserve the natural diversity (genetic, phenotypic, and behavioral), spatial distribution, and resiliency of populations in the face of natural stochastic processes, and thus the long-term viability of the distinct population segments as a whole.

Achieving this goal will require a number of closely coordinated activities, including further research into the diverse life-history cycles and adaptations of southern steelhead to a semi-arid and highly dynamic environment (including the ecological relationship between resident and migratory populations); monitoring of existing populations; and the completion and implementation of recovery plans. Steelhead recovery in South-Central and Southern California will take place in a landscape which has been highly modified, and currently occupied by over 22 million people. Recovery will require re-integrating the listed sub-populations back into habitats in a manner which allows the co-occupancy of watersheds by both fish and people.

San Luis Rey Watershed Assessment: Steelhead Recovery Planning in Southern California

Dave Kajtaniak (Presenter), Kimberly Pettit, *and* ***Scott Downie,*** *Pacific States Marine Fisheries Commission, Coastal Watershed Assessment Program*

The San Luis Rey River Basin is located in San Diego County, 38 miles north of San Diego, CA, and encompasses approximately 560 square miles (358,400 acres). Of the nine watersheds within the San Diego region, the San Luis Rey (SLR) Basin is the third largest.

Historically, steelhead trout (*Oncorhynchus mykiss*) runs were present in the SLR River until the 1940s. Prior runs were reportedly sufficient enough to provide a major food supply for the local Luiseño Indians as late as the 1890s and early 1900s (USFWS 1998). The San Luis Rey River has been impacted by an influx of anthropogenic actions which have greatly altered the hydrology and habitat conditions of the river and its tributaries. These activities have contributed to a typical set of problematic issues facing southern California watersheds and the potential recovery of the Southern California Steelhead Distinct Population Segment. Factors limiting steelhead recovery in the SLR Basin:

- The construction of the dams in the middle and upper portions of the watershed not only has created fish passage barriers, but has limited the timing, duration, and amount of stream flows to the remaining watershed. The lower dam diverts practically all stream flows, usually leaving the river dry below the dam;
- Stream flows are further diminished by tributary diversions and overpumping of the underground aquifer located along the majority of the river;
- Imported Colorado River water combined with agricultural and urban wastewater disposal contribute to the poor water quality present in much of the lower river;
- Accessibility to potential spawning and rearing habitat is blocked at various points in the basin;
- Widespread introduction of exotic flora and fauna have adversely altered habitat conditions along the SLR River and some of its tributaries;
- Historic and current land use has altered watershed processes and conditions;
- The overall lack of southern California steelhead to repopulate the basin.

Steelhead recovery in southern California will occur in a landscape that has been profoundly altered and is currently occupied by over 18 million people. Climatic change and increased demands on regional or local water supplies are taxing an already diminished resource needed for the various lifecycle stages of steelhead. Recovery will require more than restoring degraded habitats – it will require re-integrating the listed sub-populations back into habitats in a manner which allows the co-occupancy of watersheds. While federal and state agencies can provide guidance, recommendations, and funding, implementation of a conservation and restoration strategy in the SLR study area depends on the political will of those who control and utilize land along riverine areas. It remains for the people that live in and regulate the watershed to determine the functions to be restored and the desired landscape and community pattern.

Life History Decisions in Steelhead: the Role of Growth Opportunity

Susan Sogard, *National Marine Fisheries Service, Southwest Fisheries Science Center*

Diverse life history pathways in steelhead (*Oncorhynchus mykiss*) are presumed to be the consequence of an interaction between genetic thresholds and the environment the fish experience. Natural selection determines the genetic framework, and a variety of natural and anthropogenic factors affect the environment. We are using an integrated approach of field studies, lab experiments, and modeling to determine how growth opportunity influences life history expression in age-0 steelhead, and how local adaptation in different populations might influence these pathways. Based on common garden experiments in the lab, Central Valley steelhead have a greater inherent capacity for growth and a higher size threshold for survival in seawater compared to central coast fish. Although lab experiments did not support our expectation of a specific time window for the decision to smolt, condition indices (Fulton's K) suggested an early separation between fish that subsequently emigrated in spring and those that remained in freshwater. Field studies concurred with lab studies in finding significantly faster growth rates in Central Valley compared to central coast populations. Major differences in prey availability, flow rates, and fish density may underlie growth variability. Age structure and the prevalence of resident life histories also varied greatly among streams and appeared to match model predictions based on growth opportunity and the expected survival of smolts emigrating from nursery habitats. An improved understanding of how individuals arrive at a particular life history pathway will greatly enhance our ability to monitor and predict effects of changing environments on steelhead populations.

Hydrologic and Geomorphic Legacy Issues: Solutions for the Past and the Future

Saturday Morning Concurrent Session 2

Session Coordinator*: Eric Ginney, Philip Williams and Associates, Ltd.*

This session blends elements of hydrology and fluvial geomorphology to examine various "legacy issues" at various temporal and spatial scales. In the session we explore the legacy of "old problems" (those born in the far past; e.g., splash dam logging, forest road networks, and early drainage of side channels and tidal marshes), and the coming legacy of relatively recent impacts to our river ecosystems (for example, main-stem dams impacting hydrology and sediment supply, and Delta water diversions) that with future hindsight are likely to be viewed as "legacy issues." In each presentation we examine the role of time and space relative to restoring the systems influenced by these impacts, and explore the potential solutions and implications of these legacy issues.

Hydrologic and Geomorphic Impacts of Residential Development on Legacy Roads

John Green, Pacific Watershed Associates

Since 2002, Pacific Watershed Associates has been working with landowners, agencies and local governments in Sonoma, Marin, Monterey and Santa Cruz Counties to minimize the impacts of rural high-density development with regard to erosion and excess sedimentation in salmonid habitat watersheds. Pockets of high-density residential development are a common feature of rural areas in these coastal California counties. Many rural subdivisions were established as vacation communities on subdivided former timber lands, with residences built on very small lots along dense road networks originally constructed for timber harvesting. This process has caused a dramatic increase in the area of impervious surface in developed watersheds over time.

The natural hydrology of such areas is disrupted, and a cascade of hydrologic and geomorphic effects ensues, often exacerbated by local geology. The natural hydrologic regime is replaced by a more urban pattern, with flashier storm hydrographs and lower base flows. Drainage from impervious surfaces is rapidly routed to stream channels, directly and via gullies and roadside ditches. These runoff paths effectively deliver road-derived fine sediment to streams, while heightened peak flows increase erosion and sedimentation within stream channels, adversely impacting water quality and further degrading salmonid habitat conditions.

Addressing such problems in these areas can be challenging. High road density and closely spaced structures limit opportunities to increase infiltration by dispersing runoff or constructing retention basins. When confronted by these conditions, treatment options are often limited to attempts to minimize ditch and gully expansion and erosion without addressing the underlying hydrologic disruptions. Local building codes and construction practices often exacerbate the problems, dictating that runoff from impervious surfaces be piped to roads, ditches or storm drains, rather than dispersed or retained.

To protect aquatic resources and habitat in proposed and existing areas of rural development, local hydrology should be normalized to the extent possible. Some California counties have begun incorporating into their building codes an approach that includes minimizing the amount of impervious surface and increasing groundwater recharge by dispersing or retaining runoff.

Slow Water Manifesto—From Slopes to Streams: Legacy Issues of Upland Land Uses on Fluvial Function and Fecundity

Brock Dolman, *Occidental Arts and Ecology Center, WATER Institute*

Deforestation to desertification is an age old tradition by many cultures. The clearance of primary upland vegetation to make way for agriculture, grazing and forestry along with "pave and pipe it" human settlements have left their seemingly indelible marks on our hydrological health. Incised channels, flashy flows, disconnected floodplains, dry stream beds, extirpated fisheries, lowered groundwater tables and dead zones are but a few of the fluvial symptoms of hydro-illiterate upland development. This presentation will explore the implications of these legacy issues and introduce a number of ideas for ways to re-think and re-pattern our 'terrestrial' settlement systems towards more functional performance of creeks and cities for fish and farmers. From urban Low Impact Development to rural Keyline Design, solutions-oriented images will be shown and discussed in support of a rehydration revolution based on Conservation Hydrology.

The Klamath Dams: The End of an Era

Eric Ginney, Philip Williams & Associates, Ltd

On November 13, 2008, PacifiCorp, the states of California and Oregon, and the U. S. Department of the Interior announced an "Agreement in Principle" that outlines steps and a framework for the presumed transfer of the four Klamath dams from PacifiCorp to a government-designated dam removal entity, which would then undertake the removal of the dams starting in 2020. This agreement formally begins the process of planning for the removal of the four existing hydroelectric dams on the Klamath River to restore the river ecosystem and encourage the reoccupation of this section of river by native anadromous fish species. As noted in the *San Francisco Chronicle* (November 14, 2008), "*The path forward will be a challenge. Reviving salmon runs, taking out power dams, and restoring miles of neglected riverbed have never been attempted on a Klamath-sized scale. Now it's time to try.*"

This presentation provides a summary of a preliminary, reconnaissance-level "restoration vision" (or concept) for the land and river areas currently inundated by the J.C. Boyle, Iron Gate, and Copco Reservoirs. The vision is intended to provide the basis from which site-specific reservoir restoration plans will be developed as dam removal planning progresses. The presentation includes description of existing (and pre-dam) conditions within the reservoirs and their influence on the potential for restoring aquatic, floodplain, and upslope habitats; a summary of our preliminary analysis of how erosion of aggraded sediment in the reservoirs can be managed to re-form the river channel and floodplain; and how revegetation, instream and floodplain habitat restoration, and slope stabilization can be incorporated to restore the conditions necessary to bring anadromous fish back to reaches of river inundated for many decades.

El Corte de Madera Creek Redwoods Watershed Restoration

Matt Baldzikowski and Meredith Manning, Midpeninsula Regional Open Space District

The Midpeninsula Regional Open Space District has been completing watershed restoration projects at our El Corte de Madera Creek Redwoods Open Space Preserve. The Preserve is located within the San Gregorio Creek watershed in coastal San Mateo County. The San Gregorio Creek watershed is a steelhead/ coho salmon watershed, and is 303d listed as sediment impaired. The El Corte de Madera Creek Preserve is located in the headwaters of El Corte de Madera Creek, a major tributary of San Gregorio Creek. The projects are located above the upstream limits of anadromy.

The Redwood forest had previously been clear-cut in the late 1880's and then roaded and tractor logged for nearly forty years, beginning in the 1950's until the Preserve was purchased by the District in the mid to late 1980's. It was also used as a motorcycle park during the tractor logging period. The extensive road network combined with the highly erosive local geology resulted in sediment delivery into the watercourses on the property.

The nearly 3,000 acre Preserve was opened for public use quickly following purchase. The mountain biking community latched onto the extensive logging road network. Some difficulties ensued regarding appropriate recreational use and recreational impacts overlain upon past logging impacts.

The District completed a Watershed Protection Plan in 2004 that included inventories of the existing road network, identified necessary patrol and recreational infrastructure, and also identified areas for road abandonment, conversion, or upgrade.

This work has been ongoing for the past few years and includes logging road removal, road to trail conversions, watercourse crossing removals and bridge replacements. There is also a monitoring component that is ongoing that includes stream flow/ sediment monitoring to establish a baseline to compare with post-treatment conditions.

Estimation of Passage Flows for Anadromous Fish Through Critical Riffles in Stevens and Coyote Creeks, Santa Clara County, California

Shawn Chartrand (Presenter), and B. Hecht, Balance Hydrologics, Inc.

Regulated streams are ubiquitous throughout the western United States and play key roles in providing drinking water, flood protection and power generation for residents of the region's major urban centers. However, streamflow regulation also impacts anadromous fish by fundamentally changing the hydrology and sediment transport regimes of the affected watersheds and by introducing artificial migration barriers. These problems have long been recognized by the private and public sectors and, as a result, many local, state and federal agencies are actively engaged in managing reservoir releases for the benefit of anadromous fisheries.

Balance Hydrologics geomorphologists and engineers, working with local fisheries experts, evaluated passage conditions along Stevens and Coyote Creeks, two regulated streams in Santa Clara County. This study was part of a larger effort headed by the Santa Clara Valley Water District to measure the condition of habitat for Chinook salmon, steelhead trout and other native fish species in several streams in the region. Field work and analyses focused on riffles in the middle reaches of each stream, which were identified as especially problematic for passage due to constrained geometric characteristics. Adequate passage conditions were based on meeting a modified version of the criteria developed by Thompson (1972) which stipulates 0.8 feet of depth over 25% of the total stream cross-sectional width or over a continuous 10% of the width. Balance provided a likely range of passage flows for each critical riffle based on three different methods: (1) manual measurements of streamflow during winter storms, (2) hydraulic modeling with HEC-RAS, and (3) iterative passage flow calculations utilizing Manning's and appropriate continuity equations.

Critical passage flows were identified for each stream and are compared to similar work at other locations, particularly results from Mosley (1982) in New Zealand. Results from this project have been used by the Santa Clara Valley Water District to make decisions regarding the magnitude of water releases from upstream reservoirs during periods of up-migration. The iterative flow calculation methodology shows promise as a useful tool for resource managers who may not have the budget or requisite technical resources needed to run HEC-RAS or establish gauging stations. Additionally, results from this work were used in designing 1,300 feet of relocated channel in Stevens Creek, which included the construction of riffles. Monitoring results of passage conditions through constructed riffles will be compared with our findings, which focused on the requisite flow needed to provide passage conditions through identified critical riffles located elsewhere in the watershed.

Long-term Geomorphic Effects of Dams on the Rivers of the Central Valley of California

J. Toby Minear (Presenter), and Matt Kondolf, University of California, Berkeley

The magnitude of the downstream geomorphic effects of a dam is determined by the degree of alteration of both the flow and sediment supply. Dams interrupt sediment transport in rivers and induce deposition of sediment within the reservoir impoundment, decreasing water storage capacity, and in some cases leading to eventual filling of reservoirs. In addition, sediment trapped within the upstream reservoir is not available for downstream transport for ecological benefits (such as spawning gravel), or geomorphic benefits (such as creation of point bars).

In California's Central Valley, there are sixteen major dammed tributaries arranged in parallel, each with differently sized and operated dams, some of which have been in operation in excess of eighty years. Due to reservoir sedimentation, no bedload material has passed through the dam sites to the downstream reaches. A critical question for downstream river restoration is the quantification of the reservoir sedimentation in the upstream reservoirs as well as sediment starvation that has occurred below these dams. Using a newly constructed reservoir sedimentation model, we estimated the reservoir sedimentation rates for Central Valley rivers. While gravel augmentation has offset some of the sediment starvation occurring in these rivers, the amount of gravel added has been much less than the amount of gravel that historically was contributed to these downstream river reaches. This is a work in progress that hopes to benefit future large-scale river restoration projects, particularly in the Central Valley.

Saturday Morning Concurrent Session 3

Session Coordinator*: Frank K. Lake, Ph.D.,*

US Forest Service—Pacific Southwest Research Station

The effects of wildfires on fisheries and riparian zones have been understudied. The complexity of short- and long-term linkages of wildfire impacts and potential benefits to fisheries could be better understood by fisheries managers and restorationists. Wildfire was and will continue to be a significant ecological process in western forests. Western forests and riparian zones affected by wildfires directly influence the integrity of aquatic habitat necessary to sustain viable fisheries populations. Changing climate conditions are predicted to increase the extent and severity of wildfires across the range of significant salmonid refugia. Restoration and conservation management strategies for salmonids should consider climate and subsequent wildfire effects at the landscape scale. This session will provide an overview, and incorporate specific knowledge from a diverse group of specialists about the effects of wildfires on fisheries populations inhabiting western forests.

Wildfire and Native Fish: Scaling of Disturbance and Population Structure as Context for Restoration and Conservation

Bruce Rieman, Ph.D. (Presenter), *USDA, Forest Service Rocky Mountain Research Station;* ***Charlie Luce,*** *USDA Forest Service Rocky Mountain Research Station, Boise Aquatic Sciences Laboratory; and* ***Matt Dare,*** *USDA Forest Service Rocky Mountain Research Station, Boise Aquatic Sciences Laboratory*

Wildfire has been a focal issue in public land management in the West for fully a century. Recent efforts to mitigate the effects of long-term fire suppression, changing climate, and other habitat disruption have reinvigorated a political and scientific debate over the last two decades. The controversy and attendant challenges have been particularly apparent at the interface of aquatic (fishes and fisheries) conservation and terrestrial forest and fuels management on federal lands in the West. It is clear that wildfire can have a profound influence on watersheds and streams and the aquatic organisms associated with them. It is also clear that aggressive management can lead to disruption of watershed processes and the quality of habitats for those same species. The immediate effects of a severe fire may be perceived as a catastrophic event (e.g. the local extinction of a rare species), or as one of the necessary costs associated with longer term restoration or maintenance of a diverse and productive system. Aggressive fuels management can be painted in the same terms. These are essentially elements of a basic tension in applied ecology characterized on one hand by "restoration ecology," intent on re-creation of more natural forests and sustained ecological services, and on the other by "conservation biology," focused on threatened, endangered, or sensitive species and remnant, native biological diversity. The association between these two is not simply coincidental, but tied, in part, to past land management activities which disrupted both terrestrial and aquatic ecosystems and the linkages between them.

In this paper we consider the processes that link forests, wildfire, and aquatic systems across watersheds of central Idaho and explore the potential opportunities for more integrated management among them. We conclude that a native fish conservation perspective for fire and fuels management depends on the joint scaling of disturbance and the species population structure. We argue that common ground in fire, fuels and aquatic management will emerge from broad perspectives where diverse management objectives may conflict or converge in complex ways across landscapes of forests, watersheds, semi-urban development, and the structure of populations that are the focus of conservation efforts.

Improving Our Understanding of Spatial and Temporal Effects of Wildfires on Forests, Riparian Zones, and Fisheries in the Klamath Mountains, United States of America

Frank K. Lake, Ph.D., *US Forest Service-Pacific Southwest Research Station*

Wildfires have influenced forests, riparian zones, and fish in the Klamath Mountains for millennia. The complexity of factors challenges our understanding of direct and indirect effects of wildfires on aquatic communities and fisheries. A synthesis of research studies from western North America can assist managers and restoration practitioners with predicting the effects of wildfires on salmonids in California and the Pacific Northwest. In the Klamath Mountains, salmonids have evolved with variable climate patterns and fire regimes. In addition to natural factors, policies and programs striving to restore and conserve salmonids need to be considered. In particular, wildfire management practices affect salmonids at the landscape and stream habitat scales.

This presentation will review changes in wildfire behavior, severities, and frequencies that pertain to salmon restoration and conservation efforts in the Klamath Mountains. Specific inquires into how changing climate and resultant wildfire effects affect salmonids will be covered. Case studies from several larger wildfire complexes will be provided, utilizing newly developed methods to integrate MODIS satellite imagery, air (RAWS) and water temperature (US Geological Survey and Forest Service, and tribal fisheries program), air quality (Regional Air Quality districts), and wildfire progression and severity mapping data to investigate direct and indirect effects on forests, riparian zones, and fisheries. Examples of how smoke plumes resulting from wildfires covering large areas are linked to decreasing stream temperatures which are hypothesized to benefit salmonids will be explored. Other factors related to changes in current and predicted wildfires influenced by climate change in the Klamath Mountains will be discussed.

Forest Survivorship and Regeneration Following Crown Fires on Three Streams in the Santa Cruz Mountains, California

Will Russell, Ph.D., *San Jose State University, Department of Environmental Studies*

The Santa Cruz Mountain region is composed of a matrix of forest types including coast redwood, mixed evergreen, closed cone pine, ponderosa pine, and oak woodland, as well as coastal prairie and chaparral. Each of these types responds differently to fire. Fire-tolerant vegetation types such as chaparral and closed cone pine forests support stand-replacing fires, and regenerate prolifically from seed and underground lingo-tubers following fire. Fire-resistant vegetation types such as coast redwood do not generally support stand-replacing fires, and regenerate quickly through both above-ground and below-ground sprouting. The ability of vegetation in riparian corridors to withstand fire has direct and immediate consequences on soil erosion into stream channels as well as stream temperature. This study measured the survivorship and regeneration of vegetation, and the viability of soils, following fires in the Santa Cruz Mountains. The percent canopy cover, percent shrub cover, density of surviving trees, density of dead trees, and the depth of the soil organic layer following fire, were measured six months following fire on three streams in the Santa Cruz Mountains. Initial results indicate that the highest degree of survivorship, the fastest post-fire regeneration, and the greatest viability of soils were all found in the coast redwood forest type. These results suggest that the coast redwood forest type can act as a buffer between riparian zone and more fire-prone vegetation types.

Post-Fire Watershed Restoration: Protecting Water Quality, Fisheries and Wildlife Resources from Soil Erosion Processes in the Aftermath of Wildfire in Santa Cruz County

Rich Casale, *USDA Natural Resources Conservation Service*

Nearly one million acres of private property were devastated following the wildfires that ravaged through California during the 2008 fire season. Much of the land that burned in the state was woodland, including commercial timber composed of redwood, Douglas fir, with some mixed hardwoods. Significant fire damage also occurred in riparian species, killing or severely damaging riparian forests and watercourses. Forest and watershed land owners and managers were very concerned about what might happen to fire-damaged soils, slopes, drainages and streams in the 2008-2009 winter. They were also wondering what could be done to minimize the effects of erosion processes before any significant storm events, and how best to protect water quality and fish-bearing streams, either on or downstream of their properties.

In Santa Cruz County, where over 5,000 acres of land burned in watersheds with declining salmonid resources, the Natural Resources Conservation Service (NRCS) conducted on-site assessments of fire-damaged properties where natural resources, including fisheries and wildlife habitat, were damaged or destroyed. NRCS also provided treatment recommendations to property owners and stewards of these natural resources that were designed to minimize both short term and long term soil loss and damage to downstream water courses, fish and wildlife habitat.

This presentation will focus on the NRCS-recommended restoration strategies and treatment practices, and their effects on natural resources in wildfire-ravaged watersheds of Santa Cruz County.

Overview of FERC Hydropower Relicensing: What It Is, Who's Involved, and What Can Be Achieved

Session Coordinator*: Keith Nakatani, Director, California Hydropower Reform Coalition (CHRC)*

The Federal Energy Regulatory Commission (FERC) hydropower relicensing process provides a powerful opportunity to restore rivers, because FERC is required to give "equal consideration" to power and non-power uses of rivers for hydropower projects it regulates. As project relicensing happens only every 30 to 50 years, it is a "once-in-a-generation" opportunity to mitigate the damage caused by hydropower dams. Over the years, river advocates have secured numerous hydropower license settlement agreements resulting in thousands of river miles of flow improvements, removal of dams, improvements in boating, fishing, and camping opportunities, and protection of cultural resources, with minimal reductions in power generation.

As the relicensing process is five-plus years, with a number of specific deadlines and requirements, the presentation will not describe the process in detail, but rather provide a sense of what is involved and emphasize the environmental benefits that can result. For organizations and individuals interested in participating in specific relicensings, CHRC members are available to provide technical assistance. A list of technical resources is also available.

The Klamath River: Relicensing Process Update and Key Issues

Steve Rothert, *Director, California Field Office, American Rivers*

The Klamath River is one of the highest profile ongoing relicensings. The overall environmental objective is to remove four dams, which would be the largest dam removal project and one of the largest river restoration projects in U.S. history, and result in the return of over 300 miles of salmonid habitat.

This presentation will provide an update on recent activity and will provide a perspective on what to expect this year and beyond. For example, in November 2008, after years of negotiation, a non-binding Agreement in Principle (AIP) to remove the dams was signed by the Interior Department, the states of California and Oregon, and PacifiCorp, the dam owner. The AIP provides a framework for stakeholders to determine additional needed environmental and economic studies. The intent is to finalize the AIP by June 2009, and conduct studies until 2012. Afterwards, the Secretary of the Interior would make the final dam removal decision.

In January 2008, the Klamath Basin Restoration Agreement was signed by 26 parties. The agreement includes provisions that will: 1) reduce irrigation diversions but provide farmers greater water and power certainty; 2) guarantee adequate water for national wildlife refuges in perpetuity; 3) initiate a comprehensive restoration program that will restore thousands of acres of former wetlands and hundreds of miles of stream habitat; 4) resolve water rights disputes among tribes and farmers; and 5) prepare for the re-introduction of salmon and steelhead to 300 miles of historic habitat. The basin agreement specifies resource management goals and approaches, highlights potential legal issues, suggests implementation strategies, and specifies funding needs, but the agreement is contingent upon dam removal.

The Yuba-Bear: Relicensing Process Update and Key Issues

Jason Rainey, *Executive Director, South Yuba Bear Citizens League*

This "project" is comprised of four interconnected hydropower relicensing projects affecting more than 200 miles within the Yuba, Bear, and Middle Fork American watersheds. With over 36 reservoirs, 18 powerhouses and 400 miles of canals and pipelines, the Yuba relicensings are some of the most complex, and afford unique opportunities for taking a broad and regional approach to restoring important salmonid habitat.

This case study is a good contrast to the Klamath, because it is in the relatively early stages, just starting year two of the Integrated Licensing Process, and because it involves numerous licensees. The presentation will describe the thorough preparation conducted by river advocates before the official start of the relicensing, the activities and strategies during year one, and what lies ahead.

Thus far, restoration priorities and strategic goals have been identified, and needed tools and analyses developed. This involved drafting and submitting various study plans addressing issues such as hydrology, amphibians, temperature modeling and monitoring, fish populations, macroinvertebrates, recreation, angling, cold water pools, geomorphology, and an unprecedented climate change study plan. The restoration strategy also involves advocating for comprehensive project boundaries that extend into existing salmon habitat, including impacted reaches more than 40 miles downstream of some of the hydropower facilities. A citizens' river advocacy training program, the "FERC Academy," was another unique element of preparation for the Yuba-Bear hydropower relicensings.

Environmental Justice, Cultural Resources and the Role of Tribes in the FERC Relicensing Process: The Klamath River as a Case Study

Kathleen Sloan, Ph.D., *Director, Yurok Tribe Environmental Program*

Klamath River Tribes have worked collectively and individually to bring issues of environmental justice, socio-economic and cultural impacts of the hydro-electric dams on the Klamath River to the fore in the FERC relicensing process. The impacts of the continued operations of these dams on Tribal lifeway, subsistence and cultural practices and traditions are classic issues of environmental justice. Klamath River Tribes have worked with outside agencies, regulators and stakeholders to advocate for the serious consideration of project impacts on Tribal rights and resources within the FERC NEPA and regulatory process. Through this experience the issue of environmental justice has remained a constant, and one that the FERC has yet to adequately address. This presentation will summarize the process, highlight some challenges and successes, and also emphasize the inherent environmental justice issues facing Tribes when working within a FERC regulatory process such as PacifiCorp's Klamath hydro-electric project.

Juvenile Steelhead and Coho Salmon: Central Coast Habitat and Population Research

Saturday Afternoon Concurrent Session 2

Session Coordinator*: Kristen Kittleson, Fishery Resource Planner, County of Santa Cruz*

This session will focus on long-term juvenile salmonid monitoring and recent on-going field research taking place in the Central Coast region. These presentations explore how water temperatures, lagoon habitats, winter rearing and large woody material define central coast salmonid ecology. This research points towards new directions in central coast salmonid conservation.

Steelhead Use of Warm Water Habitat in Central California Coast Streams, with Management Implications

Don Alley and Chad Steiner, D.W. Alley & Associates

It is a myth that juvenile steelhead mainly use lower warm water reaches of central California coast watersheds and their lagoons as seasonal migration corridors. In fact, these reaches provide habitat for the fastest growing juvenile steelhead in watersheds, despite relatively low tree canopy closure and seasonally warmer water temperatures than upstream reaches and tributaries. These warm, lower reaches contribute a sizeable proportion of the larger juveniles that will smolt their first winter after one season of rapid growth. Supporting data will come from 1) more than a decade of juvenile steelhead sampling and population estimates in several coastal watersheds (San Lorenzo River and Soquel Creek in Santa Cruz County; San Luis Obispo and Santa Rosa creeks in San Luis Obispo County), 2) scale analysis of juveniles living in warm, lower reaches, 3) scale analysis of returning adult steelhead and water temperature monitoring. These results indicate the importance of protecting the steelhead habitat that is most vulnerable to human activities in the most heavily developed portions of watersheds.

The Grow Zone: Ecology of Central Coast Lagoons

Jerry J. Smith, Ph.D., Department of Biological Sciences, San Jose State University

Estuaries/lagoons can provide valuable habitat for steelhead during the summer-fall rearing period and can also provide crucial habitat for both coho and steelhead during late winter and spring by providing feeding habitat and saltwater transition habitat for out-migrating smolts. Seasonal differences in lagoon/estuary conditions mean that important restoration efforts can be directed to all or only a few of the important functions.

In the majority of smaller streams there is little residual habitat depth at low tide in an open estuary. Much of the potential rearing habitat depth and area comes with the development of a summer sandbar that impounds inflow to the lagoon. Lack of sandbar formation, artificial sandbar breaching or low inflows during droughts or from diversions can result in a shallow, stream-like channel capable of rearing few fish. In impounded lagoons, water quality is a major determinant of the rearing potential of the greatly expanded habitat. Initially the lighter fresh water rides above the salt water layer. The resulting lack of mixing can result in stratified temperature and dissolved oxygen, often with warm, hypoxic bottom water. Conversion of the lagoon to freshwater by adequate inflows and seepage of saltwater out through the sandbar can restore mixing and nighttime cooling and produce a well-mixed lagoon with cool and well-oxygenated conditions suitable for abundant invertebrates and healthy fast-growing steelhead. In some systems strong winds can similarly mix the brackish water column producing good potential rearing conditions. However, insufficient inflows for freshwater conversion, or lack of wind in sheltered upstream portions of lagoons, can result in unsuitable conditions in lagoons or major portions of lagoons. In some systems the sandbar does not form, only partially forms or is subjected to repeated (often artificial) breaching. If there is a large residual embayment, tidal action may be able to maintain rearing conditions in the relatively well-mixed tidal (but often small) portion of the lagoon. However, much of the upstream portion of the lagoon may not benefit from tidal cooling and mixing and be stratified, warm and hypoxic. Year-to-year differences in amount of summer freshwater inflow and in timing of sandbar formation can result in very different rearing conditions between lagoons and in different years in the same lagoon.

In late winter and spring the quality of the open estuary for feeding and saltwater adjustment by steelhead or coho smolts from the upper watershed depends heavily upon the residual depth and configuration of the estuary. Early development of a partial sandbar (more likely in drier years) may be an important factor in providing habitat. Scour at bends or structures, or off-channel sloughs, may be necessary to provide these crucial transition habitats, but have often been lost by channelization or realignment of the lower stream reaches. Efforts to improve springtime habitat conditions should not be overlooked in lagoon restoration efforts.

Coho Salmon in Santa Cruz and San Mateo Counties: Detecting Rare Fish Species Using Snorkel Surveys

Brian C. Spence (Presenter), *National Marine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center,* ***Kerrie Pipal*** *and* ***Mark Jessop,*** *National Marine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center*

Status assessment of coho salmon in the Central California Coast ESU has been hampered by the lack of systematic sampling that allows inference about status and trends across larger spatial scales. From 2006 to 2008, NOAA Fisheries conducted snorkel surveys to examine the distribution of juvenile coho salmon in streams of San Mateo and Santa Cruz Counties with the dual goals of (1) establishing baseline occupancy rates for assessing future status, recovery, and recolonization of local streams, and (2) evaluating protocols and statistical methods for estimating occupancy rates in regions where abundance is low and distribution is highly patchy.

Each year, we surveyed 46-47 randomly selected one-kilometer stream reaches, representing approximately 13%-15% of stream habitats accessible to coho salmon in ten watersheds from San Gregorio to Aptos Creeks. Within these reaches, snorkelers sampled every second pool habitat. Repeat visits were made to half the sites to evaluate detection probabilities at both the unit level (by sampling the same pools) and the reach level (by surveying pools that were skipped on the first pass). In 2008, we conducted additional surveys to gain a more comprehensive understanding of the abundance and distribution of coho salmon in four streams where they have been observed most frequently in recent years: Gazos, Waddell, Scott, and San Vicente Creeks.

Our standardized surveys indicate that reproductive success of coho salmon in streams south of San Francisco was extremely poor the past three years. In 2006, juvenile coho salmon were detected at only 2 of 47 sites surveyed; these sites were in Scott and San Vicente creeks. In 2007, coho were not found at any of the 47 survey locations. In 2008, coho were detected at 5 of 46 sites, including sites in the Waddell, Scott, San Vicente, San Gregorio, and Soquel watersheds. However, in all but two cases, fewer than 10 fish were counted. More extensive surveys in Gazos, Waddell, Scott, and San Vicente Creeks confirmed the low numbers of coho salmon in Waddell, Scott, and San Vicente Creeks, but demonstrated contrasting distributions. For example, in Waddell Creek, where a total of 34 coho salmon were observed, fish were spread out in low numbers over more than 5 km of stream. In contrast, in San Vicente Creek, where 188 coho were counted, most fish were concentrated in less than a kilometer of stream.

When surveys at coho-bearing sites were repeated, coho salmon were consistently observed in the same pools where they had been observed on the first pass. However, in two instances of extremely low abundance, coho were not detected when pools skipped on the first pass were surveyed. Thus, when fish are present in modest numbers, the practice of skipping pools is unlikely to result in "false absences" at the reach level, but when fish are at very low abundance, this risk of "false absences" becomes non-trivial. In designing presence-absence surveys for rare fishes, the influence of population abundance on detection probabilities should be considered.

Assessing the Effectiveness of Large Woody Debris for Coho Salmon Habitat Enhancement

Eric Ettlinger (Presenter), *Aquatic Ecologist, Marin Municipal Water District,* ***Deanna Morrell*** *and* ***Katherine Pofahl,*** *Interns, Marin Municipal Water District*

Lagunitas Creek, in Marin County, is home to one of the largest wild runs of coho salmon (*Oncoryhchus kisutch*) in California. Since 1998, the Marin Municipal Water District has been installing large woody debris (LWD) structures to create or enhance pool habitat and provide shelter for juvenile coho, among other benefits. Prior to building each structure, sites are snorkeled to quantify the baseline coho abundance. Streambed topography is also mapped at all sites where LWD is intended to create or enhance pool habitat. Sites are re-surveyed for a minimum of two years following installation, unless structures are dislodged, to track how the structures influence streambed topography and coho abundance over time. Juvenile coho densities at LWD sites are then compared with densities in pools at established sample sites throughout Lagunitas Creek.

Prior to LWD installation, coho densities at LWD sites were 60% lower, on average, than at established sample sites. One year after LWD installation, coho densities were 60% *higher* than at those reference sites. Two years after installation, coho densities were 130% higher than at reference sites. LWD was also generally successful at encouraging pool formation, although the degree of streambed scour depended on the design of the structures and streambed substrate. On average, LWD increased channel depth by 20 cm in the first year (range: -17 – 67 cm), and by 15 cm over the life of the structure (range: -15 – 64 cm). Structures that had the largest impact on streambed topography were also the most likely to be dislodged during storm events.

A Limiting Factors Approach to Conserve Steelhead and Coho in San Gregorio Creek, San Mateo County, CA

Neil Lassettre (Presenter), Zooey Diggory, Frank Ligon, Carson Cox, Elizabeth Soderstrom, and **Neil Panton,** *Stillwater Sciences*

The San Gregorio Creek watershed, which drains 135 km^2 (52 mi^2) along the San Mateo County coast, sustains steelhead and has been identified in the Recovery Strategy for Coho Salmon (California Department of Fish and Game, 2004). As part of the San Gregorio Watershed Management Plan, limiting factors analyses (LFAs) were conducted to link land-use activities with their effects on instream habitat and salmonid populations and, ultimately, to identify spatially- and life stage-specific management and restoration opportunities. Human activities affect watershed inputs (e.g., water, sediment), leading to a cascade of changes in important geomorphic processes, habitat characteristics, species abundance, and population dynamics. The approach to identifying limiting factors began with a general conceptual model describing the life history of steelhead and coho in the region, and identifying habitat constraints most likely to affect survival of key life stages. This general formulation provided context for reviewing and evaluating recent reports to develop hypotheses about mechanisms controlling salmonid abundance under contemporary conditions. A set of hypotheses regarding summer and winter rearing habitat for steelhead and coho were tested with previously collected data and results of a focused field study. The results suggested limitations in steelhead summer rearing, indicated by few deep pools and few age 1+ fish found in available pools in early fall, with potential winter rearing habitat limitations as well, and limitations in coho winter rearing habitat from lack of large woody debris and off-channel habitat. These data and conclusions improved understanding of the San Gregorio Creek system and led to the development of restoration strategies that address the identified critical limiting factors. By restoring or reinitiating geomorphic and ecological processes, implementation of these restoration strategies should contribute to self-sustaining target populations. Remaining hypotheses developed from the conceptual models can be addressed by conducting the focused priority studies detailed in the Watershed Management Plan. The iterative process of hypothesis development, testing, and refinement provided an adaptive and efficient process for identifying priority restoration strategies for salmonid populations.

The Santa Cruz County Integrated Watershed Restoration Program (IWRP): An Innovative Model of Collaborative Conservation

Jim Robins (Presenter), *Alnus Ecological and the IWRP Steering Committee;* ***Karen Christensen,*** *RCD of Santa Cruz County; and* ***Kate Goodnight,*** *Coastal Conservancy and the IWRP Steering Committee*

As a result of the Conservancy-funded Phase 1 of IWRP which focused on a voluntary, non-regulatory approach to watershed restoration by providing funds for project designs and permits and establishing an interagency Technical Advisory Committee (TAC), over $11 million in construction funds have been raised for IWRP watershed restoration projects in Santa Cruz County.

Under Phase 2 of IWRP, 67 projects have been implemented in the county between 2005 and 2008, and an additional 19 projects will be constructed by 2011. This fundraising success is due largely due to the collaborative approach to conservation that has been the foundation of IWRP's success. Probably the most effective aspect of the IWRP approach has been the integration of our state, federal, and local resource agency staff into project selection, project planning, project design review, and project permitting. Because agency staff are generally involved in IWRP projects from start to finish, our projects have been heavily vetted and technically scrutinized by the IWRP TAC prior to being submitted for permits and for implementation funding.

Phase 3 of IWRP will maintain the momentum in Santa Cruz County on several remaining high priority projects, as well as expand a modified IWRP into neighboring San Mateo and Monterey Counties. Phase 3 will be more modest in scope than Phase 1, focusing on the parts of IWRP that are most easily transferable and applicable to these geographies, overseeing a smaller number of design projects, and providing guidance and assistance to local watershed partners across all three counties.

In order to tell the story of IWRP and to provide lessons learned for other counties or regions that are interested in developing a similar model, this presentation will focus on case studies in two key salmonid watersheds in Santa Cruz County, the Corralitos Creek watershed (a tributary to the Pajaro in south county) and San Vicente Creek watershed (in north county). Our efforts in these watersheds showcase the strength, effectiveness, and agility of our collaborative approach.

Water Diversions and Water Wars in California

Saturday Afternoon Concurrent Session 3

Session Coordinator*: Tom Stokely, California Water Impact Network and former Principal Planner, Trinity County Natural Resources*

California's famous Water Wars had a decade of cease fire during the years of CALFED and the Bay-Delta Accord of 1994. However, following $3 billion in public expenditures and years of meetings, the general conclusion by both environmental/fisheries advocates and agricultural/urban water suppliers is that CALFED was a failure in its dual effort to increase water reliability to south of Delta water contractors and to improve ecosystem health, and the Water Wars have broken out again. Some south of Delta water supplies have been reduced, and the Delta Smelt and other freshwater Delta species are at record or near-record lows. For the first time in the history of the California salmon fishery, there is virtually no fishing for Central Valley salmon in the ocean due to record low numbers of returning adult salmon. There is talk again of building the Peripheral Canal and new surface storage, as well as increased efforts for conservation, recycling, groundwater banking and desalination.

The Water Wars have become so severe that the California budget deadlock of the summer of 2008 was, at one point, about whether or not to take a new Water Bond to the voters in November 2008. Surface storage, the Peripheral Canal and the need for ongoing legislative appropriations for a proposed Water Bond are still key issues needing resolution prior to a new Water Bond.

Several different ongoing processes affect the future of water in California. Delta Vision, the Public Policy Institute Report on the Delta, the Bay-Delta Conservation Plan, Pacific Institute's Report on Agricultural Water Conservation and Efficiency, the San Luis Drainage Settlement, litigation over the Central Valley Project/State Water Project Endangered Species Act compliance, and a Water Bond are a few of the "battlefields" that will shape the future of water in California.

Several key questions to be discussed include the following:

- Is there really more water to send south through a Peripheral Canal (P-Canal), or is northern California tapped out, and Delta diversions need to be reduced? If so, who takes the hit?
- What is the best solution for the Delta, and is that the best solution for people in all parts of California? Is the Delta worth saving? Will a P-Canal really help Delta fisheries?
- What changes in laws and regulations would be required to build the P-Canal?
- Can California afford more indebtedness for a Water Bond, and what is the public benefit?
- Is restoration of the Klamath-Trinity fisheries consistent with the existence of a P-Canal, or, what guarantees are really necessary to protect areas of origin?
- Why isn't MWD supporting additional surface storage?
- What is the role of new surface storage as compared to conservation, recycling, groundwater storage, desalination, etc.?
- How are the Pajaro River and local issues in the Monterey Bay relevant to Central Valley and Klamath-Trinity water issues and supplies?

Fish, Water, and Science in the Sacramento-San Joaquin Delta: A Crisis is a Terrible Thing to Waste

Christina Swanson, Ph.D., *Executive Director, The Bay Institute*

The Sacramento-San Joaquin Delta, the essential link between California's largest watershed and the west coast's largest estuary, is in crisis. The ecosystem and its key fisheries are collapsing, mortality rates of migratory fishes like salmon appear to be disturbingly high, water quality continues to decline, harmful invasive species are becoming increasingly dominant. Even the Delta's physical structure is threatened by catastrophic failure of its increasingly vulnerable island levees. And if these problems are not sufficient to spur management changes, the Delta's role as the main "switching station" for one of the world's largest and most complex water management systems is now threatened by all of these problems.

Politics, court battles, and large-scale engineering schemes aside, the growing scientific understanding of this complex system clearly indicates that we have exceeded its capacity in nearly all aspects of our management. Too much water is diverted from too many places, the loss of refugial and regenerative habits like marshes and floodplains has reduced the ecosystem's resilience, the consequences of our chronic failure to address and alleviate water pollution are becoming apparent, and the already detectable effects of climate change will likely make things worse.

So, what do we do? The first step is to clearly articulate what we want from the Delta. I suggest that our primary management objective should be for an ecologically functional estuary. I further suggest that the way you define and design such a system is by asking the fish, the most integrative and comprehensive indicator of aquatic ecosystem health.

Science, fish and the science of fish can help guide the way and gauge our progress towards a sustainable future for the Delta.

New Water Supplies for California: Reliability and Costs, Who Pays, Who Wins, and Who Loses

Steve Evans, Friends of the River

Leading politicians in California and the media have been sounding the alarm about California's "water crisis." Costly new and expanded surface storage dams and a peripheral canal to increase fresh water diversions from the Delta have been touted as the solution to provide new supplies for the growing population, combating global warming, and even helping the ecosystems and fisheries already degraded by existing dams. But are these truly the most cost effective solutions to the state's water needs or are they simply the most politically expedient options? The fact is that all the most productive and cost effective dam sites in California have already been developed. New and expanded dams are costly and produce relatively small amounts of new water because we already have more than 1,400 major dams choking the state's rivers and streams. According to the state's own data, water conservation, recycling and reclamation, and environmentally sound groundwater management are more effective and far cheaper solutions and can meet all reasonable current and future needs. As water pundit Dorothy Green noted, California has a water management problem, not a water supply problem. And if state and federal politicians and agencies continue to ignore this basic truth, we can expect continued gridlock in the courts and the ballot box, as well as future water shortages.

California's Primary Fishery Resource is in the Modoc Plateau

Robert R. Curry, Ph.D., *Watershed Systems*

Medicine Lake Volcano and adjacent portions of the Modoc Plateau capture over 1 million acre-feet of snowmelt annually and release it through the Fall River Springs system into the Pit River. The total volume of water stored in this aquifer system is on the order of 36-40 million ac-ft. This water flows by gravity into the Sacramento River and, during drought times, comprises a major portion of California's available controlled water supply. Fall River Springs flow is geothermally warmed with a mean residence time in the groundwater reservoir of about 42 years.

This huge reservoir of high quality water is larger than all the rest of the surface water that is available to California, including all its top 58 reservoirs combined (35.8 million ac-ft) and is much larger than California's allocations from the Colorado River. Because it is groundwater, it is presently unprotected and largely unrecognized. California's average April 1st snowpack is 12.4 km^3, the average total inflow to California's major reservoirs is 21.7 km^3, and the Medicine Lake Caldera shallow groundwater that flows freely from the natural springs is about 49 km^3.

Historical Delta Flow exports are 4.3 million ac-ft per year but during drought periods such as 1977, delta exports of water were merely 1.5 million ac-ft of which 2/3rds was supplied by Fall River Springs. This is the most reliable water in California and requires no operation and management costs. The long residence time and lack of surface development combine to smooth out annual precipitation variations as well as multi-year drought periods for a steady long-term spring discharge. Almost half of the drought period monthly total flows from the Pit River to Shasta Lake are from this remarkable groundwater reservoir that is largely unrecognized by and completely unprotected by the State.

The Peripheral Canal: A Breach of the Public's Trust and a Vision for Destruction of the Bay and Delta

Dante John Nomellini Sr., *Central Delta Water Agency*

The cornerstone for the export of water from Northern California to the San Joaquin Valley and Southern California is the promise that only water which is *surplus* to the present and future needs of the north would be exported.

"On 10/12/1948, Secretary of the Interior Krug stated: 'Let me state… the Interior Department is fully and completely committed to the policy that no water which is needed in the Sacramento Valley will be sent out of it.' … 'There is no intent…to divert from the Sacramento Valley a single acre-foot of water which might be used in the valley now or later." (See SWRCB D 990, p. 70 & 71.)

See Water Code Sections"§ 11460. Prior right to watershed water; § 12200 et seq.—Delta Protection Statutes); § In 1959 the State Legislature directed that *water shall not be diverted from the Delta for use elsewhere unless adequate supplies for the Delta are first provided*.

Recognizing that surplus water in the Delta would be unavailable to the State Water Project (SWP) by the year 2000, the SWP was to provide 5 million acre feet of supplemental water for the Delta from north coastal streams for transfer to areas of deficiency. State and Federal Public Officials continue to engage in efforts to circumvent the promises and law intended to protect the Delta and areas of origin.

The SWP did not supplement flows into the Delta with 5 maf of northcoast water by the year 2000 yet continued to increase Delta exports.

The San Luis Act of June 3, 1960 (P.L. 86-488, 77 Stat. 756) prohibition of construction of the San Luis Unit without assurance of a master drainage outlet and disposal channel for the San Joaquin Valley was circumvented thereby resulting in increased degradation of the quality of the San Joaquin River.

In 1978 the State Water Resources Control Board found that "To provide full mitigation of project impacts on all fishery species now would require the virtual shutting down of the export pumps." (SWRCB D-1485, p. 13) Exports were not shut down and were significantly increased. Additionally, the 2 million acre feet of Delta outflow found to be needed for protection of Suisun Marsh was declared to be unreasonable and was not provided. Instead, greater upstream diversions were made into Montezuma Slough for waterfowl thereby exacerbating the adverse fishery impact.

Pursuant to the Central Valley Project Improvement Act dated October 30, 1992, the United States Bureau of Reclamation renewed contracts for the delivery of water and facilitated water transfers while failing to ensure that doubling natural production of anadromous fish in Central Valley rivers will occur.

In 1994 the California DWR and SWP export contractors entered into the Monterey Agreement to amend the Standard SWP Contracts to eliminate provisions requiring priorities for water for areas of origin and urban uses.

On December 15, 1994, the State and Federal Officials agreed on Bay-Delta Standards whereby compliance with take provisions of biological opinions under the Federal Endangered Species Act was to result in no additional loss of water supply and additional listings only with no water cost to the SWP/CVP contractors.

The SWP and CVP have continued exports from the Delta even when water quality standards are not being met. The peripheral canal and Delta Vision process are directed towards turning the Delta into an inland saline bay and increasing the export of water which is not surplus to the needs of Northern California.

The Last Surplus? Groundwater and Fish Habitat in the Sacramento Valley

Tim Stroshane, *California Water Impact Network (C-WIN)*

Most of California's waters were appropriated by the early 20th century, by the 1920s at the latest. The water industry is dominated by monopolistic sellers of water—two of which are the State Water Project (California DWR) and the Central Valley Project (US Bureau of Reclamation)—and also by three monopsonistic buyers of water—the Kern County Water Agency, the Westlands Water District, and the Metropolitan Water District of Southern California. These five actors came into existence after the 1920s—and as recently as the 1960s—and came to dominate the market for water available through the most junior water rights, the segment of California's water supplies that are the most easily interrupted and the most unreliable in times of drought.

California's legal doctrine of water provides most riparian right holders with priority of use of a stream's waters. Those with appropriative rights are allocated waters in these streams that are surplus to the needs of riparians. In Central Valley watershed politics, the source of the surplus available for export from the Bay-Delta Estuary depends on surpluses of water that would come from northern California, with its wetter climate than areas south of the Delta. North Coast streams and wild and scenic rivers are no longer available to import into the Central Valley. With these surface supplies off limits, is the last source of surplus water to be provided by groundwater from the Sacramento Valley?

This presentation will situate the empirical behavior of Sacramento Valley rivers and streams through review of longitudinal runoff data, together with longitudinal groundwater elevation data, and anadromous fish-return data to the same streams in the context of El Nino/Southern Oscillation phases.

Sacramento Valley groundwater hydrology is only poorly understood. The Governor's announcement of a Drought Water Bank for 2009 raises the possibility of greatly increased groundwater pumping by valley growers to replace surface supplies they may sell to DWR for resale to entities south of the Delta. Impacts of the 2009 DWB may include declining groundwater elevations, loss of wetlands habitat for the giant garter snake, and depletion of groundwater feeding valley streams that in better times support nurseries of anadromous salmon and steelhead. I will summarize the hydrogeology, capacity, and firm yield expectations for the aquifers of the Valley, and point out their relationship to key streams in the Valley—most of which have historically supported salmon reproduction and rearing.

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