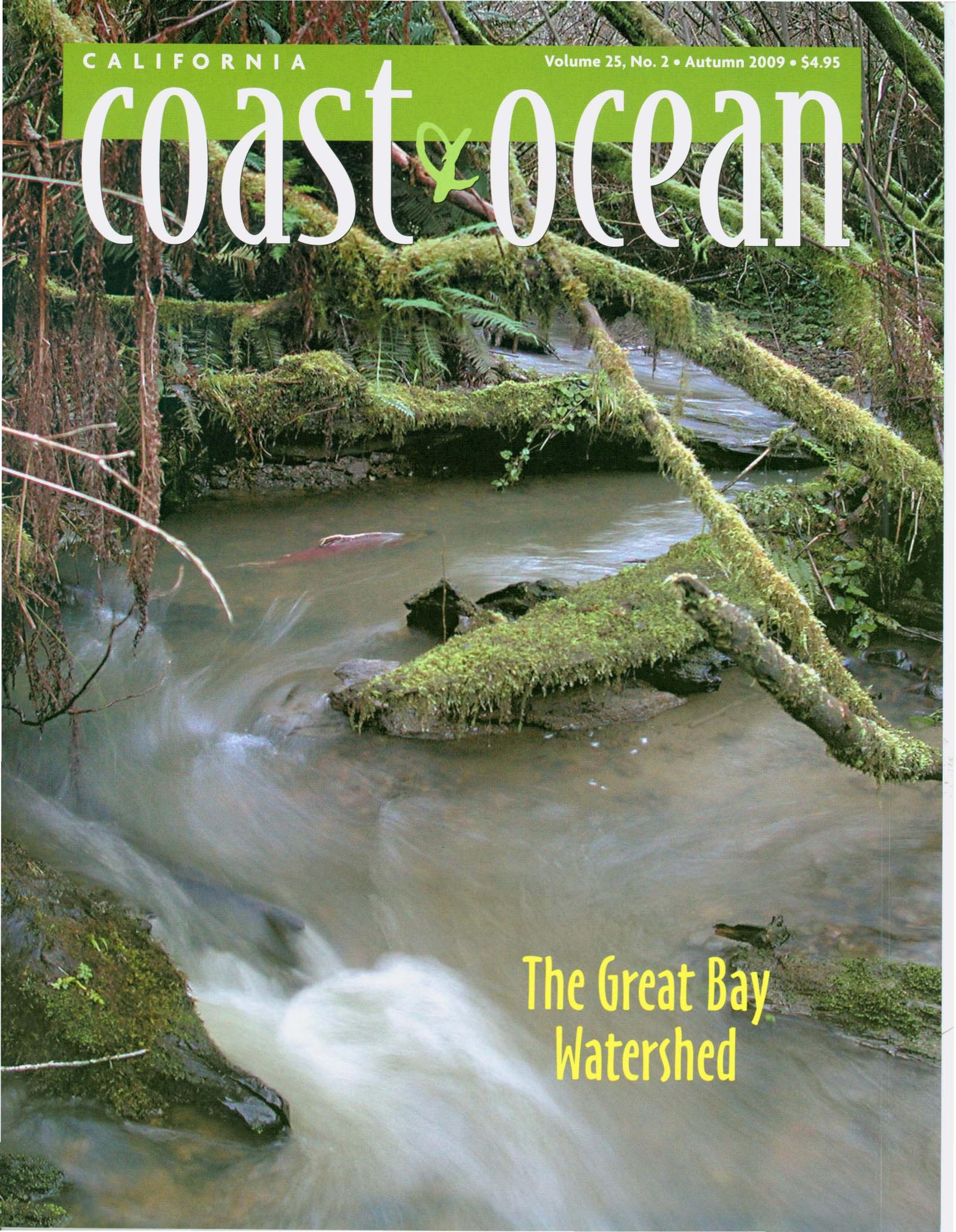


CALIFORNIA

Volume 25, No. 2 • Autumn 2009 • \$4.95

coast & ocean



The Great Bay
Watershed

DEAR SUBSCRIBERS,

THIS IS THE LAST ISSUE OF *COAST & OCEAN*.

Our funding from the Coastal Conservancy has ceased because of the State's budget crisis. If you have more issues coming on your subscription, you can request back issues of *Coast & Ocean*, a refund, or one of these two excellent quarterly magazines: *Bay Nature* (up to four issues you are due), or *News from Native California* (one issue).

Send your request by November 1 to:

Ginger Hertz
1330 Broadway, 13th floor
Oakland, CA 94612
(510) 286-0515
ghertz@scc.ca.gov

Please send us your e-mail address if you want to be notified of possible future developments. Unclaimed funds will be used by the Coastal Conservancy in its work for the coast.

CALIFORNIA COAST & OCEAN

1330 Broadway, 13th Floor
Oakland, CA 94612
Editor: (510) 286-0934;
editor@coastandocean.org

Cover photo: "Coho and Moss" by Thomas B. Dunklin. A coho salmon makes its way upstream to spawn in Morrison Gulch, Humboldt County, after a culvert that blocked fish passage was removed. Dunklin is a watershed scientist who turned to photography as a way to illustrate complex natural systems. See his work at www.thomasbdunklin.com.

Back cover: "Bollinas Ridge to Duxbury Point, 2004" by Tom Killion. This woodcut and the Gary Snyder quote are reprinted from *Tamalpais Walking: Poetry, History, and Prints*, by Tom Killion and Gary Snyder. Copyright © 2009. Heyday Books, Berkeley, California, www.heydaybooks.com.

CHECK OUT OUR WEBSITE

The *Coast & Ocean* website, www.coastandocean.org, includes most articles from the current print edition (some abridged), many color images, back issues, and other information.

The posting of the Spring/Summer issue has been delayed by our web designer's illness

California Coast & Ocean is published by the Coastal Conservancy Association with a grant from the Coastal Conservancy.

The Coastal Conservancy is a state agency that works with the people of California to preserve, improve, and restore public access and natural resources along the coast and around San Francisco Bay.



CONSERVANCY MEMBERS:

Douglas Bosco, Chairman
Jack Baylis
Mike Chrisman
Michael Genest
Marisa Moret
Bonnie Neely
Ann Notthoff

ALTERNATES:

Susan Hansch
Karen Finn
Karen Scarborough

EXECUTIVE OFFICER:

Sam Schuchat

Rasa Gustaitis, Editor
Hal Hughes, Senior Associate Editor
Anne Canright, Eileen Ecklund, Associate Editors
Phyllis Faber, Contributing Editor
Ginger Hertz, Business Manager

Design and page composition: Seventeenth Street Studios
Prepress and printing: University of California
Printing Services

Web design: Shelwyn Corrigan

CALIFORNIA COAST & OCEAN (ISSN 1052-5823) is published quarterly at \$18 for four issues. Copyright © 2009 Coastal Conservancy, all rights reserved. No part of this issue may be reproduced by any mechanical, photographic, or electronic process or otherwise copied for public or private use without written permission of the publisher. All opinions expressed are the responsibility of the authors, and do not necessarily reflect the positions, official or otherwise, of the Coastal Conservancy, the Coastal Conservancy Association, or the editors.

Articles appearing in *California Coast & Ocean* are indexed in *Environmental Periodicals Bibliography*, *Biology Digest*, and *Environment Abstracts*.

Printed on recycled paper with soy-based ink.

Coast & Ocean



THOMAS B. DUNKLIN

Salmon, leaves, sun

3 Shasta Dam Story
Ariel Rubissow Okamoto
 At the headwaters of the Sacramento River

5 Wandering the Watershed
Anne Canright
 A road trip

11 Exploring California's "Water Line"
David Carle with Janet Carle
 Sierra crest to the sea along the 38th parallel

21 Restoring Life to the Yuba River Goldfields
Rasa Gustaitis
 Reinhabiting a watershed

24 Calling Back the Yuba River Salmon
Derek Hitchcock

26 Making Way for Salmon
Eileen Ecklund
 Fish passage barriers removed from streams

DEPARTMENTS

2 COASTAL VIEWPOINT
 In Conclusion

31 EBB AND FLOW
 • The End of a Good Long Run
 • Coastal Conservancy News

32 END NOTES



In Conclusion

AFTER COMPLETING A LONG journey, it's useful to look back at its beginning. What was the vision when we set out? What is it now? What have we learned en route about ourselves in relation to our planetary home?

There was a time when San Francisco Bay was being filled with debris and trash, and stinking dumps burned on its shores. It was done legally, to make more real estate. That's hard to believe now, hard to imagine, but I saw it with my own eyes recently in "Saving the Bay," a four-part documentary by Ron Blatman to be broadcast by KQED and KTEH this fall (for more information see www.savingthebay.org).

When this bay abuse was happening, in the 1950s and '60s, conventional wisdom held that the wheels of progress inevitably destroy natural places we love, so there was no point in objecting.

Three Berkeley women, however, refused to go along. They called a meeting, made phone calls, and soon had thousands of allies. The movement to Save the Bay led to legislation that was radical for its time. It created the nation's first coastal management program, inspired the Save Our Coast movement, and became a model for the 1976 Coastal Act. I hope this documentary gets a wide audience, for it contains lessons for many of today's struggles to define and safeguard our common good.

To take effective action, citizens must be well-informed. The mission of *Coast & Ocean* has been to help Californians know their coast better, enjoy it, and participate in shaping its future. The magazine was launched more than 24 years ago with a more modest purpose: to report on changing urban waterfronts (the original name was *California WaterfrontAge*), and one of the first issues was dedicated to San Francisco Bay. We changed the name to *Coast &*

Ocean as our coverage expanded to the entire California coast, into the watersheds, and to coastal waters.

This year we reached out still farther, for the borders delineating coastal issues have kept dissolving. We built the Spring/Summer (Vol. 25, No. 1) issue around a map of the Pacific. Now, in our final issue, we look inland toward the mountain crests, wander California's largest watershed, and return to where we started, San Francisco Bay.

It's easy to get discouraged now, when short-sighted funding cuts have stopped so much good work. But if we lift our gaze to see beyond this moment, we need not lose heart.

In many streams, barriers to fish passage have been removed, allowing salmon to return. (See the map on the inside back cover for spots where you might glimpse some.) Citizens are working to restore anadromous fish to currently inhospitable places.

In July I accompanied ecologist Derek Hitchcock to the Goldfields, a vast gravel patch left behind by the Gold Rush on the Lower Yuba River. The river is confined there between towering gravel "training walls" that reminded me of the concrete channel of the Los Angeles River, built to rush stormwater to the sea.

Hitchcock talked about a project to restore juvenile salmon habitat in the Goldfields, expected to be "shovel-ready" soon. I was skeptical until I remembered that when I first heard the poet Lewis MacAdams describe the founding of the Friends of the Los Angeles River back in 1986, I assumed he was talking about an art event; the LA River had been reduced to a stormwater channel. Yet now you can walk and bicycle along that river, rest on benches in small tree-shaded parks, even watch birds and study native plants.

A vision is essential to begin a journey through unexplored terrain and guide it. San Francisco Bay is a natural wonder under restoration because three women liv-

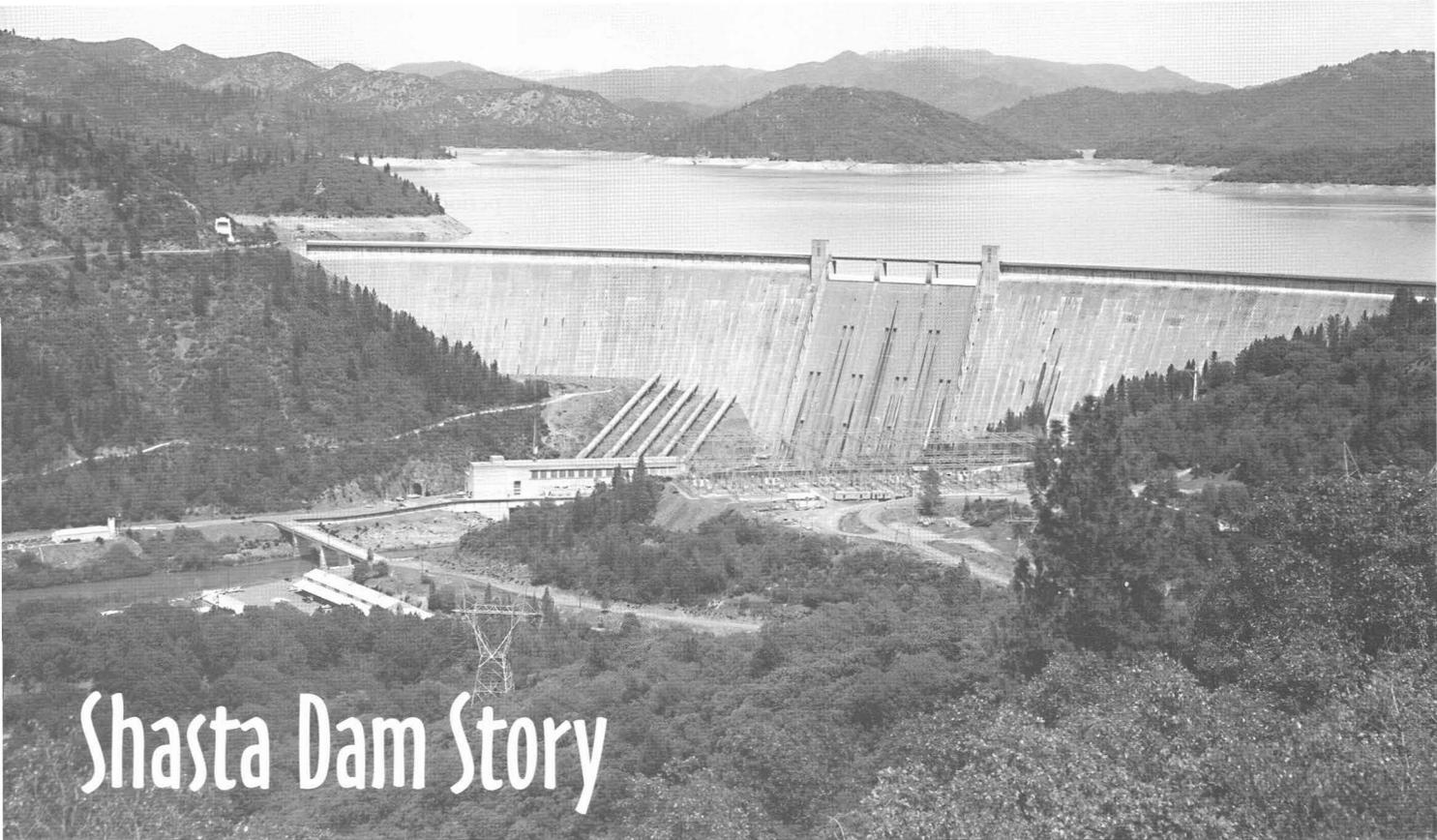
ing in the Berkeley Hills refused to accept the outrage they saw from their livingroom windows. Conventional wisdom is often blind. Some ideas seem radical only because they are eminently sensible.

In July I flew across the Pacific for the first time, to visit with friends in Japan. En route, watching a little plane move across the gray map on the screen in front of me, I imagined the people on the islands below, the turtles and sharks and ships traversing the waters, the lost shipping containers sinking. The map we had published was imprinted in my brain. I no longer thought of our coast as a sliver on the western edge of North America; we are Pacific people, connected by this ocean to life within and around it, and only by recognizing that can we—perhaps—prevent a common catastrophe.

On my last day in Japan at the Osaka Kaiyukan aquarium, the sense of shared kinship across the water was sealed: the aquarium, one of the world's largest, is organized around the "Ring of Fire, Ring of Life" that is the Pacific Rim. The elevator took me up eight levels to otters beside a mountain waterfall. I walked down a ramp that spiraled around the giant ocean tank where two awesome whale sharks swam slowly among manta rays and other creatures. Tanks on the ramp's outer side contained Pacific Rim animals, including sea otters from Monterey Bay. Watching them, I had a happy sense of belonging to a planetary home more inclusive than the one I had left in California.

Adios, dear readers. Thanks to those of you who wrote beautiful letters about *Coast & Ocean*, to my wonderful colleagues and network of allies, and to the Coastal Conservancy, which courageously enabled us to publish this magazine for almost 25 years without intruding on my editorial independence. It was a rare privilege.

—Rasa Gustaitis



Shasta Dam Story

YOU DON'T GO OUT FISHING ON THE Sacramento River above Red Bluff without "a cushion for your tush," according to the locals. The water floating your raft or rowboat is too darn cold, especially when the salmon are spawning. This mid-summer chill isn't natural in a river you could once walk all the way across in warm shallows, or swim through without turning blue. But then, not much is natural about the way water flows out of the mountains down into California's Central Valley anymore.

Ever since workers poured 6.5 million cubic yards of concrete into a canyon above the town of Redding, backing up the waters of the Sacramento, Pit, and McCloud Rivers for 35 miles behind Shasta Dam, Californians have been less thirsty and freer of floods. It's dams like this that Buford Holt, a biologist with the U.S. Bureau of Reclamation, says have "made possible a bounty of food production and kept us functioning as a state, because obviously we don't have any rain for six months out of the year." His agency runs the world's largest water development and management system: the Central Valley Project, with 20 dams, 11 power plants, and 500 miles of canals. Shasta is one of California's five large foothill dams around the Central Valley that help control floods and store snowmelt for water customers up and down the state (the others are Oroville, Folsom, New Melones, and Friant); hundreds of smaller, private dams criss-cross rivers up in the mountains, built long ago by

miners, private landowners, PG&E, and various public entities.

Standing on the top, looking down the sheer, streaked face of the 602-foot-high dam, you can't help but feel a wave of vertigo. Everything around the dam seems small and far away—snow-topped Mount Shasta in the distance, the other end of the green-blue lake created by the dam, the specks of ducks bobbing in the light chop, the pin-sized pines along the river at the bottom of this massive edifice.

Inside the dam lie some hollow galleries, but it's mostly solid. Touring these inner hallways, visitors will see swastikas imprinted on some pipes, evidence that those ordering plumbing supplies during the dam's construction (1938 to 1945) got some from Germany before World War II broke out. Newer hardware includes a device that enables operators to withdraw and release water from different lake depths—selecting the coldest bottom water, rather than the warmer upper layers, so that the eggs of spawning salmon stuck below the dam won't die in the river. That's why you need a cushion to boat on the river.

Before the dam got in their way, salmon spawned in the 187 miles of snow-chilled streams of the upper watershed. The dam brought with it a constellation of new facilities, including a hydroelectric power plant, a connection to the Coast Range's Trinity River via a tunnel and Whiskeytown Reservoir, and a smaller

Shasta Dam, with Lake Shasta and Mt. Shasta in the distance

**ARIEL RUBISSOW
OKAMOTO**



Lake Shasta

dam, Keswick, nine miles downstream. Spawning salmon that make it as far upriver as Keswick are trapped and trucked to a fish hatchery at the mouth of nearby Battle Creek. Keswick also serves as what is known in water engineering lingo as an “afterbay,” a place where the powerful flows released from Shasta for maximum power and revenue generation can be stored temporarily, then meted out slowly to the river. This way, the water level downstream doesn’t change too dramatically.

The Central Valley and State Water Projects smooth out the dramatic seasonal swings in drainage across the 42 percent of California’s landscape that is the watershed of San Francisco Bay. These projects collect, store, and release fresh water so that it fills irrigation ditches and city faucets when needed. Before the projects were built, Central Valley inhabitants had a lot more water than they needed in winter. Flow gauges placed in the Sacramento River in the early 1900s confirmed that the river sometimes rose from its normal flow of 5,000 cubic feet per second (cfs) to 600,000 cfs in a matter of days—an amount that could never be contained within its natural banks. Even today, a train of storms can cause a very rapid rise in valley rivers; one former water manager remembers the reservoir coming up 16 feet in 24 hours. “You’ve got a kind

of martini glass shape, so the lower the water level in the reservoir, the faster it can rise in a short period of time,” explains Holt.

The geography of the Central Valley is also unusually conducive to flooding. Its rivers drop quickly out of the mountains onto a vast flat basin, unlike the Mississippi River Valley, for example, whose waters gather and flow over half the continent. In his 1988 book *Battling the Inland Sea*, historian Robert Kelley described the scene before European settlement, after winter storms and spring snowmelt: “The Sacramento River and its tributaries rose like a vast taking in of breath to flow out over their banks onto the wide Valley floor, there to produce terrifying floods. On that remarkably level expanse the spreading waters then stilled and ponded to form an immense, quiet inland sea a hundred miles long. . . . Not until the late spring and summer months would it drain away downstream.”

Native Americans warned early settlers of the inland flooding, but the newcomers went ahead and built on the riverbanks anyway. Whereas the natives migrated between winter and summer villages to accommodate seasonal changes and collect different foods, the settlers weren’t so flexible. In the 1860s, the fledgling towns of Sacramento and Marysville spent months at a time underwater, and more than 80 years of ineffectual levee-building ensued.

Shasta Dam put a stop to such widespread flooding. But this year, the danger of any abundance of water is low. Listening to the chitchat on the streets of Redding, you hear talk of the size of the bathtub ring around the lake, and arguments about whether it looks worse or better than the droughts of ’76 or ’91. The ring is a pretty red color from the underlying sandstone, and a very rare plant called the Shasta snow wreath grows right above this sometimes wet, sometimes dry zone. The white-flowered shrub, like the salmon and everything else in California, will have to try to adapt to a new climate-changed hydrography in which snow melts sooner and rain comes later, and in which a higher dam may expand the bathtub ring into the shrub’s habitat. These are ecological challenges that more concrete may or may not be able to meet. ■

Ariel Rubissow Okamoto lives in San Francisco, writes on water issues, manages an organic vineyard, and is bringing up two daughters not to flush, not to run the tap while doing dishes, and to think of recycling not as an option, but as a way of life.

ANNE CANRIGHT

Wandering the Watershed

A ROAD TRIP! It's one of my favorite things: to load the car with a few essentials—detailed maps, certainly, and my camera gear—and wander out into the world with no particular goal in mind, except to see the land, maybe meet some people, and with luck, find a local coffeehouse or two with character. The road trip I undertook last spring did have a goal of sorts, or at least a theme: I wanted to get acquainted with the San Francisco Bay watershed.

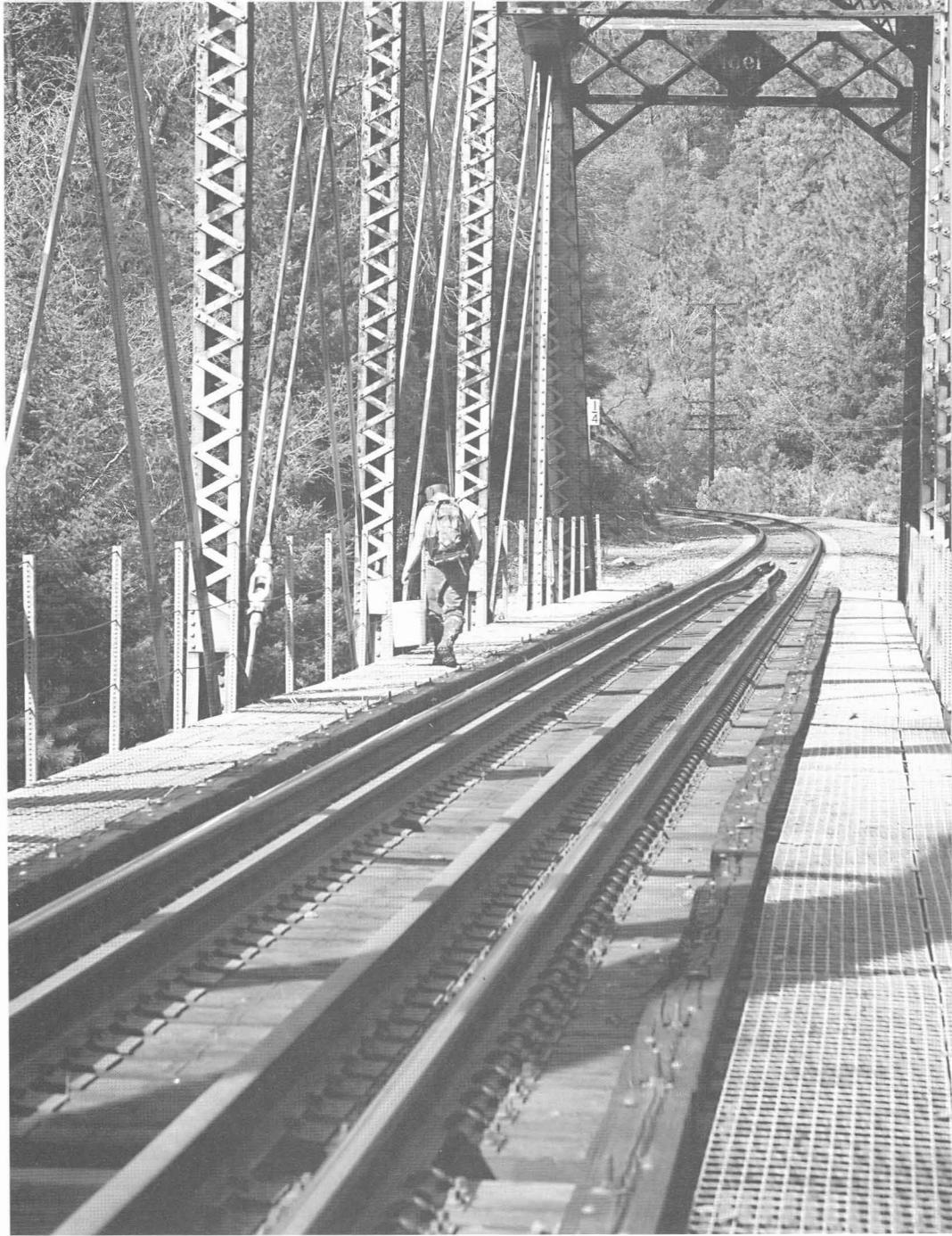
The Bay's watershed, or drainage basin, is—well, it's almost half of California, extending from the Klamath Range in the north to the Tehachapis in the south and east to the Sierra crest. That whole terrain drains to the Bay. Myriad streams, creeks, rivers, and forks of rivers course westward out of the Sierra Nevada and, to a lesser extent, eastward from the coast ranges, meeting and merging like the veins in our bodies, ultimately emptying into two great rivers: the Sacramento and the San Joaquin. These are the pumping heart of much of the state of California, water being the flowing blood.

To keep things simple, I decided to focus on those two waterways. My plan: to visit the source of the Sacramento and follow the river south. The San Joaquin's headwaters, high in the Sierra, were still under snow, so I chose to pick up that

river 15 miles north of Fresno at Friant Dam, a formidable obstacle that has changed the nature of the San Joaquin River for good and all.

My idea was to stay away from the main highways and seek out the shores of the rivers often. For the San Joaquin, I also had some tips from a

A gold prospector crosses the Sacramento River on a railroad bridge.





**Mt. Shasta seen from downtown
Mt. Shasta City, mid-April, 2009**

hydrogeographer with the Bay Institute, Peter Vorster—spots that would give me a glimpse of the varied nature of that river as it exists today. I did the trip in two parts, spending three days on the Sacramento and a weekend on the San Joaquin, putting over 1,200 miles on my trusty 4Runner. That was too short a time to allow for more than a nodding acquaintance with either river, but I did get an intriguing glimpse of California's heartland, with its two life-giving rivers and, in their way even more impressive, the vast waterworks that divert much of the rivers' flow for human uses long before they reach the sea. Two-thirds of the San Francisco Bay Area depends on this elaborate system of dams, canals and ditches, and pumping plants for drinking water, but the entire state—indeed, much of the country—relies on it for food. Yet few of us ever see much of it, or have any idea how thoroughly we have altered the landscape by harnessing the Sacramento and the San Joaquin.

Cool, Clear Water

The purported source of the Sacramento River is a shady grotto in Mt. Shasta City Park—a squat layered rock outcropping out of which gushes water. According to the Mt. Shasta Recreation and Parks District website, “The crystal clear water flowing through the park begins its journey high on the

snow-covered peaks of majestic Mt. Shasta, flowing through underground lava tubes until finally gushing forth into daylight at the City Park's headwaters area.” It then tumbles into a small stream, through lush greenery, and ultimately, after 447 miles, into Suisun Bay and thence to the Pacific. In fact, several forks of the Sacramento originate farther north and at various elevations up to almost 8,000 feet. The U.S. Geological Survey cites the river's source as the confluence of the South and Middle Forks. Wherever the official origin of all this water, it flows into Lake Siskiyou before finding a gorge that, conveniently for the builders of Interstate 5, heads south toward the immense valley of the Sacramento.

While I was visiting the gusher in City Park, a man and a woman arrived toting two five-gallon plastic containers each and proceeded to fill them with this fresh, clear water. The geology here acts as a big water filter—a quality that has attracted beverage companies to the area. Crystal Geysers and Coca-Cola both have bottling plants nearby, and in 2003 a controversy arose when the Swiss-based Nestlé proposed building what would have been the largest bottling plant in the world in the depressed former lumber town of McCloud, 15 miles from Mt. Shasta City.

Tapping into three natural springs on the flanks of Mt. Shasta, Nestlé planned to bottle 521

million gallons a year, which it claimed would create more than 100 jobs in a region hard-hit by unemployment—though skeptics pointed out that these jobs would be largely low-paying production work. Opponents feared that such a large operation could harm local water supplies and kill the appealing character of McCloud for retirees and recreational users of the river; many also objected to the amount of energy and plastic materials used to create and transport a product that is available to most Americans free from the tap. Nestlé subsequently scaled back the size of the proposed plant, and hearings have continued; an environmental impact study is under way.

As I headed out of Mt. Shasta City on I-5, the options for seeking—or even seeing—the Sacramento River down in its gorge were limited by both the rugged topography and the fact that offramps and side roads are few and far between. One of my first chances was at Pollard Gulch, a Forest Service day-use site 20 miles south of Mt. Shasta City. There I encountered another extractive industry on the river—not of water, or even of fish, but of gleaming, glistening gold.

In the 1850s, this spot was known as Portuguese Flat and was the site of a rough mining camp. I saw no evidence of that past on my visit, but on the railroad bridge spanning the river I did encounter a fellow, maybe 60, wearing rubber boots and carrying a big white plastic bucket and a wide, flat green pan: an actual gold prospector. He pointed out a clump of rocks on the other side of the river, said a few weeks earlier he'd pulled up some boards that had gotten lodged there and found a dozen gold nuggets. He showed me their size on the tip of his pinky, said he was "excited as a boy." But then, he wasn't sure how, the "snuffer bottle" (a small plastic bottle that sucks gold out of a pan) he'd put them in ended up upside down, floating away on the river. And so today he was back, to look again. He explained that he grew up in Mt. Shasta City and used to walk from there to Shasta Lake, all along the river—a distance of 30 miles. "I'm an Indian," he said. "That's what we do." I wished him luck as he clambered down the opposite bank.

For my next stop I planned to visit Shasta Dam, 602 feet high and 3,460 feet across, the second largest in the United States (after the Grand Coulee). Built between 1938 and 1945, it creates the many-fingered Lake Shasta, third largest lake and largest reservoir in California. Or more accurately, the lake is created by the inflow of the

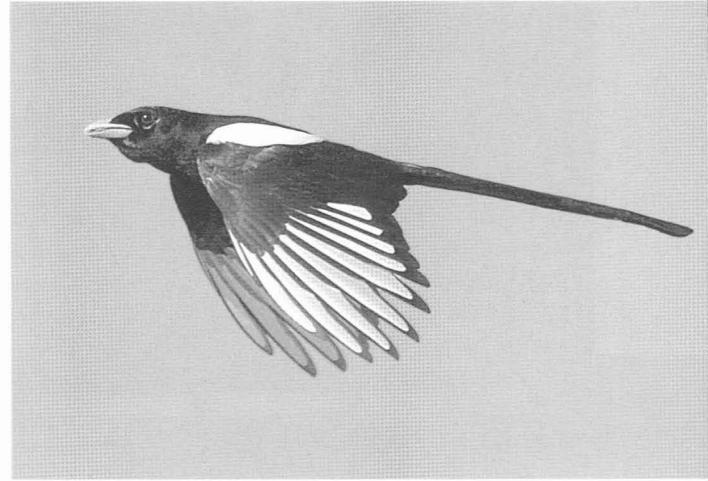
Sacramento, Pit, and McCloud Rivers, as well as several smaller tributaries, whose flow is stopped short by the dam. When water exits the lake over the dam's spillway, it has the dubious distinction of forming the largest manmade waterfall in the world. Somewhere in that torrent, too, it regains the name Sacramento River.

But before I made my way to the dam, I was eager to see the lake behind it. Some wayward, muddy driving brought me near to (but not within sight of) the river, but eventually a friendly couple walking their dog pointed me in the right direction: toward the appropriately named Lakehead. Because Lake Shasta is popular with houseboaters and other recreational boaters, I sought out Lakehead's marina. Two sightseeing boats were tied up next to the small office, but otherwise the floating docks were empty. A pair of men were doing repairs, and two others were readying rods and tackle to do a little fishing. Nobody paid me any mind, short of quick nods. Looking north, I saw that the river had broadened and slowed beneath low bluffs; to my right, the water spread out, probing with deep fingers into the steep, reddish lakebank laced with manzanita and pines. In the distance, cars on I-5 poured across a bridge.

From where I stood, the dam was 20 miles south and west as the crow flies, maybe 30 as the car flies. I hopped back in my car and headed south on I-5, exiting at Shasta City. Half an hour later I was looking north at stunning views of the dam, lake, and, rising grandly in the distance, Mt. Shasta itself, but unfortunately, I was half an hour too late for the dam tour—the perils of road-tripping *sans* guidebook.

Into the Valley

As I drove back on Shasta Dam Boulevard toward I-5, I was able to survey the Sacramento River Valley from a slight elevation. Although I couldn't see the river from here, the spectacle of that broad, flat valley that extends as far as the eye can see—and a few hundred miles farther—made me feel as if I were smack in the middle of a giant relief map of California. The Central Valley, that great depression cradled by mountains, is what so much of the state seems to look in toward, to flow into.



The yellow-billed magpie (*Pica nuttalli*) is a true California endemic, occurring only within the state.



Top: Self-portrait of the author in the stylishly chrome-and-Naugahyde-appointed restroom at Shasta Dam

Bottom: The Sundial Bridge over the Sacramento River at Turtle Bay Exploration Park in Redding. The bridge serves as an actual sundial but, because of its alignment, marks the time accurately only once a year, on the summer solstice.



Not all that long ago, it was a place defined by oak-studded grasslands and great tracts of wetlands—as much as five million acres—that invited ducks, geese, and swans to alight and rest on their long journey from and to wintering and summering grounds. Now, some 95 percent of those wetlands are gone, and the river has been tamed of its natural tendency to flood. The lands of the Central Valley have been tamed as well, to feed not birds but us humans. It is very much a cultural landscape, with little sign of the wild past. As I continued into the valley, I forgot about the tumbling river in its Mt. Shasta-shadowed gorge, and started thinking about food.

No, I wasn't hungry. But all of a sudden I was surrounded on all sides by food—or the promise of food, anyway. For today, what gives order and definition to the Central Valley is not the exuberance of nature, but the well-ordered industry of agriculture. In the Sacramento Valley, primary crops include rice, wheat, nuts (almonds and walnuts), olives, tomatoes, prunes, and apricots. (The valley controls more than two-thirds of the worldwide prune market, and together with the San Joaquin Valley it produces 80 percent of the world's almonds.) As I wove my way back and forth between I-5 and Highway 99 from Redding south toward Sacramento, everywhere I turned there were gnarled trees, marching in perfectly ordered lines and grids.

Farther south, rice fields became the norm; during much of the year, these fields are full of water, yielding rice of over a dozen types. Rice is one of the few crops that grows well in the clayey soils of the Sacramento River Valley. It's a summertime crop, though, and requires irrigation, so each year the 500,000 or so acres of rice fields in the Central Valley are flooded. Following the autumn harvest, past practice was to burn the rice stubble to eliminate disease. The resulting haze and associated health concerns led in the early 1990s to California's Rice Straw Burning Phase-Down Law; instead of burning, farmers began increasingly to flood their fields during the fallow months. At the same time, the late environmental writer Marc Reisner—who once called California's rice industry "a monsoon crop in a desert state"—cofounded the Ricelands Habitat Partnership, a coalition of rice farmers, conservationists, and waterfowl protection groups, to reform rice-growing practices to create more wetlands habitat for wildlife. Now each winter more than 350,000 acres of rice fields are flooded, and while they are not a true substitute for the natural wetlands that have been drained

in the Central Valley, they do provide some significant feeding and resting benefits for migrating waterfowl.

Burning is still allowed, but today it applies to only 15–25 percent of the acreage that 20 years ago was routinely put to the torch. South of the town of Willows, just off I-5, I watched some flames lick their way through a small field near a giant grain silo. Behind me I'd left 10,000 acres of pond-studded marshland/upland, the main unit of the Sacramento National Wildlife Refuge (NWR) Complex. Another 25,000 acres are distributed through almost 30 units of the complex, most of them along the Sacramento River.

To my uneducated eye, the large ponds with small grass- and reed-covered islands at the Sacramento NWR, with great egrets skirting the edges and various species of duck dabbling free, looked pretty “natural.” So did the two stretches of river I visited at the Pine Creek and Llano Seco units of the refuge. I was surprised to learn, therefore, that these units rely on managed water just as much as the rice farmers do, with draining, discing, and even burning, as well as managed planting and irrigation, aiding in the creation of habitats beneficial to birds, and carefully monitored water flows (thanks in part to Shasta Dam and the Red Bluff Diversion Dam) now also helping in the recovery of salmon stocks.

Where Is the River?

When it comes to being far from past conditions, though, the San Joaquin River has the Sacramento beat hands down. The Sacramento is now essentially a managed conveyance channel, bringing 75–80 percent of the river's natural flow to the Sacramento–San Joaquin Delta. The San Joaquin, however, has had a different fate: there, 75–80 percent of its natural flow has been removed from the system. And of course, a dam is involved. At 319 feet, the Friant Dam, completed in 1942, is diminutive compared to Shasta Dam, and the reservoir it creates, Millerton Lake, much smaller. But its impact on the natural river system is huge. At Friant Dam alone, some 95 percent of the natural runoff of the San Joaquin River is diverted for irrigation.

Both Shasta and Friant dams, and dozens of others besides, are part of the federal Central Valley Project, established in 1933 to store and divert water from Central Valley rivers for agriculture in the San Joaquin Valley. More infrastructure was built beginning in the late 1950s, with the launching of the State Water Project. Of the amount of water captured today statewide,

some 80 percent is used for agriculture, according to the Pacific Institute.

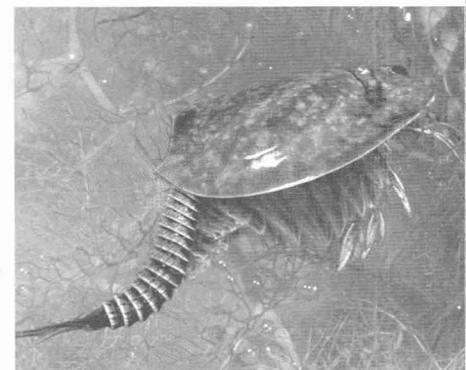
Much of that water is delivered by canals, ditches, bypasses, aqueducts—and as I drove across the San Joaquin Valley on Highway 152, I was struck by all the gleaming ribbons of water. Peter Vorster told me to watch for a bridge over the San Joaquin, commenting that “there may not even be a sign—it's almost a joke.” There was a sign, fortunately, because it was immediately obvious what he meant about the “joke”: the river channel, while nice and wide, was full of . . . tire tracks in the sand. Not a hint of water, although immediately adjacent to the riverbed a canal was merrily coursing along. In fact, according to the Natural Resources Defense Council, thanks to diversions such as this, more than 60 miles of the 330-mile-long San Joaquin are completely dry in all but the wettest years.

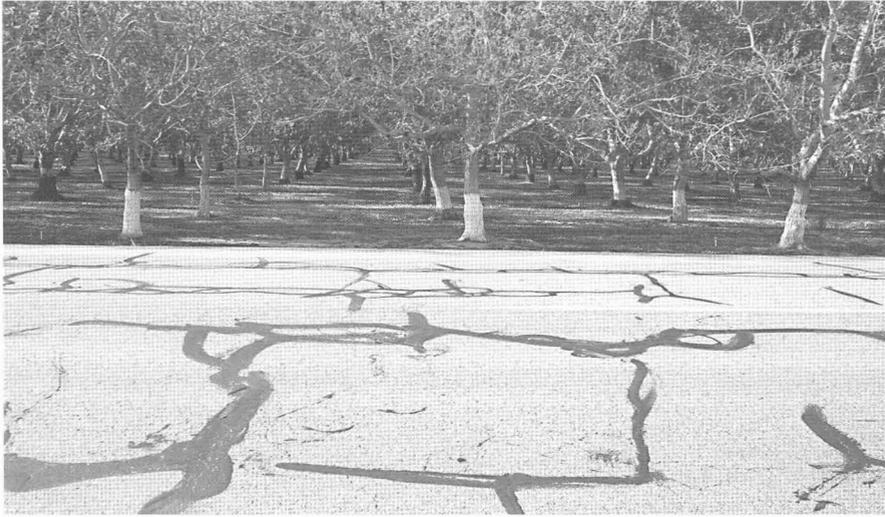
And so I set off on a detective hunt: with my map in hand, I wanted to see how many “representative” faces of today's San Joaquin River I could find. After taking a gander at Millerton Lake, which was abustle with boaters, fishers, picnickers, jet-skiers, kayakers, and swimmers, I headed down past Friant Dam and along Millerton Lake Road. The San Joaquin Fish Hatchery reminded me that the river once supported the southernmost Chinook salmon run in North America—until sections of the river went dry in the late 1940s, after the dam was completed. Since then, only the wettest years have seen salmon spawning beneath the dam, though early this year a \$400-million project, battled over for two decades, was approved by Congress to increase the amount of water released from the dam to help resurrect the river's salmon fishery.

The abundant gravel of the San Joaquin is perfect for the salmon's redds—and also for human building projects. Along Millerton Lake Road are many aggregate mining operations that remove sand and gravel by the ton, and leave behind large pits. Even in a river that isn't running at five percent of its natural capacity, such pits interfere with sediment travel and cause flow rates to slow, making it more difficult for anadromous fish to reach their spawning grounds; they also harbor non-native predatory fish, which prey on young salmon returning to the sea.

My next stop was about 35 miles west of Fresno at Mendota Pool, a reservoir just north of the town of Mendota, “Cantaloupe Capital of the World.” It was late on a Saturday afternoon, and families had gathered to sit with their fishing poles and visit by the small expanse of water

Tadpole shrimp are found worldwide, but *Lepidurus packardii* lives only in vernal pools in California. When pools dry up, their embryos can survive in suspended animation until the rains return.





A walnut grove seen across a patched road in the Sacramento Valley

Stranger and stranger: a river with no water; a river that is replenished by water taken from its mouth.

surrounded by waving reeds. At the northwest corner of the pool I noticed a lock and a canal, the Delta-Mendota. At first I thought this canal led *out* of the pool, but no: perversely enough, it brings water *from* the Sacramento–San Joaquin Delta and delivers it (back) *to* the San Joaquin River. Its purpose: to “rewet” the river, by replacing some of the water that was diverted at Friant Dam into the Friant-Kern Canal heading south and the Madera Canal heading north. In between Madera and the pool is the first stretch of river, 17 miles in length, that is bone dry. Without the backward-flowing canal, it would simply stay that way. Which would take the San Joaquin out of the Sacramento–San Joaquin Delta rather definitively.

Stranger and stranger: a river with no water; a river that is replenished by water taken from its mouth. Driving from Mendota Pool, zigzagging on township-and-range roads north and west, I kept a lookout for the river, not entirely trusting that it wasn’t some figment from *Alice in Wonderland*. In the distance, across flat fields of alfalfa, wheat, grapes, dry beans, and other crops, I could see a riparian corridor snaking: willows and other trees that relish a reliable supply of water. My map showed the river twisting and turning, accompanied by the straight legs of canals, bypasses, and ditches. I found a few places that *may* have been the San Joaquin—some were just depressions thick with vegetation but no open water, though as I worked my way north the river came into its own more and more. But then, in Patterson, I lost it: it simply disappeared. A culvert had whisked it underground.

I abandoned my quest and headed to I-5. There, on the west side of the San Joaquin

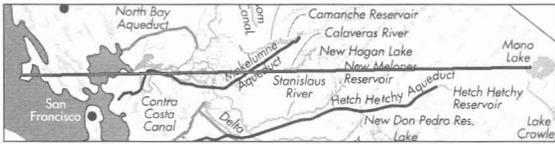
Valley, I reencountered the 117-mile-long Delta-Mendota Canal, which between the San Luis Reservoir (on Highway 152) and Tracy parallels the California Aqueduct—two shining ribbons of concrete-encased lifeblood: water for us to drink, and water for our food to drink. At Tracy are two pumping plants, each of which ministers to one of these conduits, hoisting water 200-plus feet from the Delta and sending it on its way south.

At Antioch I found myself high in the air on a toll bridge that connected me to the leveed islands of the agricultural Delta. Looking down, I saw the spot where the San Joaquin flows gracefully into the Sacramento, and from there into Suisun, San Pablo, and San Francisco Bays.

My trip wasn’t finished yet, though. Peter Vorster had told me that if I wanted to see what the San Joaquin might have looked like near its mouth before its water was stolen for agriculture, I should visit the 46,000-acre Cosumnes River Preserve. The 80-mile-long Cosumnes River is the last remaining unregulated river on the western slope of the Sierra Nevada. As such, it continues to flood each year in its natural cycle, and it still supports thousands of acres of wetlands, along with native upland vegetation and wildlife.

At the Preserve, just north of Galt, I took a loop walk, enjoying the diversity of plant life. Cottonwood, willow, ash, and other flood-resistant trees edged the river itself, and valley oak riparian forest gave me a glimpse of flitting birds. Near the visitor center, a bridge allowed a view of a seasonal slough. A large proportion of the Central Valley’s greater sandhill crane population stops at the Preserve, and river otters ply the current of the Cosumnes—though the only mammal life I saw was in kayaks.

The lush tangle of greenery, both in the slough and along the river’s banks, was such a contrast to the ordered neatness of the walnut orchards and wheat fields of the tamed rivers of the valley, not to mention the tire-marked stretch of sand labeled “San Joaquin River” on Highway 152. I felt grateful for this preserve, for providing a hint of what once was. And I felt hopeful for the Chinook salmon that, perhaps before too long, will again find water to swim in all the way to Friant Dam. Their ancestral home will never return, no; but we can at least create an environment that is healthier, and more sustainable, not only for the fish but for us as well. ■



SIERRA CREST TO THE SEA ALONG THE 38TH PARALLEL

Exploring California's "Water Line"

DAVID CARLE
WITH JANET CARLE

WE WERE CAMPED AT 10,430 feet above sea level, just east of the Sierra crest, looking at small glaciers clinging to the north slopes of Mt. Conness and North Peak. Wispy clouds turned pink and there was the beginning of alpenglow overhead. It was our first evening on a 17-day trek across California in September 2008, closely following the 38th parallel from our home near Mono Lake to the Point Reyes lighthouse, exploring some of the mountains-to-the-sea watershed

that sends water to San Francisco Bay and, finally, out to the Pacific Ocean.

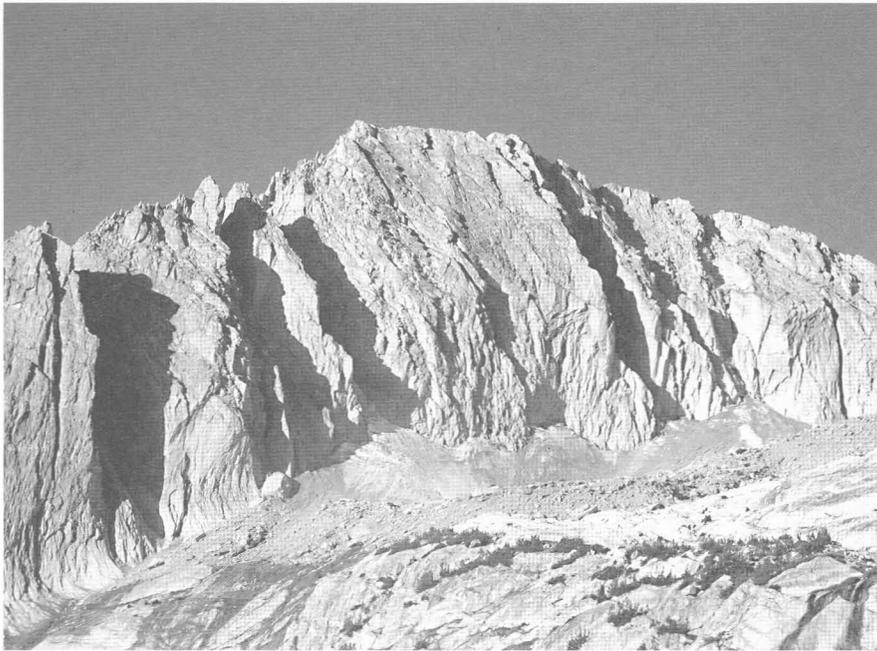
At the slow pace dictated by travel on foot, bicycle, and boat, we explored the 38°N latitude "water line," where battles have been fought over dams, aqueducts, and wetlands, and where critical water issues still are being played out.

The list includes Mono Lake, the snow-pack at the Sierra Nevada crest, Hetch Hetchy, New Melones Reservoir, the Sacramento–San Joaquin Delta, San

What is a line but a dream and the will to follow it?

(From Janet's journal)





Previous page: David and Janet Carle's cross-California trek started at their home near Mono Lake, which lies on the 38th parallel.

Above: North Glacier, at the headwaters of Lee Vining Creek, just east of the Sierra crest, is shrinking rapidly.

San Francisco Bay, and Point Reyes. At each site we met with experts involved with resource protection and restoration.

Our starting point at Mono Lake, east of the mountain range, might seem hydrologically separate from the San Francisco Bay watershed, were it not for relationships that Los Angeles and metropolitan southern California have with this entire "water line." Stresses on the water supply system in one place are today felt throughout the state.

At a sendoff party at Mono Lake we spoke with Geoff McQuilken, director of the Mono Lake Committee, about such connections. Reducing diversions from Mono Basin streams required Los Angeles to conserve water, which, Geoff noted, "affects how much is drawn out of the Bay-Delta for southern California and in turn affects users right there along your route. It's all linked together." Of course, all water bodies are part of the planetary water cycle, sharing vapor with the atmosphere until rain and snow return it to the Sierra Nevada range.

We live just a mile north of Mono Lake. The next morning we walked out the door of our house and headed west up Lundy Canyon, where Mill Creek gathers snowmelt from the surrounding peaks before flowing below our house into the lake. The canyon steadily angled southwest and, at the top, we stood exactly on the 38° line.

The Sierra Crest

Connie Millar met us as the afternoon sun dropped toward the crest. She is a U.S. Forest Service paleoecologist who explores connections

between mountain vegetation and changing climate patterns. She told us that photographs taken 80 years ago documented how the nearby glaciers had shrunk by at least 80 percent during the last century. In the last 30 years, shrinkage has accelerated. "North Glacier may be gone in a decade," Connie told us, "and all of the glaciers in the central Sierra in our lifetimes."

Some of the clearest signs of climate warming are visible at high elevations. Scientists have been trying to understand what global changes mean for local areas, because the effects vary. "In much of the eastern U.S., temperatures are actually cooling," Connie told us, "while the West is warming much faster than the global average."

A rising temperature trend has been recorded in California through the last 120 years, but the slope of that curve has steepened over the last 30 years, and "in the last ten years everything has shot up," said Connie. Forecasts give two-to-one odds that much of California will be drier by the end of the century—a 20 percent decline in precipitation—with more water falling as rain, less as snow. A trend of earlier snowmelt runoff, shorter spring seasons, and longer summers is already apparent in the Sierra Nevada.

We were sitting near the tree line. Scattered clumps of trees across the basin were primarily whitebark pine and some limber pine. Connie explained how "drier" added to "warmer" has been killing limber pines. That year she was also seeing whitebark pines starting to die, with "whole hillsides going in a flash of mortality."

"It sounds like worse news than I think it is," she added. "Even where there is a lot of mortality, it's not total." Slower-growing trees were being taken out, producing very strong selection for trees that do better under the altered climate.

"Are trees going to move upslope, chasing suitable conditions?" we asked.

"We don't see whitebark pine moving up; if it were, there should be baby pines right here."

We all wondered what might happen to Mono Lake. It would be tragic if it were to die because of climate change. This inland sea has survived prehistoric droughts, but despite success in reducing steam diversions, the buffer taken away by 50 years of diversions has not yet been restored.

Connie's concerns were broader, stretching from Mono Lake to even the smallest riparian corridors. One of her special interests is "rock glaciers," where ice lies embedded beneath insulating rock, something we could see at the lower edge of North Glacier, just south of us hugging

the mountain crest. The terminal moraine there was seeping water. Rock glaciers, with their insulating coats of rubble, should help wetlands stay lush and alive for many years during a warmer climate regime. "They won't fill Mono Lake up," Connie explained, "but they will serve these local wetlands and provide persistent streams where other canyons will just dry up. It's encouraging, not for the statewide water supply, but locally for birds and wildflowers and pika."

California's official climate strategy is to prioritize efforts toward the most sensitive resources. "People are talking about triage these days," Connie said. "There will be things we just have to let go. An example is on the west slope of the Sierra, where almost all of the resource plans have had a priority to reintroduce salmon. But by mid-century, waters may become too warm to support natural salmon runs, so you may not want to put the effort there if you are just going to lose."

It was a grim picture to consider as we sat in one of the world's most heavenly settings. We joined Connie for the first mile of her homeward trail, then headed back up to our tent to prepare for the night.

Grand Canyon of the Tuolumne

Janet: A beautiful bluebird morning at Cascade Lake. We followed a use-trail up onto Shepherd's Crest and paused at the boundary of Yosemite National Park to gaze westward across the wilderness we would cross in the coming days. Upper McCabe Lake lay on the 38th parallel below us.

Later that day we found fish nets stretched out across Middle McCabe Lake. The national park was two years into a five-year project to clean fish out and improve conditions for native yellow-legged frogs. We saw no fish, but also no polliwogs or adult frogs, yet.

These frogs are beleaguered not only by trout predation, but they are now also infected by a fungus that is killing amphibians all over the world and has spread across much of our mountain wilderness, perhaps carried by flying insects. Some individual frogs will hopefully have resistance, but add in pesticides, which interfere with

reproduction, blowing in from Central Valley farms, and the amphibians' prospects look terribly bleak.

In the following days we descended through the Grand Canyon of the Tuolumne River. We dropped past California, Le Conte, and Waterwheel Falls, gravity pulling the water, and us, down and down. We left the lodgepole forest

behind and walked beneath black oaks and Jeffrey and sugar pines. The canyon featured a series of cascades and pools, with massive granite walls framing

the views and channeling our direction of travel through a landscape that resembled upper Yosemite Valley. We saw almost no other people.

Above 6,000 feet, it felt like everything was in a hurry to set seeds before winter, including mountain ash, with its clusters of bright red berries. Where we first encountered oak trees,

There will be things we just have to let go.

Janet Carle walks a well-worn trail in the Tuolumne River watershed within Yosemite National Park.





Water cascades over LeConte Falls in the Grand Canyon of the Tuolumne.

acorns were plopping under canopies of yellow-brown leaves, but farther down canyon the trees had barely begun to think about autumn.

Janet: A long cascade into an emerald pool got us to stop for another dip. We had it all to ourselves. In another cascade of pools a water ouzel was working away, feeding under water. A great place for both human and avian dippers.

The canyon opened wider at Pate Valley, where the elevation was only 4,350 feet. The air felt noticeably thicker, and the trees were mostly oaks and incense cedar. Downstream from there the canyon curves south and then back to the west toward Hetch Hetchy Valley. If only we could follow the river down that way! But the National Park Service does not allow recreation access along the upper shores of Hetch Hetchy Reservoir, the City of San Francisco's water source, so we instead made a strenuous two-day detour. Having to climb 3,500 feet to Harden Lake on the sixth day of our hike cemented my resentment toward the access restriction. Still, there were fine vistas down-canyon from a couple of points along the climb.

The National Park system might not exist except for what happened here at Hetch Hetchy.

We left late summer behind in Pate Valley on that climb and returned abruptly to early autumn at 7,600 feet (37°53N; 7.5 miles south of the line, the farthest point south on the trip).

There were day-hikers at Harden Lake who had come from White Wolf campground, only a few miles away. Though we had 12 backcountry miles to do the next day, running into those people made it clear we had finished the most remote, wild part of our crossing.

Hetch Hetchy

As we navigated switchbacks on the trail down toward Hetch Hetchy, I glimpsed below us what struck me as a big slab of gray granite. Then my wilderness-focused brain adjusted and I realized it was the paved road to O'Shaughnessy Dam. Along this stretch of trail we also saw poison oak and knew we had truly come down from the high country.

Just after we set up our tent, not far from the dam, Spreck Rosekrans found us. He is chairman of the board of Restore Hetch Hetchy, and he also handles water issues for the Environmental Defense Fund (EDF). He became our new best friend when we saw he was carrying fresh food and wine!

Spreck's organization hopes to restore Hetch Hetchy Valley, an idea that seems audacious to some people, given the water supply challenges facing this state. Yet several feasibility studies have concluded that water storage opportunities downstream make it possible to replace the water held behind the dam and almost all of the

hydroelectric power from Hetch Hetchy. The organization formed back in 1999 as a split-off group from the Sierra Club, which refused to support that goal. On the day the Sierra Club reengages with this century-old battle, we all agreed,

John Muir would be smiling.

"The damming of Hetch Hetchy was the event that turned the Sierra Club from an outing club to a political organization," Spreck explained. "Congress authorized this dam in 1913; two years later they came back and passed the National Parks Act, basically ensuring that we're going to preserve parks and not do any more

Hetch Hetchys ever again. The National Park system might not exist except for what happened here at Hetch Hetchy.”

Janet: Spreck walked with us across O'Shaughnessy Dam and we looked at the exhibit panels. We found no photographs there of the valley before the reservoir. Spreck did us another major favor the next morning by driving me and our backpacks to the campground at Cherry Lake, while Dave walked the 15 miles carrying just a day pack.

The camp host was vacuuming debris off the road (shades of cartoonist Phil Frank's Velma Melmac!). The campground was full of deer hunters. I found a site and put signs up for Dave and our son, Ryan, who was meeting us there with bicycles and supplies.

Sonora to Stockton

We had finished walking across the mountains. The next day, on the autumn equinox, we biked down through the Stanislaus National Forest, aware that all of us on the 38°N latitude line saw the noon sun that day at 52 degrees (90°–38°) above the horizon. The 40-mile stretch to Sonora was a forested and scenic route that was extremely hilly. At one point I was pedaling uphill so slowly that a butterfly heading the same direction passed me by.

In Sonora, at the house of Kurt Stegen, we took our first showers in nine days, and then Kurt drove us to the New Melones Reservoir visitor center. He has been a volunteer with Friends of the River for about 35 years. The height of the dam to be built on the Stanislaus River, as well as how much of the canyon was to be flooded, were issues of passionate contention. In 1974, Friends of the River sponsored Proposition 17, a ballot initiative to prevent the reservoir from inundating nine miles of a popular river rafting stretch at the upper end of the canyon.

Another group, Friends of New Melones, formed expressly to defeat the ballot measure, posted billboards proclaiming: *Stop "Wild River" Hoax! Stop Pollution of the River!* The *Los Angeles Times* editorialized that “the billboards seem an absolute betrayal of the truth to us. We, too, oppose Proposition 17. But to call it a “wild-river hoax” and to suggest that the proposition would result in pollution is a resort to tactics that have no place in responsible democratic campaigning.” Proposition 17 lost, 47 percent to 53.

An exhibit in the visitor center summarizes some of that history, which Kurt and so many others lived first-hand. From there we drove to the viewpoint overlooking the dam, a massive earthen plug 625 feet high, spanning 1,560 feet across the canyon. A parking lot, restroom building, and shade shelters sit abandoned at the canyon rim about a half-mile downstream from the dam, at the end of an access road that is now closed to the public.

In 1979, as the reservoir began to fill, Mark Dubois, then director of Friends of the River, chained himself to a boulder in a secret location that would be flooded. Several others joined that protest, forcing water to be released from the dam to avoid drowning the protesters.

In 1980, the California State Water Resources Control Board set a low limit for the reservoir level, but heavy runoff after the record winter of 1982 trumped political will and filled the reservoir to its spilling point. In 1983, the Board lifted its filling restrictions; a full reservoir was a *fait accompli*. Despite its defeat, Friends of the River has played a significant role in river protection ever since.

Toward sunset, we stood at the Parrot's Ferry site, where the whitewater rafting stretch once began, and looked at tree snags poking up above the water (the reservoir was at only 46 percent of capacity). For Kurt, that low level opened up an intriguing possibility: perhaps the reservoir could be managed such that the whitewater stretch could be restored, while still ensuring emergency flood storage capacity in high-water episodes like those forecast to occur more frequently with global warming. The Stanislaus River story may not be finished.

In the morning we began an all-day bike ride from Sonora to Stockton. There were too many trucks and no bike lane on Highway 4, so we dropped out of the foothills through Salt Springs Valley, passing scattered ranch houses, cattle, and fields remote from the busy travel routes. We saw white pelicans, pied-billed grebes, and assorted ducks on the reservoir at the bottom of that valley. As we approached Highway 26, the road we were traveling was lined with tailing piles, the gravel debris left by miners who had seemingly chewed their way across the surface of the land.

The hard physical part of this trip was over once we reached Stockton, since we would embark by boat in the morning. Hiking and biking had given us a new, physical appreciation for the size of this state.



Wind turbines generate electricity in the Montezuma Hills, near the confluence of the Sacramento and San Joaquin Rivers.

The Delta

After dropping us at the Stockton marina, Ryan left to drive back home. The fact that he could return in a few hours to where we'd started 11 days before was part of the relativity we were exploring on this trek.

We watched a parade of boaters come and go: mom, pop, dog; then several lone fishermen; and five head-shaved, tattooed young men crammed into a boat built for speed rather than fishing. John Knotts's 33-foot Catalina sailboat emerged from among a group of college rowing-crew kids launching their sculls. It was to be our mother ship for the next five days. John had been the Sierra District State Park superintendent, which included responsibility for the Mono Lake unit. With David Martin (another State Parks employee) along as crew, he had sailed from San Francisco Bay to meet us. John's brother, Marty, came along in his smaller catamaran.

Toward sunset that first night on the Delta, we turned out of the deepwater channel and anchored near Lost Isle. David Martin had a portable GPS unit; he paddled his kayak a few yards away, then called back that he was *exactly* on the 38th.

Swimming in the warm water felt fantastic, though I could not help speculating about the agricultural runoff chemicals that were in the mix. I told the others that the lower San Joaquin River has been derided as the "lower colon" of the valley's river system because it carries so much pollution. Still, it was a beautiful evening in a natural setting.

One side of the channel was green and lush and noisy with birds. The other side was a bare rock levee, devoid of life. As night fell, from behind that levee we heard the insistent beeping of vehicles backing up. The next morning we saw the source of the noise: trucks driving atop the levee, each pulling two trailers brimming with tomatoes harvested during the night.

Our westerly route took us through Frank's Tract. Several miles south were the massive pumps that send water into the aqueducts serving the San Joaquin Valley and southern California. We anchored at the Brannan Island State Recreation Area marina (38°07'N, 121°41'W).

Janet: Life on the river is a whole different world, with pace dictated by tide, wind, and marina. It was hard to believe that the little channel in front of us could take us to the Golden Gate and the open sea. But as we chugged along that gradually widening channel, the scale of the Delta revealed itself.

You could feel the power of the water, full of life, giving life, moving life. The water has a wonderful sweet smell, like "sweet rain," I decided. A very different feel and odor than a Sierra stream. More rich, warmer, and dense with life.

The most exciting part of our first full day on the river was a sea lion. I saw a dark head, then thrashing body, then a flash of a huge silver fish. So much is going on under there! I felt privileged to catch the glimpse—a sight becoming rare as the salmon disappear. What must it have been like 100 years ago, with the rivers teeming with multiple salmon runs?

We had been given an update on the issues affecting the Delta while we were at Hetch Hetchy

because Spreck Rosekrans had just come from a Bay Delta Conservation Plan (BDCP) meeting. The BDCP group, appointed by the governor, sought agreement among water diverters, environmental interests, and Delta farmers and residents, a process Spreck characterized as “gnarly.” Spring and fall runs of chinook salmon and the tiny delta smelt, populations of fish that once were incredibly abundant, are now close to extinction. There is a huge seismic risk to levees. Water agencies want a peripheral canal around the Delta so they can continue moving fresh water if levees fail and salt water reaches the pumps. Delta landowners worry that, with a canal in place, other interests would no longer share the “common pool” that gives everyone an incentive to maintain levees. Major concerns remain that enough flow be guaranteed to the estuary ecosystem and that a peripheral canal not facilitate ever more diversions.

John Cain met us at Brannan Island. He is the director of restoration programs for the Natural Heritage Institute (in the 1990s he had worked for the Mono Lake Committee). While Janet and I toured in John’s car, the boats shifted to the southwest end of Sherman Island. Our road ran beside the Sacramento River, the major river artery of the northern half of the state. Massive wind turbines decorated the hills beyond the channel.

John told us that groundwater pumps run constantly in the Delta to keep fields dry enough to grow crops. Farm soils are constantly subsiding because the peat soil, exposed to air, is oxidizing and losing one to two inches of soil volume each year.

We stopped on Twitchell Island, 12 feet below sea level, where native tules and cattails were growing on several acres of ponds. John reached into the water and came up with a handful of dripping black mud. “The rate of tule muck accumulation is about two inches per year. We’re reversing subsidence—actually building up this island. These islands have become a substantial source of atmospheric CO₂, so this converts a carbon source to a sink. We’re hoping to do this on a much larger scale.”

We mulled over “carbon-capture farming” as we drove to the south end of the island to see an experimental “green levee” covered with lush growth. Engineers prefer that levees be bare so they can see signs of failure, but during a recent flood event, John said, “when people thought the standard levee was going to go, everyone

took shelter behind this levee armored with vegetation.”

To reach the Antioch Bridge and the south shore of the river channel, we drove across Sherman Island, 11,000 acres of farmland at the western margin of the Delta that are theoretically protected by levees. However, those levees were built on sand foundations that may undergo liquefaction during a large earthquake.

Across the bridge are the communities of Antioch and Oakley, with shopping malls, housing tracts, and crowded highways. On a dairy farm near Dutch Slough, a few miles east of Oakley, construction of 4,500 homes had been planned, but the farmer was persuaded instead to sell the 1,200 acres to the State, a purchase made with CalFed Bay-Delta Accord water bond funds. This Dutch Slough project, conceived by John for the Natural Heritage Institute, includes the Coastal Conservancy, California Bay-Delta Authority, Department of Water Resources, and City of Oakley as partners, and will become the largest freshwater tidal marsh restoration project in the Delta.

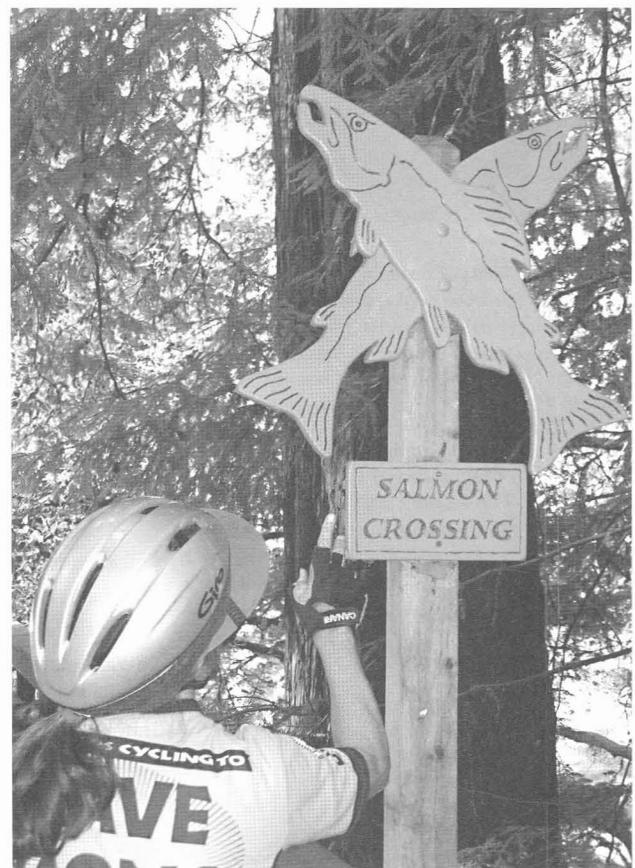
We walked atop a levee, trying to visualize the pasture as tule wetlands. “Come back in ten or 20 years,” John told us, “and you should see valley oaks and sycamores and walnut trees grading out into grasslands and tidal marsh.” In time, the restored wetlands should support juvenile salmon pausing to feed and grow before they finish their own treks from the mountains out to the sea.

Our final destination with John was a subdivision in Oakley built below sea level. The levee there meets 100-year FEMA standards, so homeowners are not required to buy flood insurance. With climate models forecasting a possible four-foot sea level rise by the end of the century, however, such faith in levees seems a recipe for disaster.

Strait to the Bay

The following morning, the 14th day of our trek, the tide was very low, the Bay nearly flat, the weather sunny and calm—perfect for paddling the 9.5 miles to

Janet Carle looks at a salmon crossing sign on Lagunitas Creek in Samuel P. Taylor State Park, in Marin County, where salmon habitat is being restored.



Vallejo in handmade kayaks John Knott and David Martin had brought on the sailboat. We were rocked by the wakes of several massive ships far out in the deep-water channel. Cars looked tiny on the freeway spans of the bridge far overhead. As we paddled beneath them, I whooped out loud with exhilaration. It was a thrill to kayak under the Carquinez Strait bridges into San Pablo Bay, reaching that destination along with vital flowing water that had originated in the Sierra Nevada high country.

On the far side of the strait we rounded a breakwater and entered Mare Strait. We continued to the Vallejo Municipal Marina, where the sailboats caught up with us. There we took Marc Holmes on board. He is the bay restoration program director for the Bay Institute. Marc guided us a few miles up the Napa River to former Cargill salt ponds now being restored (at 38°09N, ten miles north of our latitude line—the farthest we strayed on the trip). Originally there were 196,000 acres of tidal marshes from Suisun Marsh out through San Francisco Bay. Eighty-six percent of that is gone. The opportunities for coastal wetlands restoration in the Napa-Sonoma marshes are enormous.

As we motored upriver, Marc pointed toward houses lining the northeast shoreline. “None of those residences could be permitted today, because they’re built in the tidal margins of the Bay. The San Francisco Bay Conservation and Development Commission was established in 1965 to regulate bayfront development and protect the Bay. By then, one-third of the Bay had been filled or diked or drained.”

Everyone transferred to Marty’s catamaran to motor into the salt pond complex, now managed by the Coastal Conservancy. Tidal marsh had been converted there in the mid-1870s to grazing land and later to duck hunting clubs. The Leslie Salt company bought the properties and later sold them to Cargill. The salt pond complex circulated Bay water through 12 increasingly concentrated 1,000-acre ponds.

“This cordgrass that you see is new growth since the levees were breached 18 months ago,” Marc said. “None had been in here in 100 years

These birds had perhaps chosen the most direct migratory route, following the 38th parallel, as we had, to reach the ocean.

or more. Their seeds traveled naturally on the tide. I’m *stunned* to see that much cordgrass in so little time.”

The rest of the food chain was returning too, including invertebrates and birds. “And we haven’t even talked about fish,” Marc added. He reiterated what we’d heard from John Cain about the importance of wetlands to juvenile salmon. “And this is the farthest west habitat for delta smelt,” he added. The endangered delta smelt is at the center of controversy over diversion cutbacks, because aqueduct pumps chew up so many of the tiny fish. “This is so great; you’re seeing it right at the beginning,” Marc exulted. “Come back here in five years and the cordgrass lines will extend across the pond.”

China Camp, Point Reyes

Janet: After anchoring for the night at the mouth of the Petaluma River (38°06'42"), off we went toward China Camp. We transferred our things to the catamaran for the shallow-water landing and sadly said goodbye to Captain John and David Martin.

On the ride up onto the beach, I felt like Columbus coming ashore in the New World. China Camp beach is exactly on our latitude line (38°00'03"N). We checked out the shrimp camp museum while we waited for Ryan to show up.

China Camp’s oldest resident, Frank Quan, told us that in the late 19th century about 500 Chinese people, including his family, had lived at this shrimp camp, one of many around the Bay. Two million pounds of shrimp were harvested each year until the Chinese bag nets were banned as a shrimping technique. Frank still fishes in the Bay, but the native shrimp population is almost gone. He explained that shrimp go up to the mixing zone to find less salty water, but with water diversions from the Delta there is less dilution within the Bay. Frank does not expect the shrimp to last through his lifetime.

We spent the night with friends in San Anselmo, then continued by bicycle to the Point Reyes National Seashore headquarters at Bear



Valley. Don Neubacher, the park superintendent, had attended the graduate School of Ecology at U.C. Davis with two of the founders of the Mono Lake Committee. He spread a map on a picnic table outside the park office and told us about the many projects they are working on to restore coastal marshes and reopen miles of streams to fish passage, the single biggest effort being the 560-acre Giacomini Marsh at the south end of Tomales Bay (see p. 28).

"It had been a dairy," Don said, "and they diked off the bay in the 1940s. Lagunitas Creek flows through there and is the one creek in this region that still has a pretty good run of coho salmon. You'll see three-foot fish in 12 inches of water."

Don told us that the Giacomini project alone adds ten percent to Central Coast wetlands. "That gives you an idea how little there is left," he said. "On October 25th we'll open the last bit of levee, and 50 to 60 percent of the land will flood at high tide. This thing will be transformed in a couple of years." [On October 26, 2008, 500 people celebrated the opening of the levee and watched the first high tide move across the land.]

That afternoon we bicycled over the ridge to Limantour Beach. Studying the surf swells rolling in and seeing how far away Point Reyes was, we decided to change our plan to kayak from that beach the next morning. Camping that night in a volunteers' campground not far from the headquarters, we heard the screechy calls of spotted owls.

To the Lighthouse

The morning was overcast as we pedaled up the west shore of Tomales Bay, but we found the sunshine as we wrapped around Drakes Estero and turned back south toward Drakes Beach. Ryan, who had rejoined us at China Camp, had been photographing California gulls while waiting for us to arrive. We wondered if they were from Mono Lake, where three-quarters of that species found in this state are born. These birds had perhaps chosen the most direct migratory route, following the 38th parallel, as we had, to reach the ocean.

We inflated our two-person kayak and changed into wetsuits and life jackets. The bright yellow boat, our "rubber ducky," had to carry us for 2.3 miles across Drakes Bay.

We were novices at launching through waves. Three aborted tries sent us tumbling about on the beach, but finally we made a successful launch. About halfway to the fish dock at Chimney Rock, we heard the wonderfully mysterious calls of loons and then saw several of them dive and surface, calling repeatedly. Then from the beach came the deep, resonant, vibrating "chonk" of elephant seals.

Ryan met us at the fish dock and we loaded gear into the car. Then we finished our trek across California by walking across Point Reyes



Top: In a former salt pond on San Pablo Bay's north shore, levees have been breached to allow tidal wetlands to return. This egret is among thousands of birds that now visit the rapidly recovering marsh.

Above: Many Chinese shrimp camps sprang up around the Bay after 1869, when completion of the transcontinental railroad released thousands of Chinese workers. Shrimp were dried and shipped to China. You can see the last remnant of the camps at China Camp State Park.

Top: The Delta-to-the-Bay boat crew, standing from left: David Martin, David Carle, Marty Knott; kneeling, John Knott, Janet Carle, Zippy the sailor dog.

Janet, Ryan, and David Carle at the end of their journey, above Pt. Reyes Lighthouse



to the lighthouse, where our San Anselmo hosts were waiting at the parking lot with food, champagne, and several other friends. Together we went out to the lighthouse overlook (37°59'44"N, 123°01'23"W).

The picnic food was spread out and champagne was poured. We took turns proposing toasts and speaking about the trip, with breaks to watch whales blowing offshore. "What most impressed me," Janet said, "is how kind and how supportive all the people along the way were in meeting with us and giving us their time and sharing their passion and really *being* passionate. It was very hopeful and inspiring."

The most striking lessons about California water came gradually as our journey connected the watershed from the Sierra crest to the sea. Positive feelings built as we were shown each restoration effort and the dedication of so many good people pursuing meaningful environmental goals. That does not mean we can forget the state's many

water problems. Yet, to pull a concept from the presidential campaign under way that September, we emerged with audacious hope.

How vast the distance across the state became when walked at two miles per hour, sailed at four miles per hour, and bicycled, at times, up steep hills at a "speed" easily exceeded by a cruising butterfly. In 17 days we had traveled 350 miles, 75 of them on foot, 168 on bicycles, and 107 on boats. (A direct line from start to finish would have been 220 miles.) Crossing the state slowly, with time to look at things closely and experience them directly, provided new lessons for the two of us, who were born in the state, have worked and lived in many of its regions, and always cared about this special place on Earth called California.

At the overlook, an elderly couple who had been coming there for more than 30 years said that day had the best weather conditions they had ever seen at that spot. Janet and I stared at the ocean, trying to grasp the fact that we had finished. Off to the southwest, the profiles of the Farallon Islands were visible. Over the horizon, far to the west, the 38° latitude was heading toward another landfall, in Japan. ■

David and Janet Carle worked as park rangers at the Mono Lake Tufa State Reserve for over 20 years and still live north of the lake since their retirement from the State park service. Their on-going exploration of the 38th parallel will take them around the world and will become a book to be published by the University of California Press. David is the author of ten books, including four in the UC Press Natural History Guide series, about water, air, fire, and earth in California. Follow their journey at <http://paralleluniverse38n.blogspot.com>.

Restoring Life to the Yuba River Goldfields



WE ARE ON THE SOUTH BANK of the Yuba River, standing atop a gigantic pile of gravel in the midst of a landscape so strange and devoid of life that it calls up images of the moon. The water below us seems to bear no relationship to any real river. It's oddly blue, very clear, and is confined to a channel between near-vertical gravel walls that, in some places, rise as high as 100 feet on both banks. So eerie is this scene that I can't actually see the river flowing; it seems frozen in place. Turning to look downstream in the direction of Marysville, I see a vast gray stony field with odd-shaped mounds extending to the horizon, with only here and there a bush or a tree.

This alien yet oddly beautiful place is called the Goldfields. It's a 10,000-acre wasteland left behind by the Gold Rush in the middle reach of the Lower Yuba River, about 20 miles west of Nevada City. I'm with Derek Hitchcock, an ecologist working with the South Yuba River Citizens League (SYRCL) to restore salmon habitat here. "Ironically," he says, "the magnitude of the

destruction wreaked upon the Yuba watershed in the 19th and 20th centuries has created a unique river system that presents unique restoration opportunities in the 21st century."

After gold was discovered in the American River in 1848 and before a court largely stopped the practice in 1884, hydraulic mining blasted away entire hillsides and sluiced 1.5 billion cubic feet of debris down the tributaries of major Sierra rivers flowing into the Central Valley. Almost half of that came out of the Yuba watershed. Vast amounts of gravel, mud, uprooted plants, and other debris traveled down into the Feather River, on into the Sacramento River, and as far as San Francisco Bay—which helps to explain why the Bay is so shallow; its average depth is only eight feet.

Much of the heavier debris landed along a six-mile stretch of the Lower Yuba, where it slows as it enters the flat Central Valley, and where, in the past, it used to spread, becoming a braided valley river. Piling up, the debris raised the riverbed, causing floods that drowned hundreds of square

RASA GUSTAITIS

Jason Rainey, executive director of SYRCL, in the gravel field on the Lower Yuba River

miles of farmland in a mixture of mud and gravel. In 1893, the State set up the California Debris Commission to build dams that would capture mining debris that was still coming down rivers, to keep it out of the Valley.

On the Yuba, Daguerre Point Dam was constructed at the downstream end of the enormous gravel deposit, and about 16 miles of “training walls” were erected to channelize the river by piling gravel on both the north and south banks, as well as down the center of the river in some places to create two channels. The effect was to keep the river from spreading in its floodplain and to turn this stretch of the Yuba into a conveyance channel that speeds water downstream to serve agricultural and municipal users.

By the turn of the century, a switch from mercury to cyanide for gold extraction made it profitable to mine the Lower Yuba again, for gold that came down with the debris. In cooperation with State water supply engineers, miners used bucket-line dredges, and piled gravel still higher on the banks. They gouged into the riverbed and flood basin, leaving steep ravines and deep holes that filled with water and became ponds. They turned over earth and gravel again and again and threw it onto piles, building odd-shaped mounds. Today, gravel mining is the major extractive industry in the Goldfields. The aggregate here has high commercial value for construction.

A Promising River

The Yuba River, one of 14 major rivers flowing into the Central Valley, begins in the Sierra as three forks. The North, Middle, and South Yuba cascade over granite boulders and meander down through forests, and support fish, wildlife, and people who come from near and far to enjoy small sandy beaches, water-polished rocks, and quiet pools; to camp, swim, sunbathe, fish, and cool off under trees that arch over clear water. These forks merge near a steep gorge 24 miles east of Marysville, where Englebright Dam was built in 1941.

There’s good habitat for salmon upstream, but salmon can’t get to it. Many perish downstream at the 24-foot-high Daguerre Point Dam; none can get past 260-foot Englebright Dam, 12 miles upstream from Daguerre Point. If these two dams were removed, over 100 miles of upstream salmon habitat would reopen, according to the Upper Yuba River Studies Program, a study commissioned by the Department of Water

Resources, completed in 2005. Even in its current dammed state, however, the Yuba meets the basic requirements for habitat restoration, says Hitchcock. It still has a spring run of about 260 Chinook—endangered—and a fall run of about 2,300. In 2007, a total of 2,600 Chinook were counted, with similar counts for 2008, he says. A big plus for the Yuba is the absence of hatcheries that could reduce the genetic integrity of native fish. Water quality is exceptional, water temperatures are suitably cold, and the vast supply of loose gravel in the riverbed is suitable for spawning habitat, as well as being commercially valuable. What’s badly missing are the shaded backwaters and streamside vegetation that juvenile salmon need to grow.

One such haven does exist, though, and we now start hiking downriver toward it. On the opposite bank, the gravel piles are smaller and rounder, and some brush grows at the waterline, backed by summer-gold grassland and, farther on, a dense stand of trees. The ridge we’re walking rises and dips and turns. We come to a sign that says we are entering Bureau of Land Management (BLM) land, climb a small peak to admire an oak growing there—a lone pioneer—then look down at a wider river in which shrubs grow on a midstream gravel bar laced with meandering channels. Across the river is Hammon Grove County Park, with lots of trees, while directly below is that one salmon-friendly spot, the Hammon Backwater.

It’s a quiet off-stream pool shaded by willows and cottonwoods, protected by the wide midstream gravel bar and a curve in the river just downstream. Each year, a few lucky salmon fry are washed into this pool while they are not yet strong enough to negotiate the river current. Here they can grow into six-to-eight-inch fish ready for the precarious journey to the sea.

SYRCL is studying this backwater, with the help of \$165,000 from the U.S. Fish & Wildlife Service, with the goal of replicating it elsewhere in the Goldfields. Hitchcock says restoration project costs here need not be unreasonable, because it’s likely that “the river itself will do most of the work if it’s allowed to. Finding the absolute minimum that must be done, and the right spot, is key. Once hydrological studies are complete, maybe all we need to do is cut a channel into a training wall. Because the restoration would be done on BLM land, we can sell the valuable gravel that’s removed, and let riparian vegetation recolonize the site over time.” Among

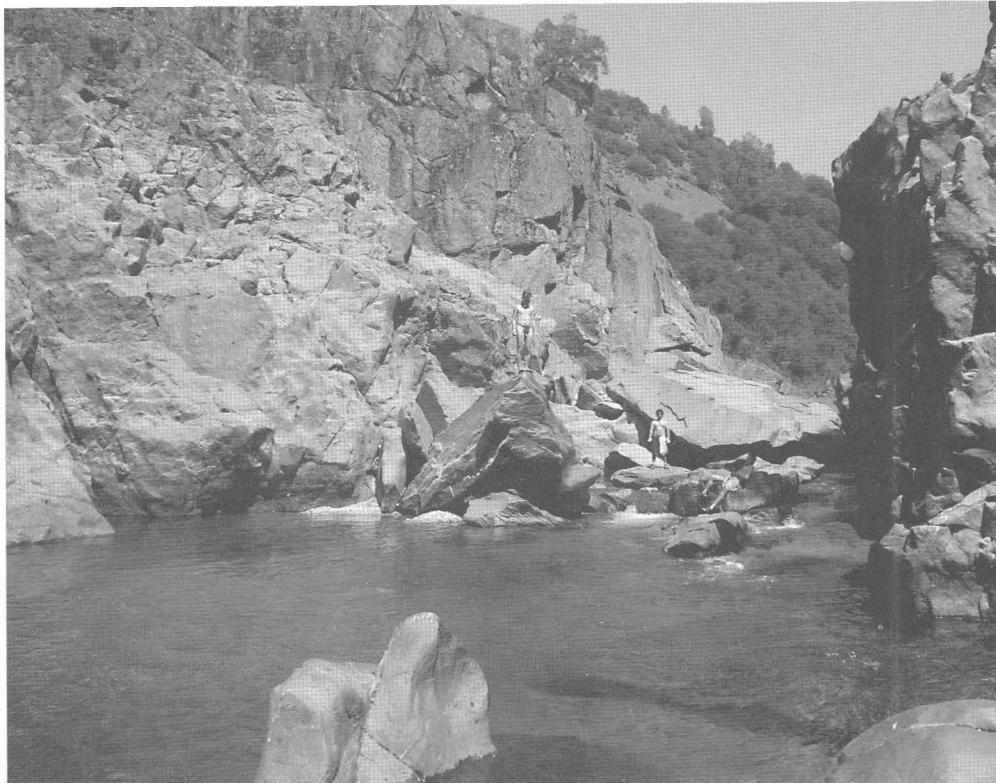
the useful natural forces the river provides are beavers. "Beavers are instrumental in backwater habitat creation and maintenance," he says. "Juvenile fish can swim through beaver dams to a pleasant, cool, insect-rich environment, safe from predators." Beavers helped to create the Hammon Backwater.

Small Steps toward the Vision

In the bigger picture, restoring West Coast salmon runs will require a "four-four-two solution," Hitchcock says: removal of four dams on the Snake River, which feeds the Columbia, four on the Klamath, and two on the Yuba. "With the Yuba you get the biggest bang for the buck. Both of these dams [Daguerre Point and Englebright] are federal property, so [Secretary of the Interior] Ken Salazar could do it with a stroke of the pen." Daguerre Point Dam is the first candidate for removal, being much smaller and farther downstream.

SYRCL formed 25 years ago to fight against dams proposed in the idyllic upper South Yuba, and has continued as watchdog and steward of the river. Its volunteers have been monitoring water quality at 38 sites on the Yuba for eight years. They offer rafting tours to view salmon spawning in October and November (see www.yubariver.org), lead field trips for schoolchildren, visit classrooms, and participate in community events, including traditional Native American salmon ceremonies.

Early in 2008 SYRCL entered into a conservation partnership with Western Aggregates, the Texas-based owner of most of the Goldfields, and the YOA Hunting and Fishing Club. Their goal is to resolve user conflicts and improve conditions for salmon on a three-mile-long, 180-acre stretch of the river in the Goldfields. Each partner had reasons to collaborate with the others. Western Aggregates has long been embroiled in legal battles about public access across its property to otherwise unreachable public lands. Fishermen want more access to the river and better conditions for salmon. All the partners want to restrict off-road vehicle access to the river and the steep slopes of the training walls. To the property owner they are a liability hazard, to salmon they are a death threat. "We have doc-



Friends enjoy the South Yuba River below Jones Bar

umentation of off-road vehicles driving across salmon nests," says Hitchcock. The partners have agreed that a fence will be erected to steer OHV romping farther away from the south side of the river. An access road will stay open to the public.

When Hitchcock first started talking about salmon restoration in the Goldfields I was skeptical, but I'm beginning to see the potential. Surely the smaller dam can be dispensed with, or at least equipped with an adequate fish ladder. Studies and plans for removing obsolete dams from the Carmel River, the Ventura River, and elsewhere are under way, so why not here? There's not much time left for saving these salmon.

Later, as we sit atop Englebright Dam watching a thin stream of water pouring out through a pipe into a mostly dry riverbed far below, it's clear that this massive concrete barrier is not likely to come down anytime soon. There's a nine-mile recreational lake behind it. Yet as in many difficult undertakings, it's the big vision that inspires people to take the first steps. For salmon advocates on the Yuba, each step has made the next one possible, while also helping watershed inhabitants to know and appreciate the river and landscape. Eventually, Hitchcock says, he and other Yuba allies hope to see "the return of this Sierra Nevada watershed to a free-flowing, ecologically healthy, salmon-rich place of abundance, connecting the Sierra with the urban shores of San Francisco Bay." ■

Thanks to Derek Hitchcock for his considerable contribution to this article.

Calling Back the Yuba River Salmon

IN MY EARLY THIRTIES, I began to grow weary in my work as a field biologist. I had been moving from one place to another every two years or so, learning an entirely new ecosystem and culture each time, but feeling fundamentally an outsider at the end of the day. I had sat around evening fires with Bushmen at the edge of the Okavango Delta in Botswana, with Hmong villagers in a remote forest in northern Thailand, and had worked in Panama and Costa Rica on forest restoration. Though I had learned a great deal as I moved about, I found myself yearning for the wisdom that could only be attained through long-term intimacy with a place, the kind of wisdom I had perceived among indigenous people I had come to know.

So I returned to the San Francisco Bay watershed, where my family had been living for six generations, and where I had grown up in the Sierra foothills above Nevada City. My goal was to begin a lifelong study of the natural and human ecology of my native region.

My first job was as environmental programs director for the North Fork Rancheria of Mono

Indians of the upper San Joaquin River watershed. It gave me an opportunity to begin reconciling a dissonance between ecological science and traditional knowledge, which had been troubling me ever since I walked out of the University of California, Berkeley, degree in hand, and found that the natural world did not fit neatly into the categories I had studied. Working with the tribe required a merging of traditional and modern knowledge. Under the guidance of elders, we tended the landscape in traditional ways to enable plants valuable for cultural uses, such as basket weaving, to thrive. At the same time, we cleared brush and rehabilitated the soil using scientific fire prevention principles and knowledge of soil microbial dynamics.

Three years ago an opportunity arose to work in my native Yuba watershed, at a time when an unprecedented collaboration between Indians and non-Indians had just begun there, born out of a shared goal of restoring salmon to the upper Yuba River. A non-Indian man, Bill Jacobsen, had recently relocated to the area from western Marin County, where he had been intimately involved in the successful reestablishment of Coho salmon to a tributary of Olema Creek. This process involved reducing the physical barrier where the creek flowed under Highway One, and the consistent carrying out of a ceremony passed down to Jacobsen by a Suquamish elder from British Columbia, intended to call the salmon in from their adult feeding grounds in the Pacific Ocean to a section of creek where no salmon had been seen in 70 years. In the winter immediately following these modifications (1999–2000), significant numbers of Coho were spawning upstream of the former barrier.

After settling in the Yuba watershed, Jacobsen talked with Jason Rainey, a Yuba watershed native serving as director of the South Yuba River Citizens League (SYRCL), and they agreed that a ceremony on the Yuba required a Native American

Runners crossing Deer Creek, a tributary of the Yuba River, with Jessie Raeder carrying the salmon. Only “spirit runners” who have fasted and followed protocols are allowed to touch the salmon.





presence. Don Ryberg, chairman of the local Tsi-Akim Maidu Tribe, agreed to participate. On a cold January morning in 2006, Jacobsen conducted the ceremony on the middle reaches of the South Yuba River, above Englebright Dam, which blocks all passage of anadromous fish. At the end of the ceremony, Ryberg said: "That was all fine and good, but the salmon on the Yuba don't speak Suquamish, they speak Maidu."

During the next several months, Ryberg sought out tribal elders and discovered that knowledge of the Maidu First Salmon ceremony had not been lost. That same year, in October, when the few remaining fall-run Yuba salmon were ascending the river below Englebright dam, the ceremony was performed in the Maidu language, for the first time in over 150 years. It was a modern ceremony, inclusive of two historically oppositional cultures and the reality of a barricaded and highly plumbed river system.

At sunrise, Maidu traditional hunters, who had fasted and prepared for this day, were sent out to spear a single adult Chinook. This sacred fish, weighing close to 40 pounds, was wrapped in a ceremonial blanket and carried by the hunters and additional spirit runners ten miles upstream and around the dam. They ran past the most critical spawning habitat remaining for Yuba salmon, the last operating hydraulic mine and, after a boat ride across the reservoir, arrived around midday at Bridgeport State Park. There they were greeted by hundreds of people and the fragrance of smoking salmon, brought by Yurok people from the Klamath River and roasted the traditional way, on redwood sticks. During the ceremony, all participants circled the fire and sent their intention out to the Salmon People that their return to this area is welcomed by the human community. Some of the ceremonial fish was fed to elders,

some returned to the river. Everyone feasted.

Honoring the cross-cultural origins of the nascent idea, and aware that the restoration of salmon to the upper Yuba would require a unified effort by everyone concerned, SYRCL, the tribe, and others formed the Calling Back the Salmon Committee, with equal representation of Indian and non-Indian people. It brought together individuals with specific regional knowledge of fisheries biology and ecology, history, archeology, and media, as well as indigenous knowledge. It has been meeting regularly ever since, and has delved into issues that have long divided the local community.

The Calling Back the Salmon Ceremony has become an annual event, and will take place again on October 10, 2009; all people are welcome. I will be one of the spirit runners, as I was last year. This ceremony is a prayer to the Salmon People, offered in acknowledgement that to be ready to receive them we must heal the wounds we have inflicted on each other and on the earth. Here in my home watershed, I find that a reconciliation is taking place. Boundaries between areas of knowledge that seemed to clash are melting away as we realize that we can include all effective approaches that are rooted in understanding of place. With our many differences, we join in a community united around a common goal: calling back the Yuba River salmon. ■

Derek Hitchcock is an ecologist who works for the South Yuba River Citizens League.

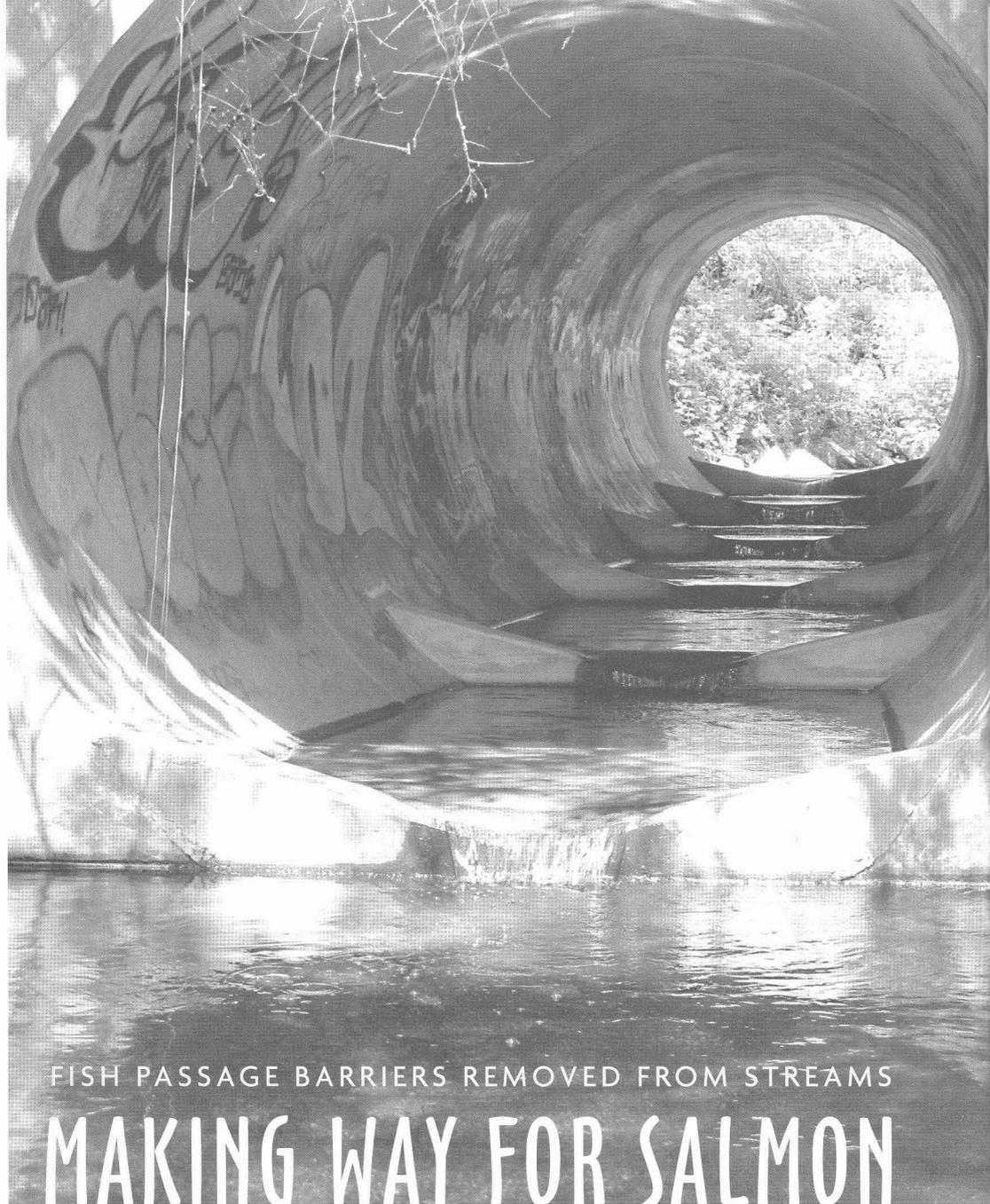


Top left: Jason Ryberg holds the salmon aloft before crossing the river at the end of the run. His sons Ben and Bronson stand behind him.

Top right: Runners cross the river toward the ceremonial ground at Bridgeport.

Above: Yurok people brought salmon from the Klamath River to roast on redwood skewers.

TOP PHOTOS: HANK MEALS; RIGHT: THOMAS B. DUNKLIN;



FISH PASSAGE BARRIERS REMOVED FROM STREAMS MAKING WAY FOR SALMON

EILEEN ECKLUND

Before this culvert on Valencia Creek near Aptos was retrofitted with concrete baffles, water shot through its smooth barrel at high speed, making it difficult for fish to swim upstream.

IN 2001, A SMALL MIRACLE OCCURRED in a stream south of the city of Arcata: the salmon came back. Lots of them. The stream, called Morrison Gulch, flows into Jacoby Creek, which empties into Humboldt Bay. Biologists knew it had once been spawning ground for salmon, because for several years they had counted hundreds trying to make their way upstream to mate—600 in one winter alone. But an old culvert under Quarry Road blocked the way; not one fish could make the jump into it from the pool below. Faced with such a barrier, some fish will try to find other places to spawn; others will die of exhaustion from their futile attempt to reach historic spawning grounds.

Then, in August 2001, the County replaced the Quarry Road culvert with a wider one and

regraded the stream above and below to raise the channel, allowing the fish to move freely through the new culvert. With the barrier gone, the salmon moved right back into the stream. That winter, biologists counted 70 coho returning to spawn, and the following winter they observed 238 adults and 116 redds (spawning nests).

What happened in the Jacoby Creek watershed is happening, or beginning to happen, in many watersheds along the coast from Del Norte County to Monterey. In the past ten years, through collaborative efforts by counties, state and federal agencies, private landowners, and nonprofit organizations, almost 300 miles of streams have been reopened to salmon and restored to conditions favorable to the fishes' survival. At a time when everything else seems to

EILEEN ECKLUND

be going wrong for West Coast salmon, this achievement is a ray of sunshine.

Locked Out

Culverts and other small stream barriers may seem trivial compared to the large and intractable difficulties salmon face—drought, water diversions, hydropower dams, changes in ocean productivity—but there are so many of them that they have effectively locked fish out of huge areas of spawning habitat. A 2004 report by the Coastal Conservancy identified more than 19,000 barriers in California's coastal watersheds, at least 1,400 of them severe or impassable.

Even obstacles that are not completely impassable to adult salmon can exhaust the fish before they reach spawning grounds, or keep juveniles, which can't jump as high as adults, from reaching tributaries that serve as safe havens during floods. "It's a huge problem," said Tom Weseloh, North Coast manager for California Trout. "If you've got a barrier at the mouth of a watershed, the whole watershed is impaired."

Long before people knew about the life cycles of anadromous fish, they understood that salmon needed to be able to move freely up- and downstream. In his 2003 book *King of Fish: The Thousand-Year Run of Salmon*, geologist David R. Montgomery wrote of a 12th-century English statute requiring that English rivers "be kept free of obstructions so that a well-fed three-year-old pig could stand sideways in the stream without touching either side." Pigs were not at issue; the purpose was to protect salmon.

Despite many such laws and restrictions over the centuries, the needs of fish have rarely been considered when roads and other structures were built, until recently. In California's early days, many coastal roads were cut right next to creeks for the logging industry, and streams were constricted and blocked by pipes and culverts. In 1935, federal fisheries biologists surveying streams in the Klamath and Shasta National Forests reported that culverts were cutting off salmon from the Klamath River and other main streams, and recommended that small bridges be used instead. They were ignored.

Those roads, usually built quickly and cheaply, have eroded over the years, spilling sediment into the creeks and causing creekbanks to fail. During heavy rains, the old culverts block water and sediment flow, causing floods. But quick fixes cost less up front than bringing back a more natural streamflow, and because there are so many barriers, removing any one of them seemed a waste of

time and money—until 1996 and 1997, when coho salmon on the North and Central Coasts were listed as threatened or endangered under the Endangered Species Act (ESA).

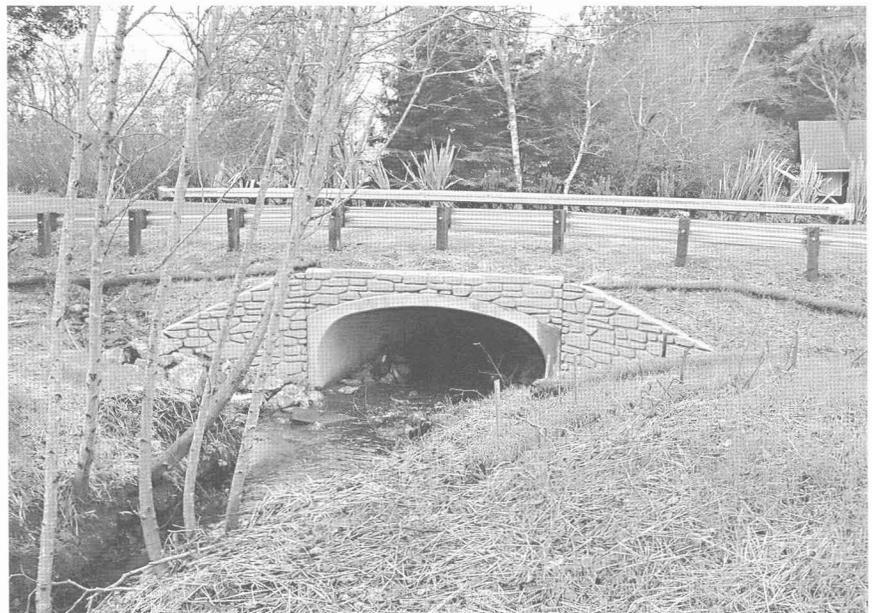
Counties Collaborate

North Coast counties, remembering the economic and social turmoil that followed the spotted owl listing in 1990 and nervous about their vulnerability to lawsuits, moved first. Shortly after the North Coast ESA listing in 1997, Del Norte, Humboldt, Trinity, Siskiyou, and Mendocino Counties agreed to work together on watershed-wide strategies to help save the fish. That same year, they created the Five Counties Salmonid Conservation Program (5C) to focus on county land-use policies, general plans, and roads projects that would provide immediate benefits to salmon. In the past 12 years these counties have removed or modified 53 barriers—about 45 percent of their high-priority sites—opening up 130 miles of stream. Morrison Gulch was one of the first four projects completed.

"The 5C program largely pioneered the field of fish passage improvement in California, particularly in coastal watersheds and on county roads," said Michael Bowen, the Coastal Conservancy's North Coast project manager.

In 1998, Bay Area and Central Coast county supervisors established FishNet 4C in response to federal listings of their own coho and steelhead runs. Bringing together Sonoma, Marin, San Mateo, Santa Cruz, and Monterey Counties, and part of southern Mendocino County, FishNet 4C has to date helped remove 58 barriers, opening 162 miles of stream.

This new bridge, which replaced a culvert that impeded salmon migration, was part of the Digger Creek Fish Passage Improvement Project in Fort Bragg.



A Glimpse of the Work Required

In the quiet little Marin County town of Woodacre, near the corner of Redwood Drive and Park Street, Woodacre Creek bubbles beneath a plain concrete bridge on its way to San Geronimo Creek, which flows into Lagunitas Creek, which in turn flows into Tomales Bay. When the rains begin, wild coho salmon will make this journey in reverse, swimming up Lagunitas Creek and into Woodacre Creek and other tributaries to spawn. Although the Lagunitas Creek watershed has lost more than 90 percent of the breeding salmon population recorded here in the 1940s, it supports the largest wild coho remaining in central California today; typically, that's about 10–15 percent of the state's total coho population.

Painfully few coho salmon returned to this watershed in winter 2008–09: biologists counted only 43 adult fish and 26 egg clusters. Changes in offshore upwelling have meant scarce food supplies for the fish, and three years of drought have brought stream levels low, exacerbating the already precarious condition of these fish after so many decades of losing habitat to human activities. That's why this bridge in Woodacre is so important, though to all appearances it's nothing special. It was built in 2005–06 to replace an old culvert that was a serious obstacle to coho traveling upstream. When the Marin County Department of Public Works removed the culvert and three other in-stream barriers, it opened up the entire potential spawning habitat in Woodacre Creek. Marin's coho have been especially dependent on tributaries like Woodacre Creek for spawning and shelter since 1950, when Peters Dam was built on the main stem of Lagunitas Creek, closing off approximately 50 percent of all upstream spawning habitat in the Lagunitas watershed.

Like most fish barrier projects, replacing the old culvert was no simple task, but “the contractors have it down to an art form,” said Kallie Kull, senior planner for Marin County Department of Public Works' Fish Passage

Program. First a cofferdam of sandbags was built across the channel to stop stream flow, and a large hole was dug immediately downstream and lined with plastic to capture the subsurface flow. From there, the water was pumped through a screened hose to a rocky area below the project. As the project site slowly emptied of water, fish were caught in nets and relocated to deep pools downstream.

The crew then removed the old culvert and the section of road that crossed the stream, dug deep holes and built footings to anchor the new bridge, and installed a more suitable culvert, an arch with no bottom. The new culvert made it possible for the road to cross the stream without putting footings in the streambed itself, so that the road became “invisible to the fish,” said Kull.

When the culvert work was done, the stream channel was reconstructed using massive boulders, the banks were replanted, the utilities replaced, the road repaved, and the “fish-viewing style” guardrail installed. Finally, at the very end of the project, the water was returned. “I know it sounds corny, but it's a magical moment,” Kull said.

That was just the construction phase; long before it could begin, the County had to negotiate with neighbors, apply for a multitude of permits, study the site, design the replacement, and piece together funding. For this project, funding came from the Coastal Conservancy, State Water Resources Control Board, the nonprofit organization American Rivers, Marin Municipal Water District, and the Marin County General Fund.

At each of the barriers on Woodacre Creek, the County faced a different challenge. On the property of the Woodacre Improvement Club, at the top of the watershed, the creek ran through a 180-foot-long culvert beneath a tennis court. The court was moved and the creek was brought to the surface, to flow freely.

At a third project site, right below the confluence of Woodacre Creek's east and west forks, the creek ran through a resident's

back yard before squeezing through two narrow, rusted pipes that carried the water under a road. The house had been built close to the creek years ago, and just upstream, the east fork ran under the garage. The County removed the pipes and installed a new bridge, again with an open-bottom arch, and restored the creekbed and banks. But before they could do that, they had to move the fish—lots of them. “We pulled 424 steelhead from 100–150 feet of stream when we dewatered it,” Kull said. “Most of them were juveniles, but a few were huge—we needed the really big coolers to move them. In good years, this neighbor has salmon spawning right through his backyard.”

The fourth project was a culvert under San Geronimo Valley Road, a big flat-bottomed concrete box through which the water flowed very fast, then dropped steeply to the scoured-out creekbed on the downstream side, making it nearly impassable to fish. The culvert couldn't be replaced, but a series of rocky pools was created in the creekbed to slow the water's velocity and gradually raise the creek's level up to the lip of the culvert.

Salmon are getting assistance throughout the Lagunitas Creek watershed. Down at the creek's mouth, where it flows into Tomales Bay, Point Reyes National Seashore has restored portions of the Giacomini Ranch to wetlands. The Marin Municipal Water District is fixing eroding roads, putting woody debris in the stream to create pools for fish, and planting native trees and other vegetation on the banks. The Marin County Open Space District works mainly in the upland areas of the watershed, reducing erosion into the creeks from roads and trails, and the Salmon Protection and Watershed Network (SPAWN), Wilderness Way, Students and Teachers Restoring a Watershed (STRAW), and other nonprofit organizations are busy throughout the watershed. If the salmon don't recover here, it's not for lack of attention from their local friends.

In 2002, federal, state, and local watershed restoration partners in Santa Cruz County, including the Coastal Conservancy, established the Integrated Watershed Restoration Program (IWRP) to help prioritize restoration projects and provide funding and technical advice for project designs. In addition, the group helps coordinate

permits and approvals, and negotiates with public and private landholders. Since then projects have moved more swiftly, allowing 67 fish barriers to be removed in Santa Cruz County, with 14 more projects ready for construction. IWRP is helping to coordinate projects in San Mateo and Monterey Counties as well.



A Chinook salmon made its way through shallows of Lindsay Creek after a barrier was removed.

All along the North and Central Coasts, the counties and IWRP have been doing more than remove fish barriers. They have worked to reduce runoff from roads into streams and wetlands, to restore marsh habitat, and have trained county road crews in fish-friendly construction and maintenance practices. “We have people on our road crews now who are red-legged frog experts,” said Kallie Kull, senior planner for Marin County Department of Public Works’ Fish Passage Program.

The Coastal Conservancy has been a key source of assistance in all these coastal areas, funding not only construction but also project design and permitting, which other agencies and organizations typically have been reluctant to do. The Conservancy also compiled the first comprehensive inventory of passage barriers along the coast, a key step in helping counties determine which should be fixed first.

“The counties love these programs now,” said Weseloh, “because they have so many benefits.” When stream flow is restored for salmon, counties also save money on road maintenance and flood control. The projects also bring some jobs and new business opportunities to rural areas. “There are tremendous benefits, a lot of them things you don’t see,” said Mark Lancaster, program director of 5C. “And at an average [cost] of \$110,000 per mile of habitat restored, it’s some of the cheapest habitat restoration out there.”

Private landowners have been increasingly interested in participating. “The demand far exceeds the resources we have,” said Karen Christensen, executive director of Santa Cruz’s Resource Conservation District and a founder of IWRP. “People see fish in the streams on their land and get excited,” said Weseloh. “They want to know if they can get help fixing their driveway culvert.” Part of what gets people so excited is that “It’s instant gratification. Whenever you

remove a barrier, you generally see fish upstream in the first season.”

An Uncertain Future

Despite the success and cost effectiveness of the barrier removal programs, their future is uncertain during the current severe recession. Many barrier-removal projects are funded by voter-approved State bonds, which were frozen in December 2008 (see *Coast & Ocean*, Winter 2008–2009). Although many bond-funded projects that were under way before the freeze can now be restarted, there is no guarantee they will get all the funds needed to finish construction. No bond funds will be available for new projects for at least another year.

Despite an unpromising future, many people who have been working on these projects are trying to forge ahead because they care deeply about salmon. The 5C program on the North Coast, once under the aegis of Trinity County, has shifted to nonprofit status to allow it to compete more effectively for grants. Central Coast and Bay Area counties are also searching for new funding sources. “The 5C success is as much about the huge dedication of my two coworkers as anything else—the quiet, heroic work of the people who care enough to make it happen,” said Mark Lancaster. “I admire them every day.” At one point Lancaster stopped cashing his paychecks to make sure the organization would have cash on hand.

Times are even worse for the salmon than for their helpers, and global warming is likely to bring only more bad news. Lancaster, however, chooses to focus on the progress that has been made. “The good news is that we’ve opened up habitat, including some places where fish had never been recorded,” he said. With all the challenges that salmon have to overcome, “it’s important to open as much habitat as possible, to allow them to move as much as possible.” ■

“The good news is that we’ve opened up habitat, including some places where fish had never been recorded.”

Restoring Rocky Gulch

In 2008 an excavator came and dug the creek out of Ali O. Lee and John Wrigley's back yard—and they couldn't have been happier. When they bought their two and a half acres just south of Arcata in 2004, the little creek called Rocky Gulch flowed through their land in a narrow, silted gully, evidence of a logging and shingle mill that had operated on the site in the 1960s. The year-round creek, overgrown with vegetation and barely visible, meandered around rusted metal pipes and cement blocks.

The mill operators "used to drive bulldozers up and down the streambed," Wrigley said. The logging operation had left behind piles of old junk—pipes, valves, fire-suppression equipment. There certainly was no sign of any salmon at this upper reach of the creek. But one downstream neighbor had over the years spotted salmon swimming past his property, and another, Darren Mierau, from whom they had bought their land, told them that Rocky Gulch had once been a spawning stream. Now Mierau and others were working on a plan to open up the lower reaches of Rocky Gulch for the fish to return; Lee and Wrigley's stretch of creek would become the farthest upstream to be restored.

The story began in 2000, when Mierau, an aquatic ecologist for the environmental services firm McBain and Trush, bought seven and a half acres of land along Rocky Gulch. Given his profession, Mierau was intrigued by the little creek, so he did some research and found that it had been a spawning ground for coho salmon and steelhead until the 1950s or '60s, when the fish disappeared. An accumulation of factors spelled their doom, in addition to the logging and milling activities: a tide gate had been built near the creek's mouth in the early 1900s, blocking fish from swimming upstream; the creek's lower reaches, where it passed through agricultural land, had been diked and channelized; grazing cattle had damaged the streambanks; several road culverts, including one under Mierau's own driveway, also blocked the stream.

So Mierau set out to do something. He talked to his handful of neighbors along the creek and to the State Department of Fish and Game, where staff encouraged him to apply for a grant that allowed him to document the stream's condition. His firm got involved, as did other colleagues in the environmental restoration field. After a couple of years of

grant writing and meetings, the work on Rocky Gulch began.

In 2004, the tide gate was replaced, and in 2005 the lower channel, which flowed through ranch land, was restored. "We found baby salmon in the pasture in 2005. That was just amazing," Mierau said. In 2007, the culverts under both Old Arcata Road and Mierau's driveway were replaced with larger ones, the streambed was widened, and the riparian zones replanted with native species. These two earlier projects were funded largely by the Department of Fish and Game and the Coastal Conservancy; the federal Natural Resources Conservation Service funded the one on Lee and Wrigley's land, providing \$10,000, which the family matched with their savings, labor, and materials.

Artful Work

At first, "the idea was just to remove the old pipes cheaply," Wrigley said. "Then it became this sort of art project, putting rocks and redwood stumps in the creek [to create pools for the fish]. Matt [contractor Matt Smith] was very artful about how he did it; you'd hardly know that he'd been here. But it looks a lot different—it looks like a stream now. Before, it looked like it was struggling to be a stream."

All in all, Smith removed seven tons of metal from the creek, and even then some had to be left behind because removing it would cause the bank to erode. "We recycled the metal via Bonnie Connor at Arcata Scrap and Salvage, and the money we recouped went back into the project," Lee said via e-mail.

Wrigley took two weeks off from his own house-building and design business to work on the project, donated PVC pipes, and encouraged his business partner John Pope to help as well. "I recall the three of us happily feeding downed alders into a wood chipper that could have easily swallowed one of us," Lee wrote.

The major work took only a couple of weeks, but for the handful of families that live along the creek it is ongoing. Lee has planted native azaleas, red alders, and vine maples, and among other things learned that "native rhododendrons are really hard to transplant; there's an 80 percent failure rate," she told me, laughing.

"We really wanted to do [the restoration] with our children; they were a part of the whole process and I think it will stick with

them." Their two sons, ages ten and 13, "spend most of their time after school at the creek, so they're very invested in it. Their hands have done the work, first building the house, now restoring the creek."

Ready for the Salmon

Restoring Rocky Gulch has been a community effort, drawing neighbors and other allies together for the sake of a creek and some fish. Jeff Anderson, the engineer for the projects on the lower reaches of the creek, volunteered his time on Lee and Wrigley's project, Lee wrote, as did "a host of others, including our Bayside neighbors Victoria Vance and Cayman Durham-Vance, age 12 at the time. They stood in the diverted creek last summer with us, with flashlights and goldfish nets, rescuing salamanders, frogs, and fish far into the night. In boots, with buckets. I believe it was nearly midnight before we stopped moving creatures from the 150 feet of creek that the Department of Fish and Game had electro-fished [stunned the fish with electricity so they could be moved without harming them] to the lower reaches below the bridge, where the creek was running normally. They also helped plant red alders to restore the riparian zone.

"The project has been a magnet for people to gather in support of the natural community, through which we have developed community. When the salmon return, we will gather these river people around again, and celebrate something meaningful. Although we realize the return of the fish to this one watershed is seemingly insignificant, the project has already reverberated in ways we are only beginning to understand. We sit by the creek, hang our feet in its water, and wonder at its ways that came long before us. We sit in a small watershed, between the larger Jacoby Creek and Freshwater [Creek] watersheds, and bear witness to something inarguably good."

Last year, the salmon returned up Rocky Gulch as far as their neighbors' land, about a quarter-mile downstream. Lee, Wrigley, and their sons are still waiting. "We hope to one day hear the flapping tails going upstream," Wrigley said. "We'll go out and clap at their return. I'd be happy to see just one salmon—that will make my day, my week, my year."

"It's definitely wide open for them to get up there now," Mierau said.

—EE



The End of a Long Good Run

If you are reading this column, it means that you have come to the end of the last issue of *Coast and Ocean*.

Launched in 1985 as *Waterfront Age*, for nearly 25 years *Coast & Ocean* has covered both the doings of the Coastal Conservancy and the larger stories, trends, and issues affecting California's coast. Despite years of budget cuts, California's coastal management program continues to stagger forward; after a mandatory 15 percent cut in the Coastal Conservancy's operating budget, this magazine is something we can no longer afford to publish.

Among the magazines and newsletters published or funded by public agencies, *Coast & Ocean* has been unique for at least two reasons. First, it is the only publication in the state, and maybe anywhere, that is exclusively devoted to the coast and its environs. Second, it has been operated with a great deal of editorial independence from the State agency that funds most of it. I also happen to think that it is the best-written and best-looking magazine of its kind.

As far as Coastal Conservancy news, there has been little to report since our

portfolio of over 300 grants and contracts was frozen in place at the end of last year, and only recently have we been able to restart about 70 percent of these. The rest remain frozen. We haven't launched any new bond-funded projects since then, and it's anyone's guess when we will be giving the green light again. Nearly all of our grantees are in severe financial distress; some of the smaller ones have gone out of business entirely.

However, *Coast & Ocean* has found plenty of bigger issues to cover, including marine protected areas, the crises of salmon, climate change, and off-shore oil are in the news. Desalination, ocean zoning, aquaculture, and wind and wave energy loom in the future. Although development is in a slump, it will assuredly come back, and we will be reminded that our coastal lands are finite. Unfortunately, we will respond to all of these issues and more without *Coast & Ocean* to help establish a context and history.

Eventually California will emerge from its budget woes, as it always does. There is even talk of reform in the air; perhaps some



of the structural causes of our deficits will be, finally, fixed. (I wouldn't be much of a liberal if I couldn't hold on to irrational hope, now would I?) In the meantime, plenty of damage will be done. The many state parks that are closed will be in shabby condition if they are ever reopened. Species will go extinct because we couldn't list them as endangered in time, or couldn't protect enough of their habitat. Our inability to spend bond money now means we will miss out on some once-in-a-lifetime deals when real estate prices are at historic lows, and treasured coastal land that citizens have long fought to save will be left unprotected. And then there is everything outside of our limited domain at the Coastal Conservancy that is not being attended to, such as our roads, schools and, most important, people.

For all of its natural beauty, it is the diversity and complexity of our people that makes California such an interesting and vibrant state. Likewise, the Coastal Conservancy wouldn't be what it is without its staff, and *Coast & Ocean* has been blessed over the years with its own extraordinary collection of people who have labored very hard for very little to publish the magazine. Editor Rasa Gustaitis and her colleagues Hal Hughes and Eileen Ecklund have made an elegant, readable something out of nothing four times a year for decades, and as much as we will miss the magazine, we will miss them more.

Sam Schuchat is the executive officer of the Coastal Conservancy.

COASTAL CONSERVANCY NEWS

Petaluma Marsh Trail

When Petaluma celebrated the opening of its state-of-the-art wastewater treatment and recycling facility on July 31, the public also gained almost 4.5 miles of new trail along the wetlands just south of town. The trail loops around the facility and connects to existing trails to create a 7.5-mile round-trip hike along the Petaluma River and Adobe Creek, an area teeming with birds and other wildlife. About three miles of the trails are wheelchair accessible. This is part of a much larger project to acquire, restore, and

improve access to 336 acres of Petaluma Marsh undertaken by the City of Petaluma, Sonoma County Agricultural Preservation and Open Space District, Ducks Unlimited, and the Coastal Conservancy.

New Park Slated for San Pedro

A city-owned parking lot atop 100-foot seaside bluffs in San Pedro will become Pacific Overlook, a pedestrian plaza with walkways, benches, and native plants, where residents and hikers along the Coastal Trail can enjoy the views. With the help of \$750,000 approved by the Coastal Conservancy in June 2005, the Los Angeles Harbor

Watts Economic Development Corporation expects to construct the 17,400-square-foot project in spring 2010 at Pacific Avenue and Bluff Place, a quarter-mile east of Point Fermin Park. The plaza is one component of a long-term plan to improve public access around Los Angeles Harbor and reconnect communities to the waterfront.

The site adjoins the fenced-off "Sunken City," remnants of a residential neighborhood that began sliding down the bluffs in the 1930s. Park improvements will reduce bluff erosion and lessen the risk of further sliding there.

—Derek Hitchcock

Every major river that drains into the Central Valley was dammed at low elevations, creating a “terminal rim” that, among other devastating consequences, excluded salmon from 90 percent of their spawning habitat. As a result, Central Valley salmon runs that historically were four to five million strong have been reduced to a few thousand primarily hatchery-raised fish, clear indication that one of the world’s great ecosystems is on the verge of collapse. These dams have disconnected our ocean from our mountains, severing a life cycle that has balanced the ecology of our freshwater, saltwater, and terrestrial environments. The fate of salmon and the fate of our living rivers is now very much in our hands.

—Derek Hitchcock

COAST & OCEAN SUBSCRIBERS,

If you still have issues remaining on your current subscription, please see the inside front cover for your options. We encourage you to check out *Bay Nature* and *News From Native California*, two fine quarterly magazines that have offered to fulfill your subscription to *Coast & Ocean*. *Bay Nature* features stories about the natural world of the San Francisco Bay Area and Northern California, those who are working to protect and restore it, and opportunities to explore it. *News From Native California* is the only magazine produced by, for, and about California Indians, with articles, news, and columns about native culture, politics, and more. If you prefer, you can write us to get a refund.

Please send your e-mail address to calcoast@scc.ca.gov if you are interested in information about future developments.

The “Great and Wondrous Pacific Ocean” map is available both separately and bound into the Spring/Summer 2009 issue free of charge upon request to schools and for other educational uses. Mail requests to the address on the inside front cover or e-mail calcoast@scc.ca.gov.



From left: Rasa Gustaitis, Hal Hughes, Randall Goodall, Eileen Ecklund, Ginger Hertz, Naomi Schiff, Richard Whitaker—the staff of *Coast & Ocean* and Seventeenth Street Studios who have created this magazine for you.

ABOUT THIS MAP

The map on our inside back cover shows the San Francisco Bay Watershed, with major rivers, streams, lakes, and the major water projects. Follow the orange lines to see where water is diverted within and beyond this watershed.

The fish icons show where you might still see salmon spawning in rivers and creeks, but please check www.bay.org/news.htm for more information. The Bay Institute, Salmon Aid, and the Nature Conservancy teamed up to create two online maps showing these spots, one for the Bay Area, the other for the Central Valley. The maps link to Google maps of each location. Thanks to Peter Vorster and the Bay Institute for their generous help with our map.

We regret that we were unable to deliver the large fold-out map of “The Great San Francisco Bay Watershed” we had promised.



PRESORTED STANDARD

U.S. POSTAGE

PAID

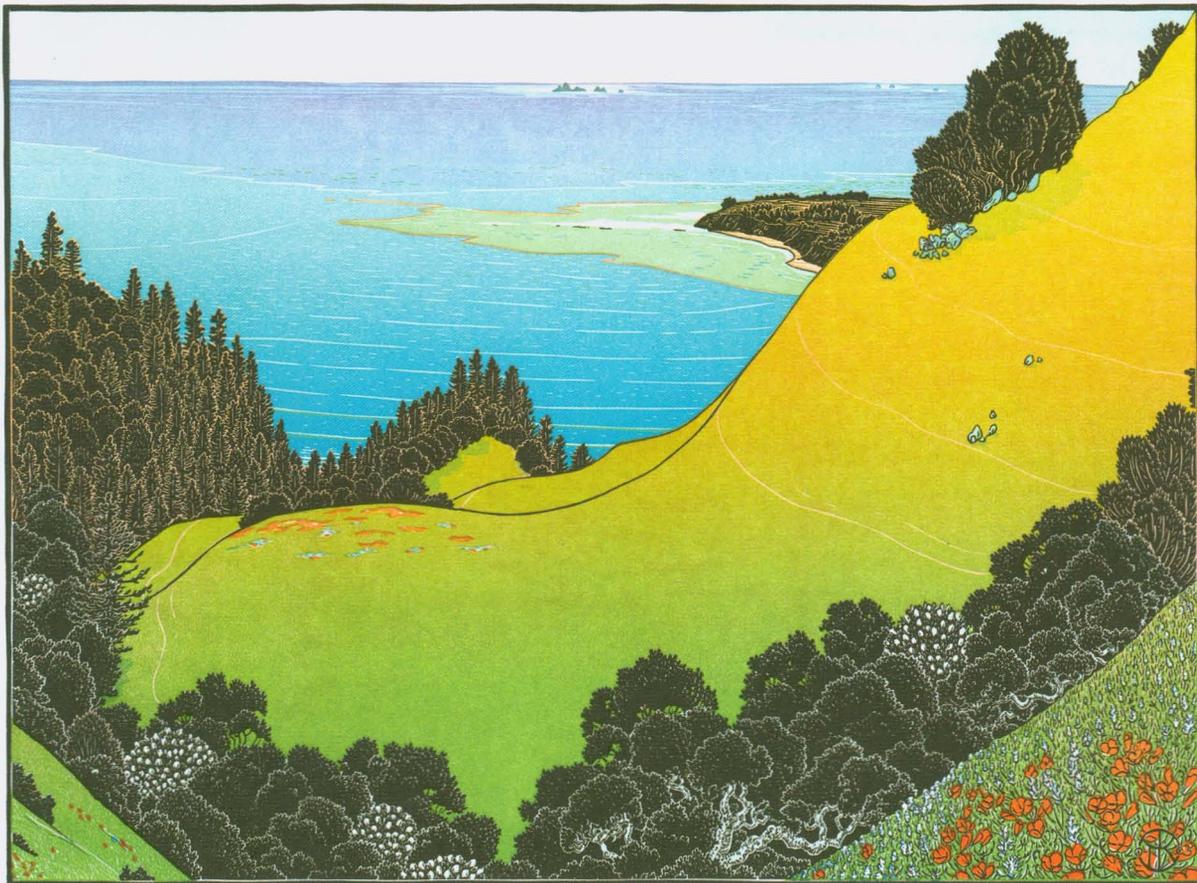
OAKLAND, CA

PERMIT #1019

CALIFORNIA COASTAL CONSERVANCY

1330 BROADWAY, 13TH FLOOR

OAKLAND, CA 94612



May we all find the Bay Mountain that gives us a crystal moment of being and a breath of the sky and only asks us to hold the whole world dear.

—Gary Snyder