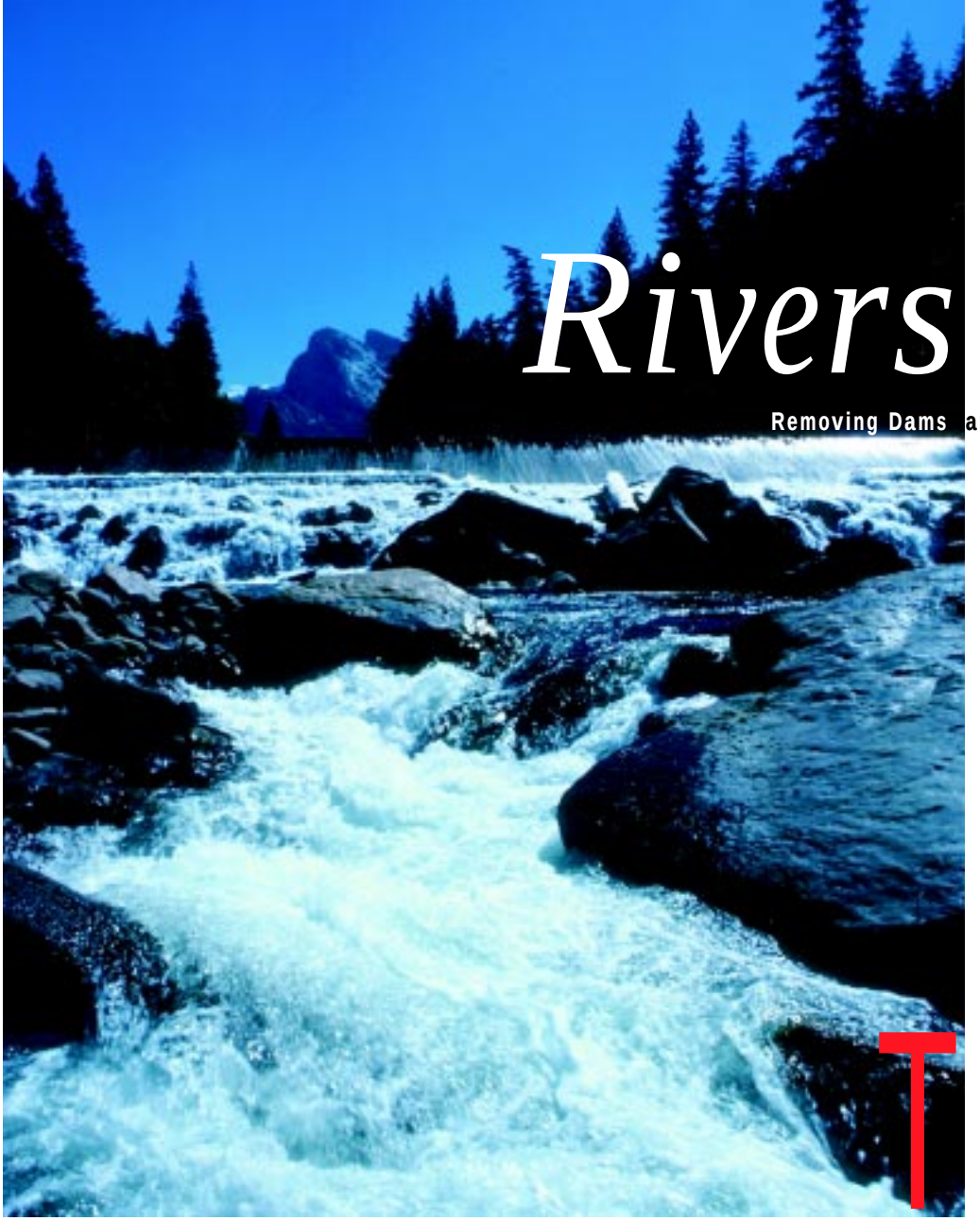


Rivers Reborn

Removing Dams and Restoring Rivers in California

Cascade Dam — *Merced River* by Tim Palmer

"As church bells pealed and thousands cheered, the backhoe scooped out a dollop of dirt and gravel that had been packed against Maine's Edwards Dam. And suddenly the Kennebec River did something it hasn't done since Andrew Jackson sat in the White House: first in a trickle and then in a torrent, it flowed freely to the Atlantic…"

– Newsweek
July 12, 1999

The breaching of Edwards Dam on the Kennebec River sparked imaginations around the country in the summer of 1999. The idea of restoring a river and its endangered fish species finally had its most prominent example. While the potential for dam removal has been an interest of regulatory agencies, scientists, conservationists, and even some elected officials, it wasn't until that backhoe unlocked the river at Edwards Dam that possibility became reality on a grand scale. A river truly could be reborn.

Of course, Edwards is hardly the first dam in the nation to be removed. Examples can be found in states like Vermont, North Carolina, and Pennsylvania. Wisconsin has quietly removed or breached more than 30 dams over the years for safety and environmental reasons, frequently finding that such actions could save up to two-thirds the cost of trying to repair obsolete structures.

Dams on Washington's Elwha and White Salmon rivers, on Oregon's Rogue, the Snake in Idaho, and the mighty Colorado in Arizona have all been targeted for potential decommissioning, breaching, or outright removal. Not only is the era of big dams over in America, but the public is now beginning to recognize that dams aren't necessarily permanent fixtures of the landscape. What were once considered monuments to our engineering prowess are now also seen as river and fish killers. What once seemed reasonable and desirable occasionally went "beyond all logic," as U.S. Interior Secretary Bruce Babbitt recently wrote, "overstating benefits, ignoring the damage to fisheries and river systems, and understating the financial costs."

In short, we are finally learning the actual price paid for building an estimated 75,000 dams across the country, including more than 1,400 in California.

Here in the Golden State, 80 percent of California's salmon and steelhead populations have been lost since the 1950s. Delta smelt have declined by 90 percent from their original levels. We have lost 96 percent of our Pacific flyway wetlands, 89 percent of our riparian woodlands, and 95 percent of the spawning habitat for spring-run salmon. All of these declines can be attributed in great measure to the construction of dams. Indeed, there are so few free-flowing rivers left in California that one federal agency has deemed the state's remaining streams as "endangered ecosystems."

The act of removing a dam, however, is more than just an act of protecting endangered rivers and ecosystems. It represents a fundamental shift toward the more complex and complete action of *restoration*; of rebuilding and restoring that which has been lost for years.

"No, we're not taking aim at all dams," wrote Babbitt. "But we should strike a balance between the needs of the river and the demands of river users...In all probability the process will continue on a dam by dam basis, with states and community stakeholders making most decisions. But there can be no doubt that we have a long way to go toward a better balance."

Dam Removal in California

Even though public interest in dam removal is a relatively recent phenomenon, unblocking rivers is a tried and true river and fish restoration tool.

Seventy years ago, the California Department of Fish and Game set out to remove numerous old mining dams in the state's mountainous areas.

courtesy: Department of Fish and Game

Steelhead migrating upstream

Because many of these dams were no longer in use, and faced with the high cost of building and maintaining legally mandated fish ladders, many dam owners allowed the agency to simply blow up or otherwise remove the old dams.

Between 1920 and 1956, twenty-two dams in the Klamath River drainage alone were removed opening up at least 100 miles of good fish habitat, at a total and unbelievably low cost to the state of approximately $3,000. And the dam removal and fish passage improvement efforts in California have continued. In 1969, Fish and Game officials granted

courtesy: U.S. Bureau of Reclamation

Interior Secretary Bruce Babbit using a sledgehammer on a Butte Creek dam in 1998.

the city of Eureka the permission to blow up the Mad River's 55-foot-high Sweasey Dam to improve fish passage. Since 1982, at least three river-barrier dams have been removed from small streams in Napa and San Luis Obispo counties.

More recently, a water district concerned about the impacts of its diversions on endangered salmon proposed and began removing four small irrigation dams on Butte Creek in the northern part of the Central Valley. This $9 million project has already removed two of the dams, restored about 25 miles of unimpeded flow in Butte Creek, eliminated at least 12 unscreened water diversions, and helped with the subsequent return of approximately 20,000 spring-run chinook salmon to the watershed.

Not surprisingly, dam removal opportunities continue to gather interest in California. Government agencies, biologists, anglers, and river recreationists have proposed or are considering the removal of perhaps as many as 50 dams, large and small, throughout the state. The benefits are quite clear: improving and protecting endangered fisheries, restoring aquatic ecosystems, and ultimately freeing large sections of rivers from their concrete shackles.

Perhaps the most important factor behind the dam removal movement in California is the federal mandate under the Endangered Species Act, which is aimed at reviving salmon and steelhead runs long blocked by dams from their historical spawning areas. The joint federal and state restoration project known as CalFed has adopted dam removal as one of its many tools for restoring both habitat and basic ecological functions of rivers. Migratory fish restoration plans for the Central Valley, developed separately by the U.S. Fish and Wildlife Service and the state's fish and game department, also consider dam removal as a viable option for restoring fisheries and habitat.

State regulations ensuring fish passage around dams and sufficient flows downstream to maintain healthy fish populations have been in place for years, but largely ignored. That fact, however, is changing rapidly. As public trust regulations governing river flows and fish passage are enforced, some dam owners are discovering it is cheaper to simply remove a structure than to build an expensive new fish ladder or increase flows.

Another driving force behind dam removal is the fact that many older dams no longer function as originally intended. The reservoirs created by some dams have filled with sediment and their structures are in a state of disrepair. Some older dams also pose significant public safety hazards. Requiring improvements to protect the public can be more expensive than the original economic function provided by these dams. In such cases, it makes sense to remove the structures.

Federal hydroelectric licenses also play a potential role in dam removal. Hydroelectric dams are typically regulated by the Federal Energy Regulatory Commission (FERC), which grants each project a 30 to 50-year federal license to operate. That license establishes the environmental conditions for each project, including flows to maintain fisheries and

requirements for fish ladders and fish screens.

When a hydro license comes up for renewal, the FERC must give equal consideration to both power production *and* fisheries, wildlife habitat, and recreational opportunities. Although the FERC historically has been reluctant to order the decommissioning of a dam, the agency occasionally chooses the environment over power, as it did when it ordered the removal of the Edwards Dam in Maine to restore one of the last remaining Atlantic salmon runs in the nation.

But it takes more than a good reason, a sledgehammer, or a backhoe to remove an unwanted dam these days. Many key issues must be resolved and legally required environmental studies must be completed before a dam is removed. Just some of the issues involved include replacing a dam's functions, disposal of sediment, determining the cost of removal, and deciding who picks up the bill.

Dam removal is not necessarily a quick and easy fix for blocked rivers and degraded ecosystems. But it is proving to be an exciting one with much promise as California enters the 21st century.

WHY REMOVE DAMS?

Fish Restoration

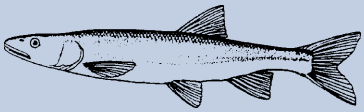
Dams block 90 percent of the spawning habitat historically used by spring-run chinook salmon and steelhead in California's Central Valley. These structures have contributed significantly to the decline of virtually every major anadromous fish species in the state.

Ecosystem Restoration

Removal of dams restores the natural ability of rivers and streams to transport gravel, sediment, and nutrients. Dam removal also helps to restore the natural flow and water temperature of formerly dammed rivers – all essential ingredients to naturally functioning aquatic and riparian ecosystems. Reservoirs behind dams also often encourage non-native, invasive species that may compete with the native species already struggling for survival.

Insufficient Benefits

Many older dams can no longer provide a useful function. The reservoirs of some dams have filled with sediment, while the functions of others have been replaced by alternative facilities. Even when an older dam is still functioning, the benefits it provides may be less than the cost of operating and maintaining the structure. In addition, legal mandates to assure fish passage, provide downstream flows for healthy fisheries, or to reduce impacts on newly listed endangered species may cost more than the revenue produced by the facility.



"Dams are not America's answer to the pyramids of Egypt. We did not build them for religious purposes and they do not consecrate our values...Dams do, in fact, outlive their function. When they do, some should go."

– Interior Secretary Bruce Babbitt

Public Safety

Many older dams are unsafe and in a state of disrepair. Their owners may no longer have the funds to maintain or remove them, or have abandoned the structures altogether. These facilities can create hazards for boaters or act as attractive nuisances for children and unwary swimmers. Some dams may also be in danger of catastrophic failure due to earthquakes or floods, and may prove too costly to improve or repair.

DAM REMOVAL ISSUES TO BE RESOLVED

Alternatives

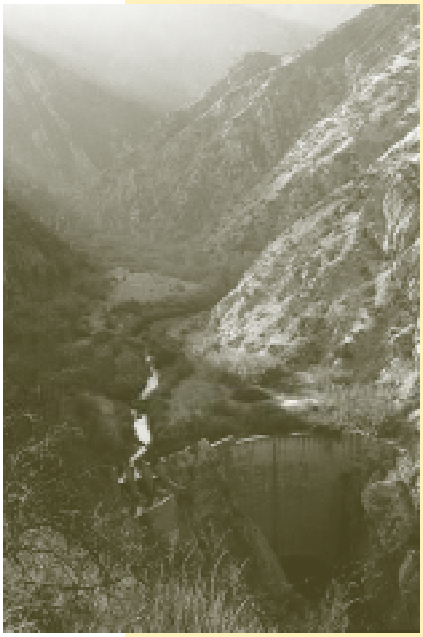
For dams that provide water supply, hydroelectric, recreation, or flood control benefits, proposals to remove the structures must address how these functions and benefits will be replaced or mitigated. Many dams, particularly larger facilities that store water for consumptive use, may be too valuable to consider removing. But the fishery and ecosystem restoration values of some dam removals may easily outweigh the benefits of an existing dam, particularly when the costs of safety improvements or environmental mitigation are considered.

Sediment

Many dams have trapped thousands of cubic yards of sediment, so much so that their reservoirs no longer can store a useful amount of water. Sediment behind dams may also contain toxic pollutants such as mercury. Removal of this sediment could be costly. Allowing the sediment simply to be transported downstream could result in flooding and pollution problems. What to do about sediment and its removal costs are among the key issues that must be addressed in any environmental review for removing a dam.

Cost

Dam removal also can prove to be expensive. Although it cost the California Department of Fish and Game just $3,000 to remove about 22 dams in the Klamath River watershed during the first half of this century, the price of doing business today is considerably higher. The estimate for removing four Butte Creek dams was initially $6 million, but the ultimate cost is now closer to $9 million. The proposed cost of removing five dams on Battle Creek, and building fish screens and ladders on other remaining dams, is $29 million. The question remains, however, how much are endangered salmon and restored ecosystems worth?



Rindge Dam – Malibu Creek

Who Pays

Determining who pays for dam removal is a key issue. Our society generally considers environmental mitigation as a cost of doing business. Just as individuals are required to ensure that their cars do not pollute the air, industries are expected to pay the cost of environmental protection and mitigation. One potential formula to use when considering dam removal is to require the owner to pay up to what it otherwise would cost to repair or improve the dam, with the public covering the remaining cost to actually remove the dam.

WHAT'S WRONG WITH DAMS?

Although California's vast system of dams and canals has benefitted people by providing water for drinking, industry, and farming, there is a darker side to this development. Dams have played a key role in the extinction and decline of many fish and other aquatic species. California has more extinct, endangered, or threatened aquatic species than any other state. Every salmon and steelhead run in the Central Valley is either extinct, endangered, or in decline, largely due to the habitat destruction and degradation caused by dams.

Dams harm aquatic and riparian ecosystems by altering natural river flows, preventing flood flows necessary for the maintenance of habitat and wetlands, disrupting natural water temperatures, and reducing water quality. Dams also drown terrestrial and river-based aquatic habitats, block the natural migration of species, and prevent the downstream movement of sand, gravel, and nutrients. Average annual flows in Central Valley rivers have been reduced by as much as 80 percent on San Joaquin River below Friant Dam and as much 35 percent on the Sacramento below Shasta Dam, resulting in significant problems for aquatic and terrestrial ecosystems.

Dams adversely affect people and their communities by generating boom and bust economic cycles associated with construction, and by encouraging unwise development in downstream floodplains. Dams also disrupt river-based tourism and recreation.

Moreover, despite their imposing cement facades, dams are not permanent. Their structures weaken over time, requiring expensive maintenance and repair. Reservoirs fill with sediment and silt, diminishing function and capability. And a few sometimes fail catastrophically with loss of life and property, as did the Saint Francis Dam in California in 1928 and Idaho's Teton Dam in 1976.

Steelhead Trout

Anadromous

(pronouced "ah-nad-rah-mus"):

Derived from the Greek word meaning *running upward.* Refers to fish migrating from the sea up a river to spawn. Examples include salmon and steelhead trout.

POTENTIAL DAM REMOVALS IN CALIFORNIA

Jeff Miller

Niles Dam—Alameda Creek

Sunol and Niles dams—*Alameda Creek*

These two small dams, once used to divert water for consumptive purposes upstream from the city of Fremont, have been long abandoned. Ranging in height from 6 to 12 feet, the dams block passage of steelhead at all but the highest flows. An old fish ladder at the Niles Dam appears to be non-functional. The remnant steelhead run in Alameda Creek could be enhanced if these barriers to fish migration were removed. Several other smaller weirs also impede fish migration in the creek, but not to the extent of the Sunol and Niles dams. Local officials consider the dams to be attractive nuisances and possible public safety liabilities. The Alameda Creek Alliance has proposed their removal. For more information, contact the Alliance at P.O. Box 192, Canyon, CA 94516, (510) 845-4675, e-mail *AlamedaCreek@formulate.com* or view *www.formulate.com/alamedaCreek*.

"My parent's generation gloried in the construction of dams across America's rivers. My generation saw how those rivers were changed, deformed, killed by dams. Your generation must help decide if, how and when those dams stand or fall."

– Interior Secretary Bruce Babbitt in a 1998 speech to the Ecological Society of America

Jen Carville

El Dorado Dam – American River

El Dorado Dam – *American River*

At one point, PG&E proposed decommissioning this small hydroelectric diversion dam on the south fork of the American River. Frequent floods, landslides, and a wildfire requiring millions of dollars in costly repairs convinced the giant utility that continued operation of the project would cost more than it produces in hydroelectric revenues. But faced with the possible loss of a consumptive water diversion associated with the dam, the El Dorado Irrigation District (EID) forced PG&E to agree to sell them the entire project — including three upstream storage reservoirs, the diversion dam, flume, and powerhouse — for exactly *one dollar.* In addition, the California Public Utilities Commission recently decided that $15 million in PG&E ratepayer funds, originally set aside to cover the "transition costs" of utility deregulation, will be used to help cover the cost of repairing the flood-damaged

project.

Friends of the River and other conservation organizations are concerned that current minimum flows in the south fork of the American are insufficient to maintain a healthy ecosystem, and that the new owner of the project will be allowed to divert even more water from the river. Friends of the River has proposed that the El Dorado diversion dam be removed, allowing EID's consumptive water supplies to flow down the south fork into Folsom Reservoir (thereby supporting the river's outstanding white-water recreation values), where the county can divert the water and pump it uphill to feed its growing subdivisions.

S. Evans

Coleman Dam – Battle Creek

Eagle Canyon, Wildcat, Coleman, & South Fork dams – *Battle Creek*

Federal and state agencies comprising the CalFed Bay-Delta Restoration Program have signed a $50 million agreement with PG&E that may lead to the removal of up to five small dams on Battle Creek, which now impede salmon and steelhead migration. The agreement also calls for significantly increased river flows.

S. Evans

Eagle Canyon – Battle Creek

Battle Creek is widely regarded as the best opportunity to restore dwindling salmon and steelhead stocks in the entire Central Valley. PG&E balked at the idea of removing Eagle Canyon Dam, claiming it was the economic centerpiece of its hydro project, and even though biologists have said the dam occupies the best fish habitat in the watershed. The current agreement compromises by providing $2 million in public funds to instead build a supposedly "failsafe" fish screen and a fish ladder on the dam.

When the Federal Energy Regulatory Commission considers amending PG&E's hydro license to implement the restoration project, Friends of the River will continue to press for the removal of the Eagle Canyon facility, plus other Battle Creek dams identified in the CalFed restoration agreement.

Centerville, Forks of Butte, Butte Creek Head dams – *Butte Creek*

The recent removal of four small irrigation dams on Butte Creek caught the imagination of many (including Interior Secretary Bruce Babbitt, who took a sledge hammer to one). Approximately 20,000 spring-run chinook salmon returned to Butte Creek in 1999, making it the most prolific spring-run salmon stream in the state.

But the ability of Butte Creek's salmon and steelhead to migrate upstream is severely impeded by PG&E's Centerville Head Dam, a structure that

contrary to state regulations has no fish ladder. The U.S. Fish and Wildlife Service has considered the removal of the Centerville facility, plus its two compatriots, a removal which together could nearly triple the amount of habitat in the watershed available to endangered salmon and steelhead.

But the debate over removing more dams on Butte Creek is now focused on the contention that existing natural barriers upstream and downstream of Centerville Dam prevented historical fish migration. At a minimum, further scientific studies should be conducted to determine the feasibility of providing salmon and steelhead additional access to Butte Creek, and whether natural barriers would have to be modified or removed (something conservationists don't generally advocate). Unfortunately, CalFed funding for such studies remains blocked by area landowners concerned that by providing upstream access to any endangered fish, private lands may get saddled with restrictions on development, logging, and mining.

Small irrigation dams — *Calaveras River*

Dams giveth and dams taketh away. That is the lesson to be learned from the Calaveras River, where high water years allow for cold water releases from New Hogan Dam. The releases sporadically provide refuge for endangered winter-run chinook salmon – a Sacramento River species not naturally found in this watershed. Provisions for cold water releases from New Hogan are the key to future enhancement. Additional goals include fish passage around three permanent diversion dams, plus the outright removal of several smaller, "flash board" irrigation dams that have been targeted by both federal and state agencies.

San Clemente Dam – *Carmel River*

The California Division of Dam Safety has ordered the owner of the San Clemente Dam on the Carmel River to make expensive earthquake safety improvements to the 70 year-old structure. Originally constructed to store water for consumptive purposes, the dam is now almost completely filled with silt. In response to the state order, the Cal-Am Water Company is proposing to strengthen the dam with 11,200 tons of concrete at a total estimated cost of $13-14 million, even though the dam stores less than 147 acre-feet of water.

The Sierra Club and other local activists have proposed that the money be used instead to remove the dam, which would provide upstream access for the Carmel River's threatened steelhead run. Currently, these ocean-going trout are required to climb one of the highest fish ladders in the state – 68 feet – to get around the dam. Young salmon migrating downstream to the ocean are simply flushed over the high dam, suffering a traumatic fall that few survive. In addition to re-establishing an upstream spawning area, removing the dam would help steelhead by improving the stream gravel replenishment necessary for spawning.

courtesy: California Department of Fish & Game

McCormick-Seltzer Dam

McCormick-Seltzer Dam – *Clear Creek*

A tributary of the Sacramento River, Clear Creek provides habitat for spring-run and fall-run chinook salmon, as well as steelhead. The CalFed Program considers Clear Creek to have a high potential for the complete restoration of ecological processes and resources. Indeed, its strategic restoration plan states, "Remove the McCormick-Seltzer diversion dam to provide greater access to upstream habitat, to

restore sediment transport processes, and to reduce predator habitat."

As far back as 1946, U.S. Fish and Wildlife Service biologists recognized the impediment to salmon passage caused by the 15-foot-high dam and recommended its removal. Instead, however, more than a $100,000 of public funds were spent constructing two different fish ladders on the dam. But the fish ladders have proven ineffective; the dam still impedes the migration of spring-run chinook salmon and steelhead into approximately ten miles of critical holding and spawning habitat.

The dam also blocks the recruitment of important spawning gravels to more than six miles of creek downstream of the dam used by fall-run chinook salmon. In addition, the dam poses a public safety nuisance. CalFed officials have been negotiating with the owners of the water diversion rights associated with the dam. The water is currently used to irrigate less than 200 acres of pasture in the Anderson area.

courtesy: The Nature Conservancy

Cosumnes River irrigation dam

Small irrigation dams – *Cosumnes River*

The Cosumnes River is the only major river flowing out of the Sierra Nevada that does not have a major dam on it. Unfortunately, a 34-mile segment of the lower river in the Central Valley is blocked by several small diversion dams, plus some possibly illegal dirt and gravel dams used to divert irrigation water on a seasonal basis.

Although these dams do not appear to be major barriers to upstream migration of salmon and steelhead, they pose considerable difficulty for fish during low flows, which are not an infrequent occurrence on the river. In addition, existing fish ladders are poorly designed and largely ineffective, and unscreened diversions can capture out-migrating young. The dams also pose dangerous hazards to the public, as three luckless rafters fatally discovered in 1998. Removal of the dams and providing substitute diversion facilities would complement the efforts of several public and private agencies working to restore the natural ecological processes and improve public safety on this important river. It has been estimated that under proper conditions, the Cosumnes could potentially support a run of more than 17,000 chinook salmon. For this reason, the U.S. Fish and Wildlife Service considered removal of the Cosumnes irrigation dams in its anadromous fish restoration plan.

Cow/Kilarc hydro dams – *Cow Creek*

A small tributary of the Sacramento River near Redding, Cow Creek currently supports small runs of threatened spring-run chinook salmon and steelhead. These fish stocks have greatly suffered from numerous irrigation diversions, and low instream flows caused by PG&E's diversion of water for a marginal hydroelectric project. The hydro facility ruins critical salmon habitat for both holding and spawning in the south fork of Cow Creek. The facility is scheduled to renew its federal power license during the next eight years.

The state's Department of Fish and Game has said, "Cow Creek offers a unique opportunity to restore salmon and steelhead even as nearby communities continue to grow." Thus, it is an ideal time to consider decommissioning PG&E's hydro project and ending its damaging diversions in order to restore salmon and steelhead habitat.

Scott and Cape Horn dams (Potter Valley Project) – *Eel River*

Scott Dam forms Pillsbury Reservoir on the main stem of the Eel River. The water from this reservoir flows a short way down the Eel and then is diverted to Potter Valley by the Cape Horn Dam (also known as the Van Arsdale Dam) through a nine-megawatt power plant. Eel River water not used to irrigate crops in Potter Valley eventually flows into the Russian River, where it is diverted by a variety of users along the way. The project's diversion of Eel River water has severely damaged the Eel's endangered salmon and steelhead runs. Pillsbury Reservoir is filling quickly with sediment (its storage capacity has been reduced by 25 percent), and the dam itself may not be earthquake proof. The structural integrity of the Cape Horn/Van Arsdale diversion dam is also in question.

PG&E has proposed reducing its Eel River diversion by 15 percent to help salmon. This idea generated howls of protest from Mendocino and Sonoma county water interests who claimed they will need to double water diversions to accommodate growth. On the other hand, the U.S. Environmental Protection Agency and the National Marine Fisheries Service have rejected PG&E's proposal as insufficient, and both agencies have recommended that decommissioning the project be considered as a viable option to improve fisheries. The fisheries service has stated that, "Achieving the goal of protecting and maintaining endangered salmon may render the Potter Valley Project uneconomical."

Meanwhile, a local citizens group, Friends of the Eel River, has emerged as a strong advocate for decommissioning and removal of the project, pointing out that it would resolve the sedimentation and safety concerns at Scott Dam, renew access to hundreds of miles of historic habitat, restore the natural flow regime to the Eel River, and bring back salmon and steelhead from the brink of extinction.

For more information, contact Friends of the Eel River at P.O. Box 2305, Redway, CA 95560, (707) 923-2146, e-mail: *foer@eelriver.org*, website: *www.eelriver.org*

S. Evans

Iron Gate Dam – Klamath River

Iron Gate and Copco 1 & 2 dams – *Klamath River*

When the Copco 1 Dam was constructed on the Klamath River in 1918, it permanently blocked access to more than 75 miles of salmon and steelhead habitat in the main stem of the upper Klamath and its tributaries. Another dam, Copco 2, was constructed just a quarter-mile downstream of the original facility in 1925.

These dams not only blocked salmon and steelhead migration, they significantly altered river flows, causing releases that could drop by 1,500 percent or more in a matter of minutes. Such radically altered flows severely damaged one of the most important salmon spawning areas on the Klamath for spring-run chinook and steelhead, stranding adult and young fish alike, exposing egg nests, cementing spawning

> "We long for the day when the salmon swim again like they did in the days of our ancestors, and will celebrate when this happens."
>
> – Yurok Tribe

gravels, and preventing upstream recruitment of new spawning gravels.

The 173-foot-high Iron Gate Dam was constructed in 1962 to reregulate the wildly varying flows from the upstream Copco dams and run a 20 megawatt power plant. With the construction of Iron Gate, another seven miles of spawning habitat disappeared for salmon and steelhead. Removal of the Iron Gate facility, and the Copco 1 and 2 dams could restore an essential part of the Klamath watershed for threatened salmon and steelhead populations (although much more still should be done to address water supply and water quality problems as a result of upper Klamath basin agricultural operations).

Removal of these dams would not only help restore fish species on the brink of extinction, it would also fulfill the obligation of the federal government to restore and maintain a fishery resource held in trust for Native Americans. Potential decommissioning of this project, increased instream flows for fish, and fish passage around the dams are just some of the critical issues that should be addressed when the FERC considers renewal of Iron Gate's federal hydro license in 2006.

Rindge Dam – *Malibu Creek*

The 100-foot-high Rindge Dam was built on Malibu Creek in 1926. Its 574 acre-foot reservoir filled with sediment in less than 25 years. Steelhead sometimes migrate several miles up the creek to the base of the dam, but then are blocked from eight more miles of their former habitat in what is now Malibu Creek State Park and the Santa Monica Mountains National Recreation Area.

The idea of restoring Malibu Creek's fishery by removing Rindge Dam has become the focus of intense scientific scrutiny. Its restoration potential was underscored by a State Parks ecologist who stated, "We need to take this dam down as soon as possible."

Key points in this debate include how much sediment is behind the dam (estimates range from 800,000 to 1,600,000 cubic yards), what methods could be used to remove both the dam and its sediment, and how much it will cost. Estimates for this project range from $4 million to $18 million, depending on whether the sediment is allowed to naturally erode away in stages, is trucked out to a landfill, or is relocated elsewhere in the canyon.

The U.S. Army Corps of Engineers is currently conducting a dam removal feasibility study sponsored by a committee of various local, state, and federal agencies involved in the Malibu Creek watershed called the Rindge Dam Task Force. For more information, contact Jim Edmondson, California Trout, 667 Country Club Drive, #1215, Simi Valley, CA 93065, (805) 584-9248, email: *edmondson@caltrout.org.*

Tim Palmer

Cascade Dam – Merced River

Cascade Dam – *Merced River*

For more than a decade, the National Park Service has been considering removal of this small, unused hydro dam in Yosemite National Park. The 170-foot-long dam is largely made of timber and is about 17 feet high. It impounds less than one surface acre of water, but holds back an estimated 5,700 cubic yards of sediment that would have to be removed along with the dam. Removal of the dam may require stabilization of the riverbank and adjacent Highway 140 embankment. Conservationists have asked the Park Service to fully analyze the

need and consequences of removing this dam as part of agency's Merced Wild & Scenic River Management Plan.

Clough Dam – *Mill Creek*

The state's Fish and Game Department has identified this dam as yet another target for fishery restoration opportunities in the Central Valley. In 1998, floods began the process of dam removal when high water took out much of the old Clough Dam. With a poorly designed fish ladder impeding the upstream migration of spring-run chinook and steelhead, it probably is cheaper to remove the rest of the dam than to replace it and install a new fish ladder.

Federal and state officials are currently negotiating with the water rights holders and landowners to replace the Clough diversion and remove the dam as part of the CalFed restoration program. The state's Department of Water Resources has designed an inverted siphon that would allow water to be diverted from existing facilities upstream without rebuilding the dam. So far, however, local landowners have not agreed to the project. The delay may prevent complete removal of the dam and construction of the siphon next year.

Charlie Casey

Woodbridge Dam – Mokelumne River

Woodbridge Dam – *Mokelumne River*

Identified by the U.S. Fish and Wildlife Service as a structure that unfortunately sustains a population of salmon and steelhead predators, elimination of Woodbridge Dam could increase salmon smolt survival by at least 10 percent. Ironically, the high springtime flows necessary for flushing young salmon down the Mokelumne, through the Delta, and into the sea, also attract predators such as striped bass and squawfish. They congregate at the base of dam where they feed on young fish migrating downstream.

Fish biologists estimate that up to 51 percent of the Mokelumne River's salmon smolt were lost to striped bass predation in 1993. Fishery experts also believe that removal of the dam would reduce delays in upstream migration of adult salmon.

In order to remove the dam, another facility or water source would have to be developed to replace the current irrigation diversion. In addition, dam removal would transform the popular Lodi Lake from a lakefront park in to a park with riverfront. Such a change could be difficult for area residents to readily accept.

Currently, the dam's owners, the Woodbridge Irrigation District, and the U.S. Bureau of Reclamation are proposing a $13.5 million restoration study for the lower Mokelumne, which may or may not consider dam removal. The public will have an opportunity to comment on the project's environmental documents.

Old Melones Dam – *Stanislaus River*

This is perhaps the most unique dam now being suggested for removal in California. Old Melones Dam is unusual because it is usually under water; it typically lies submerged beneath the reservoir created by the much larger New Melones Dam. But even dams that no longer hold water, and in fact are under water, still can cause problems.

In the case of the Old Melones structure, this subsurface dam limits water circulation and acts as a barrier to the cold water normally accumulating at the bottom of a reservoir. Consequently, flow releases from New Melones Dam are primarily from warmer surface water, leading to higher temperatures that are

often detrimental to downstream salmon. Removal or breaching of the Old Melones could reduce fall water temperatures for salmon in the lower Stanislaus River.

The problem is, dismantling an underwater dam has never been done. Engineers might have to wait until the next drought for New Melones reservoir to be lowered enough to expose the old dam.

S. Evans

Farad Dam Intake Structure– Truckee River

Farad Dam – *Truckee River*

The Farad hydro dam is another facility removed by natural events: in this case a recent flood. The dam's owner, Sierra Pacific Power Company, wants to rebuild the dam. It formerly diverted more than two miles of the Truckee River to run a tiny power plant downstream. Since the project had no minimum instream flows mandated by the FERC, the project often left a flow of 50 cfs or less in the river, particularly during drought years.

Diversions on the Truckee River have contributed to the decline of several important species, including the threatened Lahontan cutthroat trout, mountain yellow-legged frog, and native mountain whitefish. Fish biologists estimate that the optimum flow to restore and support the Truckee River's aquatic ecosystem and native fishery is 250 cfs.

The old dam also posed a hazard to boaters in high flows and prevented boating below the dam during low flows. While the utility company proposes building a new Farad dam to accommodate

> "After the destruction of the Farad Dam by the flood, the health of the Truckee River immediately improved. Today, it is a complex and rich environment that provides a multitude of habitat niches favoring native species of all types."
>
> – Ralph Cutter, Truckee River fly-fishing guide

boating and fish passage, the value of this measure seems dubious since the company seems unwilling to even discuss leaving more water in the river for either fish or outdoor enthusiasts. Currently, the state's Water Resources Control Board is conducting an environmental review of the utility's proposed reconstruction project and public comment is invited.

O'Shaughnessy Dam under construction in Yosemite's Hetch Hetchy Valley.

O'Shaughnessy Dam – *Tuolumne River*

Better known as Hetch Hetchy, this is the mother of all dam removal proposals in California. The battle over the damming of Yosemite's Hetch Hetchy valley reportedly broke John Muir's heart. He died a year after Congress passed legislation allowing San Francisco to drown what many considered a valley

O'Shaughnessy Dam – Tuolumne River

equal in beauty to the better known Yosemite Valley. But the organization Muir founded – the Sierra Club – continues the dream of bringing Hetch Hetchy back to life.

The club believes removing O'Shaughnessy Dam would help restore the character of the national park system, as well as the ecological and biological integrity – and ultimately, the aesthetic beauty – of the valley. Removal of the dam could also help restore downstream ecological functions along the nationally designated wild and scenic Tuolumne River.

The debate over dam's removal actually got a big boost in 1987, when then-Interior Secretary Donald Hodel suggested the possibility. The Sierra Club's goals are to remove the dam in a way that would not affect San Francisco's water supply (by using the New Don Pedro Reservoir downstream on the Tuolumne River), and to retain as much power generating capacity as technically possible.

For more information, contact Ron Good of the Sierra Club's Hetch Hetchy Task Force, P.O. Box 289, Yosemite, CA 95389, (209) 372-8785, e-mail: *rongood@increach.com.* The Task Force's web site is *www.sierraclub.org/chapters/ca/hetchhetchy*

Matilija Dam – *Matilija Creek (Ventura River)*

Ventura County, along with other local, state, and federal agencies (and Secretary of Interior Bruce Babbitt), have all endorsed the idea of removing the now-defunct Matilija Dam in order to restore the Ventura River's once renowned steelhead run.

More than 5,000 steelhead formerly migrated up the river and Matilija Creek before the dam was built in 1948. Now less than 100 fish make their way up the river, only to face the dam's unyielding concrete wall. The 198-foot-high dam blocks access to more than 20 miles of some of the best remaining steelhead habitat in southern California. Much of this area is already protected as part of the Matilija Wilderness and proposed Matilija Wild & Scenic River, but the dam will have to come down before any steelhead can use it.

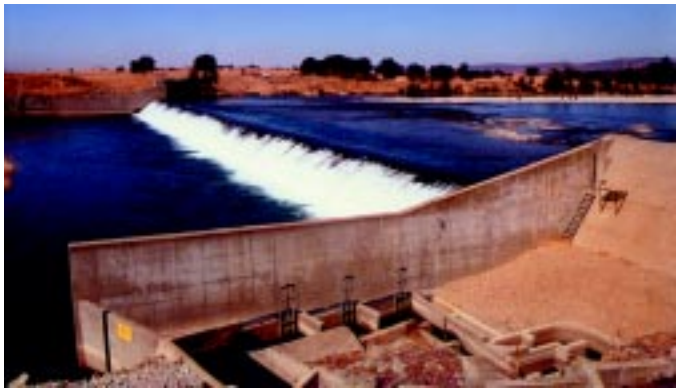
The dam was constructed of low grade materials, requiring notching to ensure public safety. The reservoir behind the dam is filled with an estimated five to seven million cubic yards of silt. One obvious question is what to do with all that material. Potential solutions range from removing the dam in layers, allowing sediment to flush naturally over the dam (and down the river to the ocean), or dredging the reservoir itself. In addition to helping restore the river's steelhead run, removal of the Matilija Dam also would help replenish the sand on Ventura County's eroding beaches.

Removal of Matilija Dam will not only open up access for fish, it will also allow pedestrian access into the Matilija Wilderness. As part of the dam removal planning, consideration will be given to providing access and day-use recreational facilities, extension of the coast-to-mountain bicycle trail, outdoor educational facilities, and acquisition of non-federal inholdings in the Los Padres National Forest.

The Bureau of Reclamation has initiated an appraisal study to be completed in the spring of 2000. Congress recently allocated $100,000 to study the

dam's removal. A demonstration project to commence decommissioning of the dam is being planned for the fall of 2000, before the Secretary Babbitt leaves office.

For more information, contact Friends of the Ventura River, 63 So. Olive Street, Ventura, CA 93001, (805) 682-5240.



Jen Carville

Daguerre Point Dam – Yuba River

Wilder Creek Dam – *Wilder Creek*

The California Department of Parks and Recreation is studying the removal of the tiny Wilder Creek Dam in the Wilder Ranch State Park, just north of Santa Cruz. This small dam was built in 1956 to store and divert irrigation water, but by 1985 its one-acre reservoir had filled completely with sediment.

High creek flows tend to encourage erosion around the dam. State Parks has decided to remove the structure and restore the area to a natural wetland and riparian habitat. Removal of the dam would reopen Wilder Creek to coho salmon and steelhead trout, as well as reduce downstream sedimentation in the Wilder Creek estuary, which provides important habitat for the sensitive tidewater goby.

Daguerre Point and Englebright dams – *Yuba River*

The Daguerre Point and Englebright dams were originally constructed in the early 1900s to capture debris from the anticipated resumption of hydraulic gold mining. Fortunately, that destructive activity never resumed. Over the years, the dams were retrofitted for other purposes, with Daguerre

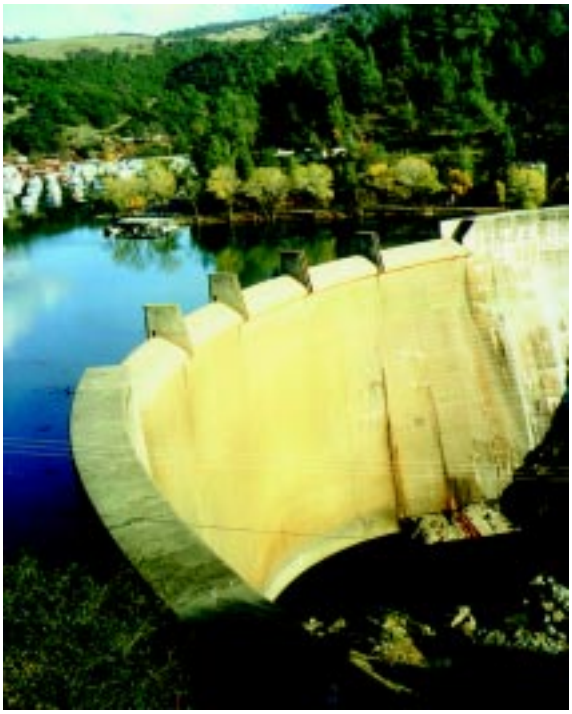
Jen Carville

Salmon attempting to jump Daguerre Point Dam.

becoming a diversion point for consumptive water users, and Englebright becoming a hydroelectric plant and recreation reservoir popular with houseboaters and anglers.

But these dams may be the key to one of the most ambitious fish habitat restoration efforts in the state. The CalFed program is looking at the feasibility of removing Daguerre Point, and considering options for reintroducing steelhead and spring-run chinook salmon upstream of Englebright.

The Yuba River supports several runs of migratory fish, but the relatively small Daguerre Point structure impedes access to more than 12 miles of upstream spawning habitat. Not only are the dam's fish ladders inadequate at various flows, they are so



S. Evans

Englebright Dam—Yuba River

poorly designed that salmon often leap out of them, only to die on dry land. The dam blocks as much as 40 percent of the river's salmon and steelhead runs.

The Army Corps of Engineers is currently conducting a feasibility study to improve fish passage around the Daguerre Point structure. Unfortunately, it appears this study may not give adequate consideration to the option of removing the dam and replacing its diversion facilities with more fish-friendly alternatives.

Upstream of Daguerre Point, the 280-foot-high Englebright Dam forms a permanent barrier to more than 50 miles of former habitat for salmon and steelhead. The CalFed program has initiated a collaborative effort to evaluate options for reintroducing salmon and steelhead upstream of this dam.

Early talk by conservationists about actually removing the dam generated a firestorm of local protests from reservoir users, some local property owners, the owners of the dam's power plants, and downstream residents concerned about flood control. Some of these interests have suggested ways to get salmon and steelhead around the dam without removing it, but conservationists argue that dam removal must remain at least a serious option to consider.

Englebright stores no water for flood control or consumptive uses. There is, however, an unknown amount of sediment behind the dam, which may be contaminated by leftover mercury from the gold mining era. In addition to providing reservoir-based recreation, the dam acts as a reregulating reservoir for the releases from the an upstream powerhouse. Removal or partial removal of the dam would also affect Englebright's power plants.

The quantity and quality of fish habitat upstream of the dam also must be assessed. Once these questions are answered, the CalFed program should evaluate the alternatives and determine the feasibility of reducing or removing the dam, in conjunction with other potential alternatives to restore salmon and steelhead upstream, as well as the cost and benefits of doing so.

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Cover Photos:
Matilija Dam, Paul Jenkin
Matilija Creek, Paul Jenkin
Endangered Steelhead, Charlie Watson
Little girl, Rapid Shooters

FRIENDS OF THE RIVER

Restoring Your River: How To Get Involved

Many of the current dam removal efforts in California have their origins with citizens who came to recognize a direct connection between insidious damage to a local stream and the construction of a structure on it. People who once thought dams were forever – that the loss of a favorite swimming hole or salmon run was done in the name of progress – are now questioning those very facilities and their once-vaunted benefits. As Interior Secretary Bruce Babbitt has said, "We routinely demolish buildings that have served their purpose... Why not dams?"

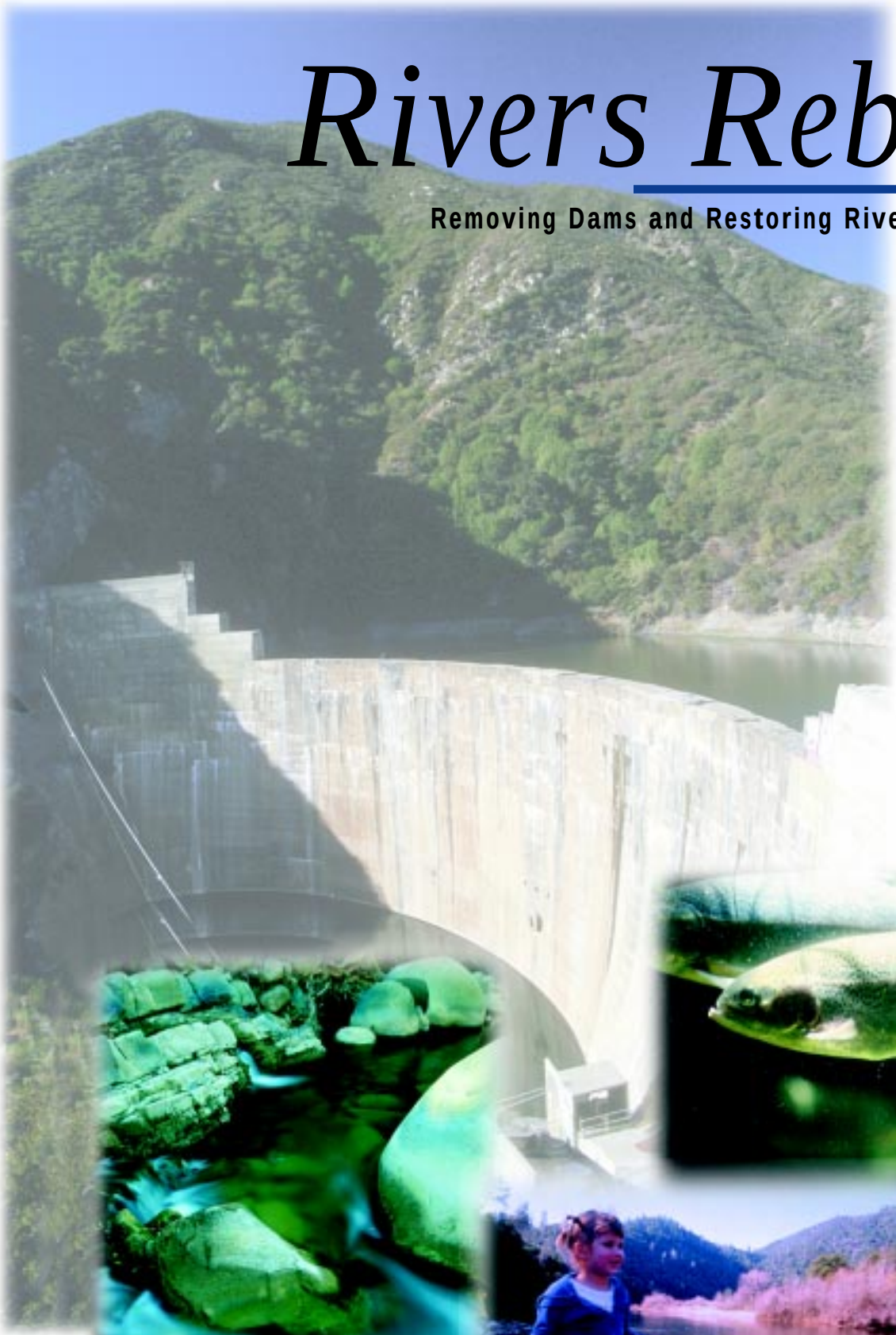
Up and down the state, locals are shaping such discussions. In Ventura County, for example, one long-time resident who recalled steelhead in the Ventura River more than 50 years ago doggedly documented how the river had been damaged by a dam upstream. Such efforts were among the catalysts for meetings with key officials, letters to the editor, governmental resolutions, and community awareness about the issue.

California rivers – and Friends of the River – could use more public involvement and support. There are a many streams and watersheds with restoration potential, if only people would get involved. Many local activists and residents have more information about nearby rivers and creeks than they realize. Knowledge about the function of a dam (no matter how big), about its operational costs and capabilities, about the damages it might be causing to fish and other species is an ideal beginning. A commitment of time, financial resources or other contributions will make a difference as we work toward restoring a better balance.

For more information about Friends of the River's dam removal and river restoration efforts, contact us at (916) 442- 3155, via e-mail at *info@friendsoftheriver.org*, or on the web at *www.friendsoftheriver.org.*

Rivers Reborn

Removing Dams and Restoring Rivers in California



a special report from Friends of the River

Potential Dam Removal Projects

Friends of the River is California's statewide river conservation organization. Founded in 1973, it is an authority on the environmental impacts of dams and river diversions, and is the most effective grassroots organization working on behalf of waterways throughout the state. Friends of the River has played a key role in adding numerous rivers to National Wild and Scenic Rivers System, and it has successfully advocated alternatives to dam development for water supply, power, and flood control needs.

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