

CALIFORNIA
COAST & OCEAN

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Sudden Oak Death
Sand for Beaches
Border Waters

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Cover photo: Glenn McCrea has been fascinated with wildlife all his life. He is a self-trained photographer who, since obtaining some very good equipment about eight years ago, has mostly pursued macrophotography.

"Most of my images are made using natural light and are an outgrowth of my near-sightedness. I love the tiny details of our natural world and strive to introduce others to the unseen beauty around us."

Back cover: *Phycodrys setchellii*, seaweed pressing by Ida Geary



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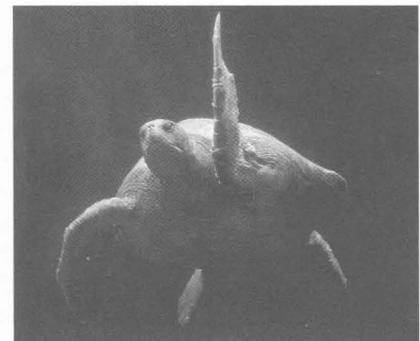
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RANDY WILDER, MONTEREY BAY AQUARIUM



Behind This Story Are More Stories

THE DISTURBING STORY of the epidemic afflicting our oaks and madrones is being reported in the press, but mostly in fragments. In this issue we provide a fuller picture, telling how the pathogen causing it was discovered, what scientists have learned so far, and what remains unknown. We hope to alert readers to the significance of this epidemic, the need to do everything possible to address it, and suggest what each of us can do—though unfortunately it isn't much at this point—to help prevent its spread.

Within every story lie many other stories. In a magazine article you must choose a focus and stay with it. Elizabeth Cole, in her report on Sudden Oak Death (SOD), does not dwell on political ramifications, nor does she delve into personal politics within the scientific community. Instead, she keeps her eye on the physical nature of the ominous problem and the quest for a solution.

The story keeps evolving, often in surprising ways. On January 8 scientists at the University of California, Berkeley, confirmed that the oak-killing pathogen had been identified in redwood suckers (shoots) collected last September in Big Sur. They stressed that the mere presence of *Phytophthora ramorum* does not prove it sickens or kills redwoods. Studies are in progress. They broke their silence before results were in because someone else was about to make news about an infected redwood.

That someone is Ken Bovero, a certified arborist whose name does not appear in our story. He has no distinguished letters after his name, for he went into the tree business right after high school. But he has worked with trees for some 20 years, and his powers of observation are keen. He and his wife do business as Marin County Arborists.

"About mid-1994," Bovero said, "I noticed that a client in Kentfield was

losing a tanoak." The tree had bleeding cankers, borers, and other symptoms. "I recommended removing it and we did that." Two months later, the symptoms appeared on three other tanoaks, and then on other clients' trees. Puzzled, Bovero consulted Ralph Zingaro, a licensed pest control advisor who had studied with an expert in tree decline. He suspected environmental stress, recalling massive dieoffs of dogwood on the East Coast that correlated with acid rain, and the decline of ponderosa pine in the San Bernardino Mountains, linked to air pollution.

Some months later, Bovero saw sick tanoaks in Mill Valley and tried to alert scientists. Then he saw the symptoms on a live oak, and "it was clear to me that this was becoming an epidemic," he said. Stepping up his campaign for scientific attention, he became so bold as to invite scientists attending a conference at UC Berkeley to come for a picnic and examine some sick trees. Five came, among them Pavel Švihra, horticulture advisor at the UC Cooperative Extension in Marin County, who recalls that Bovero was "very gracious."

Švihra said he first saw affected tanoaks in 1995, summoned by "three ladies who had been walking the same route for years and noticed that something was wrong." He fielded other calls, an increasing number after live oaks began to succumb. "It became dramatic as dying trees became infested with staggering numbers of beetles," he said. In September 1998, an Associated Press reporter interviewed Švihra and in her story referred to sudden oak death. The term caught on and SOD became national news.

Meanwhile, Ken Bovero—who, feeling slighted, thought he deserved some credit for his role—was more or less forgotten.

"He deserves credit for recognizing

the condition, alerting scientists, and also for identifying some of the host plants," said Susan Frankel, who represents the USDA Forest Service on the Oak Mortality Task Force, which is now trying to combat the epidemic.

About a year ago Bovero came upon two dead or dying redwoods in Mill Valley, but this time he did not call the experts. Instead, after obtaining a permit and felling one of the trees, he chopped into it and sent the sample to an independent laboratory. When he got the results he called the *Marin Independent Journal* to report that a pathogen, not fully identified but resembling the oak killer, *P. ramorum*, had been found in a redwood.

It was because this story was about to be published and in response to reporter Richard Halstead's inquiry that UC scientists announced at that particular time that they were studying redwoods because *P. ramorum* had been identified in suckers taken at Pfeiffer State Park.

Everyone involved in the story of this epidemic has something to add, and there are many variants, because emotion and personal perspective figure in any endeavor, including science.

Also in this issue of *Coast & Ocean*, naturalist and artist Ida Geary tells of seaweed discoveries she made while teaching about native plants near Crissy Field in San Francisco. "After I retired," she told me, "one of my students decided to keep walking along this shore, and in other places too. She has done that, and a group goes out with her. So I started something." That's not in her story, but it's important.

Covering the California coast often means writing about people like Bovero and Geary, who care about its life and help to protect it in uncounted ways, large and small, visibly and invisibly—people who start something that then goes on.

—Rasa Gustaitis

Background: *Prionitis* sp., a seaweed pressing by Ida Geary



TRACKING A MYSTERIOUS KILLER

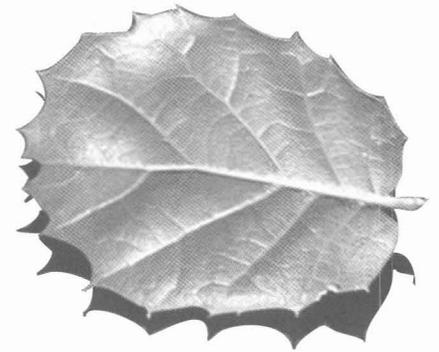
The Relentless Spread of Sudden Oak Death

ELIZABETH F. COLE

THE FOREST EPIDEMIC known as Sudden Oak Death (SOD), first recognized seven years ago, has been spreading in an enlarging fog belt area of California's central coast and was recently found as far north as southern Oregon. Tens of thousands of native oaks have already been lost.

Detective work by scientists at the University of California Davis and Berkeley has yielded information in record time about the mysterious killer, a primitive brown alga that loves cool climates and water and can be lethal to susceptible trees.

Now officially known as *Phytophthora ramorum* (meaning "infector of twigs") this previously unnamed pathogen seems to be a newcomer to the afflicted forests—as were the Asian and European fungi that, respectively, started the Chestnut Blight in 1900 and Dutch Elm Disease in the 1930s, both of which swept across the country. While these earlier epidemics took decades to decipher, a great deal has been learned in



California live oak leaf, by Br. Alfred Brousseau, St. Mary's College

a relatively short time about the SOD pathogen since it was identified in June 2000. The structure of this alga is similar to that of another of its genus, *Phytophthora lateralis*, cause of Port Orford Root Disease, which is killing Port Orford cedars in the cool, moist forests of the Pacific Northwest. Yet we need to know more, so the search for information that will help us deal with the oak epidemic goes on.

No approved chemical treatment exists that will keep the infected trees alive. Much can be done, however, to prevent humans from spreading the disease and to help healthy trees stay strong. Whether California will lose its oaks, as the country lost its American chestnuts and Dutch elms, will depend on multiple factors, not only on this pathogen. It is noteworthy that in none of the infected areas observed has

every tree been affected, nor has every infected tree died. Scientists are hopeful, therefore, that some acorns from these long-lived, wind-pollinated trees will provide genes for natural regeneration, albeit slowly. Eventually, it is expected that SOD will become episodic, flaring up only during climatic conditions it favors. At this point, however, it is believed that the epidemic is in an early stage and its spread is likely to continue.

Discovery

THE SYNDROME now called Sudden Oak Death was observed in the mid-1990s in Marin County. On a slope near Mount Tamalpais, facing the entrance to San Francisco Bay, where cool, moist fogs bathe the hillsides, hikers noted that several clusters of tanoaks had turned brown simultaneously as all their leaves died. (Tanoak, *Lithocarpus densiflorus*, is not a true oak but a close relative.) Arborists also reported dying tanoaks elsewhere, with unusually large swarms of three common bark beetles on the trunks, attracted to cankers that exuded the scent of death.

These beetles are known to burrow and tunnel in the trunks of dead trees to nest and reproduce. Because the pathogen in the Dutch elm epidemic was transmitted by insects, it was natural to assume that they played the same role in this disease. Before long, however, it became clear that that was not necessarily so.

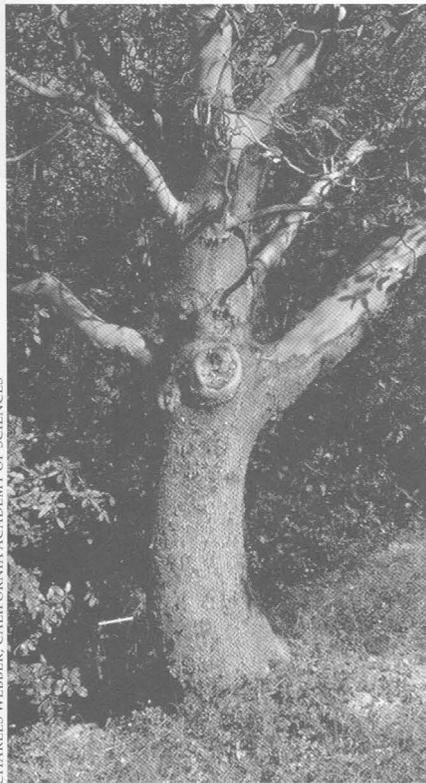
Pavel Švihra, horticulture advisor at the University of California Cooperative Extension in Marin County, investigated reports and consulted other scientists. They were all puzzled. Soon more afflicted trees were discovered just westward and down the slope from the first site Švihra had seen. This tanoak death was occurring with unusual abruptness and spreading rapidly along creek beds, hillsides, and ridge tops. Scientists soon learned that tanoaks were dying

Below left and bottom left:
Pacific madrone, *Arbutus menziesii*

Below right: California black oak, *Quercus kelloggii*

Bottom center: California live oak, *Quercus agrifolia*

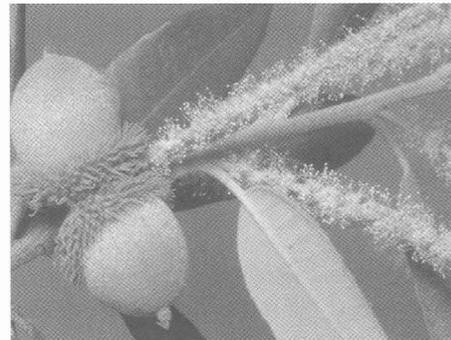
Bottom right: Tanoak, *Lithocarpus densiflorus*



CHARLES WEBBER, CALIFORNIA ACADEMY OF SCIENCES



CHARLES WEBBER, CALIFORNIA ACADEMY OF SCIENCES



L-R: BR. ALFRED BROUSSEAU, ST. MARY'S COLLEGE; BEATRICE F. HOWITT, CALIFORNIA ACADEMY OF SCIENCES; CHARLES WEBBER, CALIFORNIA ACADEMY OF SCIENCES

with the same rapidity and symptoms in nearby Muir Woods National Monument.

Marin County Agricultural Commissioner Stacy Carlsen called for help from plant pathologists at the University of California, but the pathogen proved elusive. By 1997, not only tanoaks but also coast live oaks (*Quercus agrifolia*) were dying in the Marin Municipal Water District lands on the other side of Mt. Tamalpais. Almost simultaneously and yet more easterly, trees in China Camp State Park on San Francisco Bay were dying, as were black oaks (*Q. kelloggii*) farther north.

Many of these trees had large weeping cankers, swarms of beetles, and the green to black fruiting bodies of *Hypoxylon* fungus, indicating that tree tissues were dying and the trees were severely weakened. This fungus is believed to be in the tree when it is healthy and to break out and grow rapidly in areas of sapwood that die.

Reports of SOD were confirmed in 1995 in Santa Cruz and Monterey Counties, and later in Sonoma County. By 1998 it had become clear that this disease was spreading very rapidly, that its manifestations differed only slightly by oak species, and that it had to be reckoned with. It had erupted in the urban-wildland interface—an area inhabited and visited by millions of people. It was killing trees on public and private lands, threatening residential and forest landowners, parks, industries, water supply, soil retention, and wildlife. Weakened and dead trees could topple, destroying life and property. They also posed a severe fire hazard.

Clearly, the growing epidemic had to be addressed cooperatively by many landowners and land managers. As news of the oak affliction spread, and homeowners pressed county supervisors for investigation and treatment, several state and federal agencies joined to form the nidus for what would become, in August 2000, the statewide California Oak Mortality Task Force.

How You Can Help Prevent the Spread of Sudden Oak Death

CAN YOU BE a vector of *Phytophthora ramorum*? You bet! But you don't have to be. When you are in infected areas:

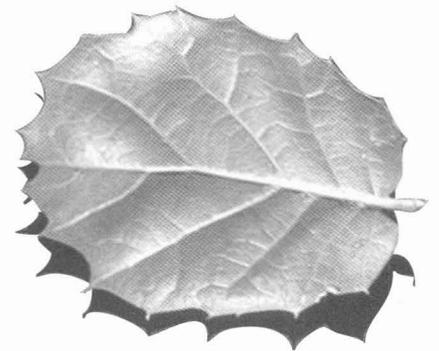
- Park only in designated areas
- Stay on trails
- Do not collect wood, plant matter, or soil
- Avoid muddy areas.

Before leaving infected areas:

- Clean soil and mud off shoes, bike tires, horses' hooves, and pets' paws
- Wash mud and soil off your vehicle's tires, wheel wells, and undercarriage.

If a tree on your property must be cut, or if you have tree work done, insist that sterilized tools be used, and make sure workers follow recommendations of the Oak Mortality Task Force.

Involved early on were the California Department of Forestry and Fire Protection, the California Forest Pest Council, and the U.S. Forest Service. By now this advisory group has grown to over 800 members and over 65 organizations, including government agencies, research groups, nonprofit organizations, business interests, and individuals. It undertook the challenge of establishing a cooperative, unified approach and offering guidance to funders, lawmakers, management agencies, research institutions, and others concerned with the disease.



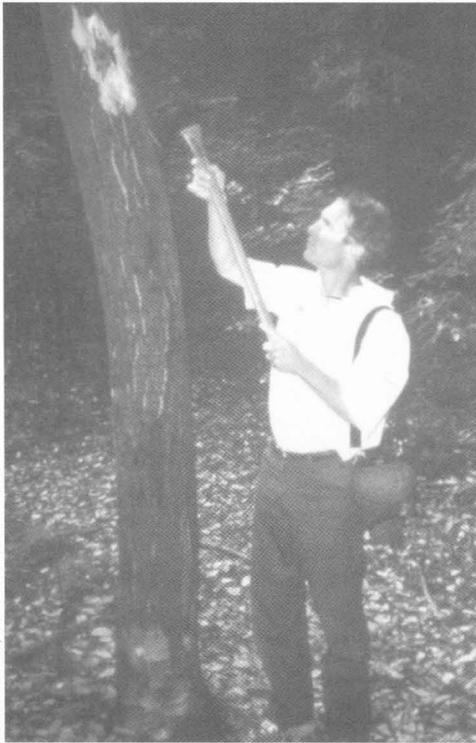
Left: Blue oak, *Quercus douglasii*, is resistant to SOD.

Center: Viburnum, *Viburnum ellipticum*, one of many host plants

Right: Toyon, *Heteromeles arbutifolia*, another host



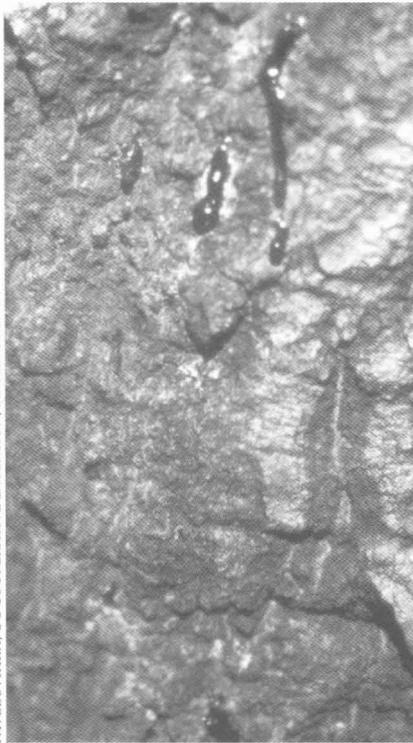
BR. ALFRED BROUSSEAU, ST. MARY'S COLLEGE (LEFT AND CENTER); J.E. (JED) & BONNIE MCCLELLAN, CALIFORNIA ACADEMY OF SCIENCES



Left: Alan Kanaskie, Forest pathologist for the Oregon Department of Forestry, examined a tanoak with SOD cankers.

Center: Bleeding cankers.

Right: California buckeye, *Aesculus californica*



Books on Oaks

THESE BOOKS published by the **California Oak Foundation** can be useful in identifying and caring for oaks:

Oaks of California; The Life of an Oak: An Intimate Portrait; Compatible Plants Under & Around Oaks; Investigating the Oak Community: A Curriculum Guide for Grades 4–8; and Acorns and Eat 'em: A How-to Vegetarian Cookbook.

All are available from:
California Oak Foundation
1212 Broadway, Suite 810,
Oakland, CA 94612
(510) 763-0282
FAX (510) 208-4435
oakstaff@californiaoaks.org
www.californiaoaks.org.

A New Pathogen

AS WORD OF THE EPIDEMIC spread, reports of hundreds of thousands of alleged victim trees sprang up all over the state. When investigated, however, not all these trees proved to have SOD. To diagnose the disease, foresters looked for stained bark areas exuding beads of viscous, dark red fluid (bleeding cankers). On seeing one, they peeled away the bark. If they discovered jagged black-pigmented lines surrounding large, expanding areas of dead cambium cells, they presumed they had a case of SOD and took samples for laboratory confirmation.

In all trees, the cambium layer of the inner bark, only a few cell layers thick, is the site of living vascular cells that transport to the roots the nutrients manufactured by photosynthesis in leaves. The pathogen appears to kill the bark all around a tree, girdling it and cutting off the flow of nutrients.

That the cause of SOD was a new pathogen was established in 2000 by David Rizzo, a professor of plant pathology at UC Davis, and Matteo Garbelotto, a forest pathologist at the Department of Environmental Science, Policy, and Management in the School of Ecosystem Sciences at UC Berkeley. Garbelotto showed, through DNA analysis, that this alga was a previously unknown member of the genus *Phy-*

trophthora. Rizzo isolated the new species, *P. ramorum*, for the first time, making definitive diagnosis possible on a tree-by-tree basis.

When Rizzo grew the pathogen in his lab he found it had several forms of spores. One type, emerging in large numbers from the fruiting bodies, has flagellae that enable it to swim. Another type, a drought-resistant, resting spore known as a chlamydospore, enables *P. ramorum* to survive in conditions too warm and dry for the pathogen in its usual growth phase. How long this chlamydospore remains viable is not yet known, but perhaps for years. This is worrisome.

Diagnosis of SOD is laborious and can be difficult. Symptoms are bleeding cankers on trunks, leaf spots, and twig dieback. Fruiting bodies of *Hypoxylon* fungus and massive attacks by three types of bark beetles may be associated with later stages of tree decline. These symptoms occur on coastal live oak, black oak, and Shreve oak (*Q. parvula* var. *shrevei*). In tanoak, in addition to the bleeding, new shoots may droop on trees less than 20 feet tall. But this cluster of external symptoms also occurs with a more common root pathogen, *Phytophthora cinnamomi*—which can also be fatal if trees are watered or conditions are very favorable for the pathogen—and even with some mechanical injuries. Ultimately, diagnosis requires that the pathogen be cultured.

Trees may be infected as long as two years before they die and the infection becomes obvious to the eye. Often no bleeding is present early on, and in any case, a small spot of ooze is hard to notice, or can be washed off by rain.

It is important to keep in mind that SOD is not the only oak killer. It may not even be the greatest current threat to oaks. Throughout the state, oaks are dying massively of many causes. Many have been uprooted to make way for vineyards and other development; many have died because of land use practices that do not take the needs of oaks into account. (Oaks need dry summer conditions and may not survive in an irrigated landscape.) Oak forests have been weakened by environmental changes such as habitat fragmentation caused by human actions, as well as by drought and by other pathogens (such as the honey mushroom, *Armillaria mellea*). When trees are weakened, for whatever reason, they become susceptible to diseases and their life spans are shortened.

Where Did It Come From?

IN 2000 CLIVE BRASIER, a forest pathologist from England, visited Marin County to see SOD, and in Garbelotto's lab was shown the new pathogen in culture. Shortly thereafter he was consulted by a German plant pathologist about a disease that had appeared on rhododendrons grown in European nurseries, causing dieback in estates and parks in Germany and the Netherlands. Suspecting that the culprit was one and the same, he contacted researchers in California, Germany, and the Netherlands and advised them to investigate further.

In December 2000, in a Santa Cruz rhododendron nursery surrounded by dying oak woodlands, a culture was taken from a

Sudden Oak Death Web Sites

THERE ARE MANY web sites with extensive information on SOD. These are among the best, and have links to other useful sites:

The California Oak Mortality Task Force: www.suddenoakdeath.org

CalFlora: www.calflora.org/SOD

University of California Agriculture & Natural Resources: danr.ucop.edu/news/MediaKit/SOD.html

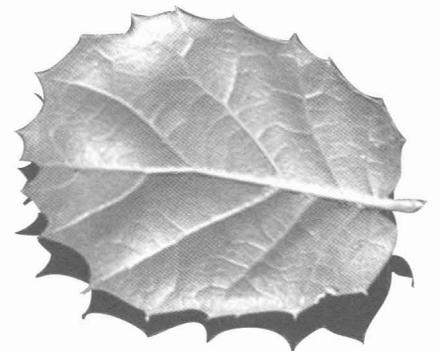
California Oak Foundation: www.californiaoaks.org

plant with spotting on its leaves, and a pathogen identical to the one killing oaks was identified.

Meanwhile in Europe, nursery-grown viburnum and rhododendrons were found to be infected, though not dying. Although rhododendrons from the two affected countries had been imported to the United States, we don't have enough evidence to assume that they were the source of the disease here. Scientists still do not know for certain when, how, and where the epidemic in California started, but it could have begun a decade ago or longer, going unrecognized until 1995.

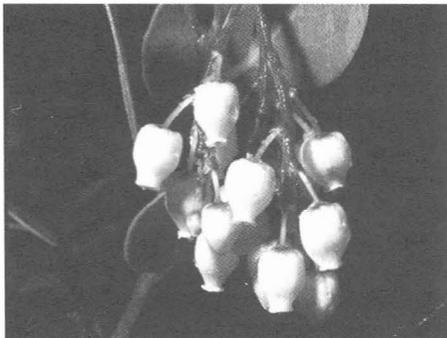
From the outset, those studying the epidemic searched for vectors that were able to carry the disease to new sites. Humans became prime suspects because most of the areas where the disease was first reported were popular with bikers, hikers, and horseback riders; dogs and cats were implicated as well. Mud clinging to boots, hooves, paws, and tires could easily have carried the spores. When mud samples from well-visited sites were tested for *P. ramorum*, they proved culture-positive.

Scientists visiting infected zones began to carry extra pairs of shoes, changing into clean pairs before entering their trucks. They now habitually sterilize shoes and tools with alcohol, 10 percent bleach solution, or Lysol, and wash tires upon leaving



Left: Common manzanita, *Arctostaphylos manzanita*

Center and right: California huckleberry, *Vaccinium ovatum*



L-R: DR. ROBERT THOMAS & MARGARET ORR, CALIFORNIA ACADEMY OF SCIENCES; BR. ALFRED BROUSSEAU, ST. MARY'S COLLEGE; GERALD & BUFF CORSI, CALIFORNIA ACADEMY OF SCIENCES

No Statewide Protection for Healthy Oaks

SUDDEN OAK DEATH is far from the only threat to California's signature landscape. Vast numbers of healthy oaks are being cut down to make way for urban sprawl and corporate vineyards. If we value the habitat, watershed, and aesthetic values of oaks on our state's rolling hillsides, we must protect them from needless destruction.

For example, blue oaks—an oak species not yet affected by *Phytophthora ramorum*—are not regenerating, for unknown reasons, and no statewide law protects them or other oaks. On December 11, 2001, the Placer County Board of Supervisors unanimously approved the destruction of 10,000 blue oaks for a development; another 8,000 blue oaks received their death sentence in Placer County making way for another development earlier in the year. California Oak Foundation is working with the Sierra Club and other groups to address this issue in the courts.

The California Department of Forestry and Fire Protection (CDF) has not responded to requests from the California Oak Foundation and others that environmental review and permits be required prior to massive removal of native oaks—even though its director, Andrea Tuttle, has called the SOD epidemic “an ecological disaster in the making.”

In September 2000, the Oak Foundation and the Mountain Lion Foundation brought suit against the Board of Forestry and CDF in San Francisco Superior Court, challenging the legality of these state agencies' decision not to conserve the oak woodlands in the state, despite their authority to do so. Judge David Garcia ruled that the Forest Practices Act gave the Board and CDF discretion to not regulate oaks. The ruling is being appealed.

More than 80 percent of the state's oaks grow on private lands. California Oak Foundation has been focusing on technical assistance to private landowners to help them hold onto their lands in economically difficult times, and to improve stewardship of those lands. For more information call (510) 763-0282 or see www.californiaoaks.org.

Janet Santos Cobb is president of the nonprofit California Oak Foundation.

an infected area. Advisories were posted urging the public to do the same, and to wash animals' paws and hooves as well. The public was also asked not to take wood, plants, or parts of plants from infected areas, and, especially, not to take them to distant places not already known to have the disease. Moving infected ornamental plants may be even more likely to spread infestation.

As the search for infected trees went on, so did the scientific research into the nature

of the disease. In 2000 Jennifer Davidson, a postdoctoral fellow working with Rizzo, proved that the water-loving *Phytophthora* could be cultured from rainwater splash. She also found that rainwater splashes onto oak trunks at the height where cankers are usually seen, and that bleeding could be started by applying pathogen spores to the outside of a healthy tree. Researchers concluded that the disease could be transmitted in water vapor and rain.

Meanwhile, Rizzo and colleagues discovered suspicious leaf spots and cane dieback on native huckleberry plants at Muir Woods. Samples were taken and cultured, and the SOD pathogen was found. This discovery opened forests to intense new scrutiny. Subsequently, leaf spots indistinguishable from those caused by a number of other pathogens have been found to grow superabundant cultures of *P. ramorum*. We now know that at least 15 woody plants carry this infection, including bay laurel, madrone, manzanita, toyon, California coffeeberry, and honeysuckle, in addition to viburnum, rhododendrons, and four or more oak species. The infection can be lethal to madrone, but usually is not to the other non-oaks. More host plants will no doubt be identified as time goes on. Clearly, anything—such as birds, lizards, and small tree-dwelling mammals—or anyone moving any of these plants or parts of them around can spread the disease.

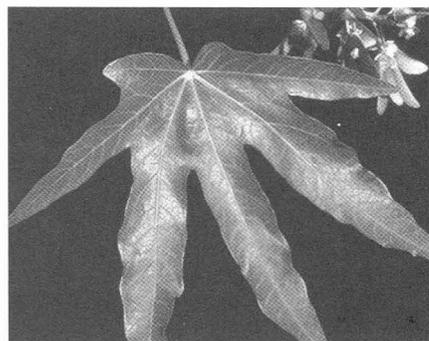
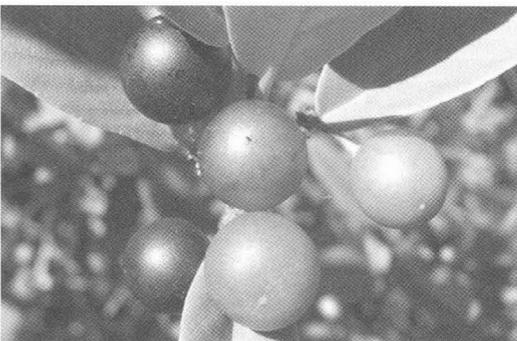
Infection with *P. ramorum* in oaks and understory associates and their soil has now been found in 10 California counties, along a 250-mile-long swath within 50 miles of the Pacific shore, from Big Sur to Mendocino. The affected area includes parts of Sonoma, Santa Cruz, Monterey, Napa, San Mateo, Santa Clara, Solano, and Alameda Counties. Most recently it was discovered in Mendocino County, near Boonville, by arborist Rob Gross.

The alarming news has continued. In August 2001 the U.S. Forest Service and

Left: California coffeeberry, *Rhamnus californica*

Center: Bigleaf maple, *Acer macrophyllum*

Right: California laurel (bay), *Umbellularia californica*



L-R: LYNN OVERTREE; BR. ALFRED BROUSSEAU, ST. MARY'S COLLEGE; TONY MOROSCO

Oregon Department of Forestry detected SOD in tanoaks in Curry County, Oregon, near the California border. Oregon is cutting and burning known hosts in an attempt to eradicate the pathogen. We know that oaks from Mexico to Canada, including those in California's Sierra foothills, are genetically susceptible, and pin oaks and red oaks on the East Coast tested positive in greenhouse inoculation trials. We don't know about oaks in Europe and Asia. Because susceptible oaks seem to be limited to the red and black oak groups—the white (valley) oaks in heavily infected areas in Marin County remain healthy—and most European oaks are white oaks, they will likely remain unaffected.

On a hopeful note, there is reason to believe that some oaks are resistant. Oak genes vary from one acorn to the next because oaks are wind-pollinated. In no affected area are all the trees dying, and some infected oaks are even recovering. From this we take heart that forests may regenerate naturally. It will take many more years of experience with this disease through different weather cycles to learn the outcome. Meanwhile, attempts to restore oak woodlands must be undertaken only with greatest caution, so as not to dilute populations that have genetic resistance.

What to Do?

WHAT CAN BE DONE about the awful fact that we are losing enormous numbers of our beloved oaks, many of them in the urban-forest interface near towns? Garbelotto has tested many chemicals as potential defenses against *P. ramorum*. Most of those used to eliminate other members of this family of plant pathogens have not been found to be effective. One or two show some promise but only when injected repeatedly into each plant. These are not registered for use as fungicides and thus are not legal to use.



BOTH PHOTOS: BR. ALFRED BROUSSEAU, ST. MARY'S COLLEGE

The California Oak Foundation has imported from Germany a product called GreenBox, described as a biologically safe compound that has been used to combat some 60 other *Phytophthora* strains around the world. Tests are being conducted under the supervision of Walter Mark of California State Polytechnic University, San Luis Obispo, in cooperation with Rizzo and Garbelotto. The foundation hopes it can be used to protect oaks near homes and other structures but sees no prospect of mass application to woodlands.

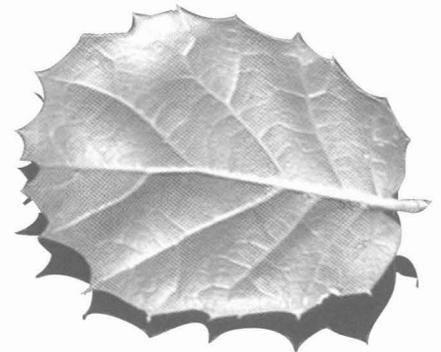
Švihra and others initially recommended using permethrin (ASTRO) against the beetles that were consistently seen at sites of infection and for a time this pesticide was advised for prevention of tree death and widely used. Once the real cause and mechanism of the problem became known, however, pathologists reasoned that it was not worth the cost or the environmental impacts. As yet, *Phytophthora* has not been isolated from the bodies of bark beetles, which apparently come to trees only when they are already severely weakened and then set about doing their usual work as biodegraders. Therefore the use of permethrins, toxic to many life forms, is now not recommended for treating SOD. Unfortunately, though, the practice of applying this poison has not been abandoned.

California's Response

SCIENTISTS TODAY agree that widespread treatment for SOD may never be available. The current approach to the epidemic emphasizes research to understand how the pathogen functions in the ecosystem, public education aimed at preventing human spread of the infection, safe removal of infected dead trees, monitoring, and possible reuse of the biomass.

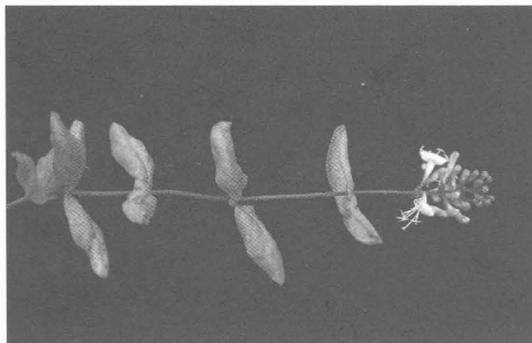
The California Oak Mortality Task Force's current focus is also on predicting risk, defining impacts, and planning for

Most of the photos in this story are from CalFlora (www.calflora.org), a community resource built by collaboration among people and institutions. This comprehensive database of plant distribution information for California was designed to provide ready access to data needed to identify critical issues in conservation of plant diversity, and to analyze consequences of land use and environmental change on distribution of native and exotic species. CalFlora welcomes new collaborators, data contributors, and volunteers.



Left: California rosebay/coast rhododendron, *Rhododendron macrophyllum*

Right: California honeysuckle, *Lonicera hispidula* var. *vacillans*



More Disquieting News

Phytophthora ramorum has been found in dying shoots of redwood trees in Big Sur and on the campus of the University of California, Berkeley. Researchers said in mid-January it is too soon to say much about the implications.

SOD. It is calling for further research to understand oak forests and woodlands and the ways by which the pathogen spreads. Without adequate knowledge, attempts to manage the problem could be futile or even counterproductive. Monitoring is also needed to understand the impact and distribution of *P. ramorum*. Regulations need to be adopted and implemented. Agreement has to be reached on how quarantines are to be enforced.

All this requires financial resources. So far, more than \$9 million has been made available to address the epidemic—over \$4 million from the U.S. Department of Agriculture (USDA), primarily for research; \$3.7 million from the State of California; and \$1 million from a private foundation. Of the State's money, \$1 million is going to infected counties to pay for the removal of trees that pose a threat to life or to property and public works.

At the initiative of Senator Barbara Boxer, \$400,000 for research has been included in the USDA appropriation bill for fiscal year 2002. She is seeking \$70 million more in federal funding to combat the disease.

Quarantines and Regulations

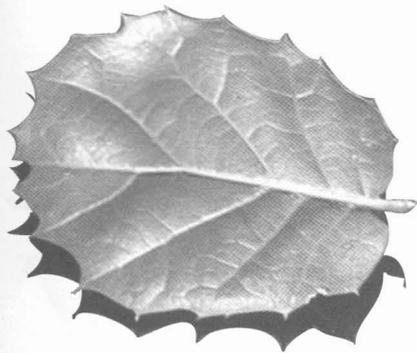
IN MAY 2001, the California Department of Food and Agriculture imposed a regulation to limit movement of infected woody materials. To protect their forests, Oregon, Canada, and South Korea have

imposed similar quarantines on woody materials from counties (including Curry County, Oregon) in which the disease has been found. In August 2000 and again in September 2001, the USDA Forest Service asked the USDA Animal and Plant Health Inspection Service to issue a regulation preventing interstate and international movement of *P. ramorum* via commodities.

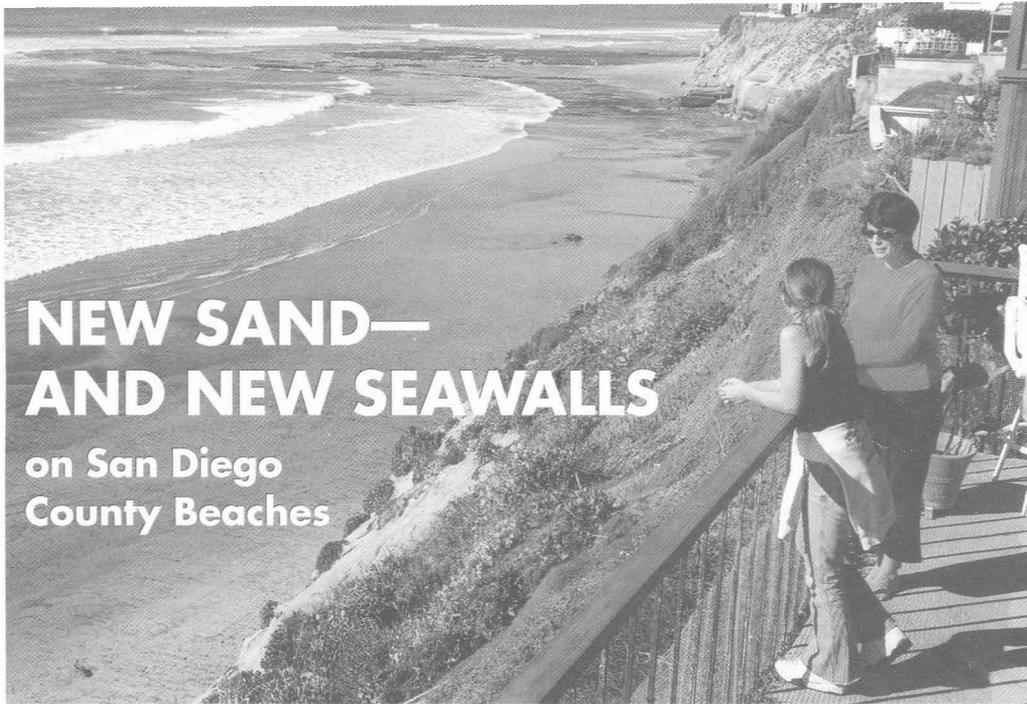
California's quarantine is difficult to enforce. County commissioners with enforcement responsibility are underfunded and understaffed for such a huge task. Nevertheless, most hard-hit industries, including nurseries, are being very cooperative to help quell the spread of this disease. All have a great deal at stake.

This is a story whose end will not be known for a long time. Learn how SOD looks, learn how to prevent its spread. Keep up with the latest news on the Task Force's web site, www.suddenoakdeath.org. We who love our coastal oaks and forests have a duty to keep informed, and to abide by quarantines and regulations. Work with others and let your voice be heard when it is needed to support efforts to limit the spread of Sudden Oak Death. ■

Elizabeth F. Cole is a member of the Oak Mortality Task Force Management Committee and Restoration Subcommittee. A retired academic dermatologist with lifelong agricultural and gardening experiences, she is active with the Bay Area Urban Forestry Council, California Native Plant Society, and Trees and Views Committee in Sausalito.



GLENN MCCREA



NEW SAND— AND NEW SEAWALLS

on San Diego
County Beaches

RASA GUSTAITIS

TOWARD THE END of last summer, strollers and surfers who for years walked gingerly across cobble on San Diego County beaches found a blanket of sand to cushion their steps. At a cost of \$17.5 million, mostly in federal funds, two million cubic yards of sand were dredged from the seafloor at six offshore sites, pumped ashore, and spread with bulldozers on 12 denuded beaches.

These beaches were once replenished naturally by sand that washed downriver or crumbled from seablufts. Since the middle of the past century, however, more and more of this resource has been held back by dams, debris basins, jetties, seawalls, and other sediment-blocking structures. In an area famous for its beaches, this loss has been keenly felt. Local communities therefore organized and, after some five years of passionate advocacy and hard work, succeeded in bringing in this new sand.

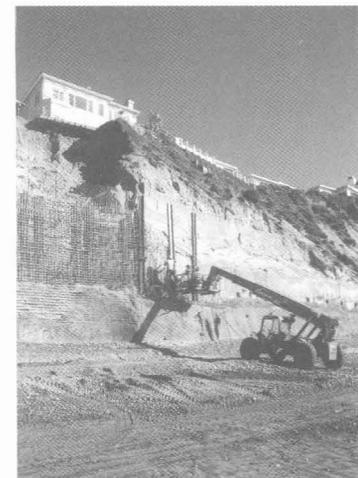
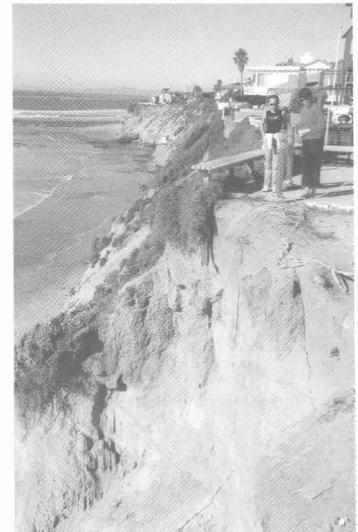
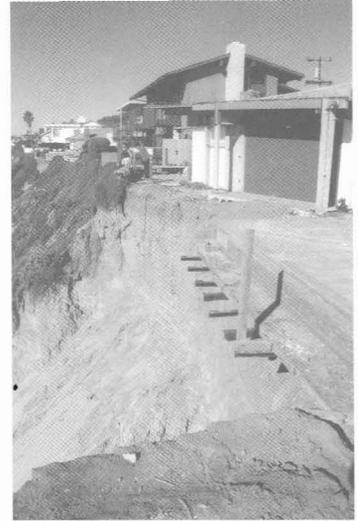
Even today, however—a mere six months later—a walk on some of those beaches could be disappointing, for much of that new sand is gone, washed away by winter storm waves. By early January, eight beaches that had received relatively large-grained sand were “holding up pretty well,” while the others, with finer-grained sand, had pretty much lost it, according to Steve Sachs, senior planner at the San Diego Association of Governments (SANDAG), which implemented the Regional Beach Sand Project. At Torrey Pines State Beach “it moved offshore fast,” said Robert Guza, professor of oceanogra-

phy at Scripps Institution of Oceanography, one of the project’s monitors. “It might or might not come back, and that may be hard to tell, for it could come back and spread out.”

Beaches generally lose sand to heavy winter waves, but they get some of it back during the summer, when wave action is gentler. If the nearshore slope at these beaches is steep, much of the new sand may accumulate deeper down, reducing the gradient of the beach slope and thus serving as protection against powerful waves.

“We stress that this was a pilot project,” said Steve Aceti, executive director of the California Coastal Coalition (CalCoast), a nonprofit advocacy group comprising 32 coastal cities, five counties, and various regional organizations, which has campaigned for this sand replenishment project. SANDAG hopes to spread another two million or so cubic yards on beaches in the next few years, and this project will provide guidance.

Artificial nourishment is a long-accepted practice in Florida, New Jersey, Hawaii, Spain, and other places with highly valued beaches. In California, some opportunistic projects have shown its value. The famous wide beaches of Santa Monica, for example, are not natural: they were built in 1948 with 14.5 million cubic yards of sand piped as slurry from the Hyperion Dunes during the construction of the Hyperion sewage treatment plant. SANDAG’s project, however, is the first multi-jurisdictional regional effort along these lines.



PHOTOS THIS PAGE BY JOLENE THOMPSON

Top left: Lynn Santina with visitor looking upcoast

Top right, middle, and top p. 12: Views of bluff failure site

Bottom, also bottom p. 12: Seawall under construction

Middle p. 12: Beach just upcoast

PAUL SANTINA



JOLENE THOMPSON



PAUL SANTINA



In California, 70 to 90 percent of beach sand used to be brought to beaches by rivers and streams. A smaller amount, varying according to topography, came down from eroding bluffs (about 12 percent along the coast between Oceanside and La Jolla, according to a recent study funded by the Coastal Conservancy). With 480 dams now blocking river flows and more and more bluffs reinforced by seawalls, many California beaches are sand-starved and vulnerable to storm waves.

Support for this form of beach management has grown among coastal scientists, beach managers, coastal advocacy groups, and legislators. Advocates believe it may be the cheapest and most environmentally sound approach to the chronic problem of beach erosion and bluff collapse, forestalling the construction of seawalls that often degrade beaches more and contribute to further erosion.

Some critics, in contrast, contend that spending millions to pour sand onto beaches is tantamount to pouring tax money into the ocean.

In fact, the \$17 million price of the SANDAG project is a pittance, considering the value of beaches—not to mention the price of some blufftop houses in San Diego County, one of which was recently on the market for more than \$20 million, observed Robert Wiegel, professor emeritus of civil engineering at the University of California, Berkeley, at the annual conference of the California Shore and Beach Preservation Association and CalCoast, held in San Diego November 8–10, 2001.

The economic benefits are obvious to blufftop homeowners, among them Paul and Lynn Santina, who purchased a home in Solana Beach about a year ago for nearly \$1 million. From 80 feet above the ocean the views are fabulous. One day last May, however, part of their property fell away when a bluff gave way as a neighbor was trying to reinforce it by driving steel pilings 40 feet into it. A concrete slab, part of a patio extension the neighbor was building, slid down toward the shore, taking with it a workman who had been standing on it. (A ledge broke the slide and he survived without serious injury.) The collapse also took part of the Santinas' next-door neighbor's yard, so that her bedroom had to be dismantled.

Now the three neighbors are building a 100-foot long, 35-foot high seawall to shore up the base of the bluff, sharing the cost, estimated at \$400,000. They intend to regain the blufftop area they lost by rebuilding the bluff face and reinforcing it. The neighbor who lost her bedroom, a woman in her 80s, would have it rebuilt where it was. So far, however, only the seawall has Coastal Commission approval, under an emergency permit.

Paul Santina is campaigning for one long seawall along the entire stretch of this eroding coast. He also favors beach nourishment.

Will the entire north San Diego County shoreline be armored and seawalled?

Oceanographer Reinhard Flick, of Scripps and the California Department of Boating and Waterways, put that question to the shore and beach conference on the last day. People were reluctant to say yes, but those who said "no" knew the odds were against them. Don Nierlich of Coastwalk inquired: "And are we going to have plastic pelicans too?"

Advocates look to sand nourishment as an alternative to seawalls. In addition, offshore structures that mimic natural headlands have been proposed to help keep sand in place (see *Coast & Ocean*, Autumn 1998). Studies are under way to determine whether some obsolete dams can be removed, restoring some of the natural sand supply.

Taking a long view, the Coastal Conservancy, Coastal Commission, and the Department of Boating and Waterways have prepared a proposal for a California Coastal Sediment Management Master Plan that encompasses watersheds and nearshore waters and comprehensively identifies problems and opportunities related to flood control, water supply and quality, habitats, bluff erosion, navigational needs, and shoreline change. This plan would evaluate needs on a regional basis and develop approaches that generate the greatest environmental and economic benefits. This year, for the first time "in recent memory," according to Aceti, the governor's proposed budget includes funds for beach restoration, \$6.5 million. More than half would go to constructing a project in Imperial Beach, the rest to studies.

Meanwhile, SANDAG is searching for ways to fund the \$15 million second phase of its Regional Sand Project. It is looking at a possible hotel and property transfer tax, and at extending and broadening an existing transportation tax or sales tax.

Sand that's right for beaches isn't much easier to find than money. Before deciding to dredge from offshore, SANDAG tried to use sand that the Navy was dredging from San Diego Harbor. It turned out to have live ammunition (see *Coast & Ocean*, Summer 1998). The City of Oceanside also looked into a "trash for sand" proposal: a waste management company that hauls coastal garbage to an Arizona landfill was to return with clean desert sand. Logistical problems sank that idea. At the shore and beach conference, Robert Wiegel suggested that affordable sand might be obtainable in China. It's an idea whose time might come. ■

Mike Murray's Highly Unusual Practice

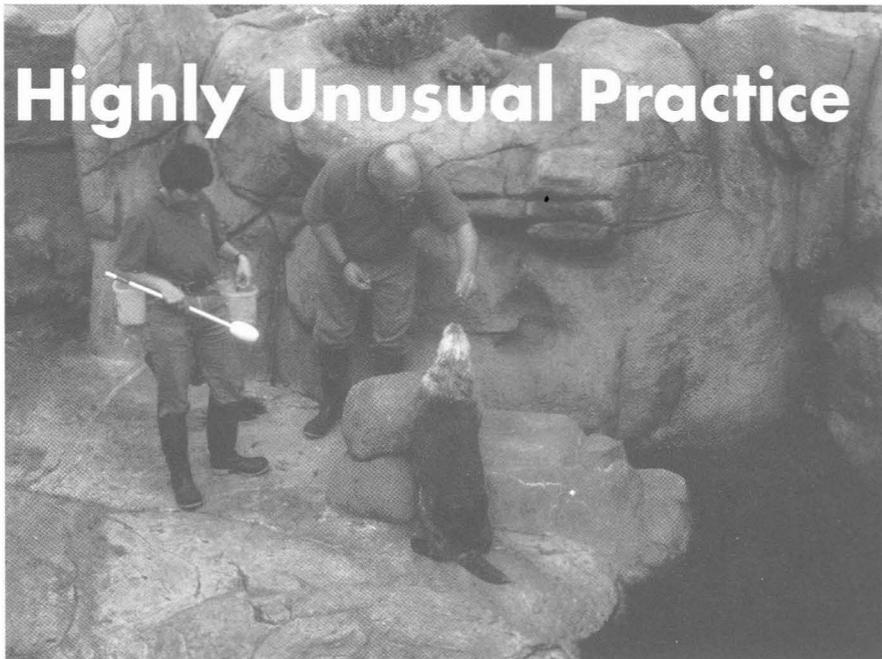
ANNE CANRIGHT

HOW DID A BOY from the rolling hills of northwestern Indiana wind up mano a mano with Roscoe the Sea Otter?

Dr. Mike Murray is that "boy," some forty years later—a man utterly content with his job. Murray is the main medical man at the Monterey Bay Aquarium, tending to shorebirds, reptiles, sea otters, and other wild local critters. In addition, he maintains a private practice specializing in exotics, with boa constrictors and macaws and about-to-hibernate tortoises as his typical patients.

He started his aquarium career in 1988, called in because of his experience with out-of-the-ordinary animals. "I was brought on primarily to work with the shorebirds. They were having some foot and leg problems, which is the bane of shorebird management," he said. "After a while, they asked me to stay on. I had an interest in fish and reptiles, and then they started expanding the collection; we started having some sea turtles, so again, I was asked to participate in that. I got to know some of the aquarists relatively well and they started asking me fish questions, so I got involved in that. It's basically just been an add-on sort of practice."

He relishes the intellectual challenges he faces. Unlike a vet who works with dogs or horses, who can draw on a body of research



PHOTOS THIS PAGE: RANDY WILDER, MONTEREY BAY AQUARIUM

and experience, the aquarium vet must rely on his wits. What do you do with an octopus, for example, not to mention a fish-eating anemone? Or even the aquarium's star attractions, the sea otters. "They're very difficult creatures to work with because the baseline medical knowledge is very limited, so you extrapolate. I was talking to a friend the other day about sea otter problems, and we were talking wallabies—trying to apply that information in different directions. We just don't know as much as we'd like to."

Mike Murray and senior sea otter aquarist Michelle Jeffries conduct veterinary exams in the sea otter exhibit.

An Exotic Life

MURRAY WAS INTRODUCED to the Monterey Bay area through a stint with the army from 1977–82. They paid for his veterinary schooling at Purdue University,

and he obliged them with six years of service. Veterinarians in the army? Well, many of them work as food inspectors. "My theory is that veterinarians used to be the ones who would inspect livestock at slaughter—cows, pigs, chickens. Just making sure that they're healthy." This was an application of his training in pathology that he had not planned for, but he also had an opportunity to do wildlife work, so he stayed on in the



army for two more years beyond the four he owed.

"I worked with plague at Fort Ord—plague surveillance, doing flea counts in ground squirrel burrows, and trapping predators and taking blood samples, looking for antibodies to the plague organism. I got to work with tule elk down at Fort Hunter Liggett, and feral pigs and goats out on San Clemente Island off San Diego. So I got to do a lot of neat things that I really enjoyed. Then the army said that it was time for me to go be a soldier, and I said, 'No, I paid my debt, I don't think I'll stay. Thank you, thank you very much.'"

He returned to the Monterey Peninsula and joined the practice of a friend, and six years later launched his own practice, specializing in birds and exotics. Soon he linked up with the Wildlife Center at the Monterey County SPCA, and that led to work with the Ventana Wilderness Society and its efforts to reintroduce the bald eagle and California condor to the central coast. Ultimately, all that experience brought him to the aquarium.

Today, Murray is a very busy man, what with a full-time practice, part-time work at a highly visible public aquarium, and volunteer work with delicate endangered animals, not to mention teaching activities and hours of extracurricular reading of obscure journals that might just shed some light on the physiology of the obscure animals he works with.

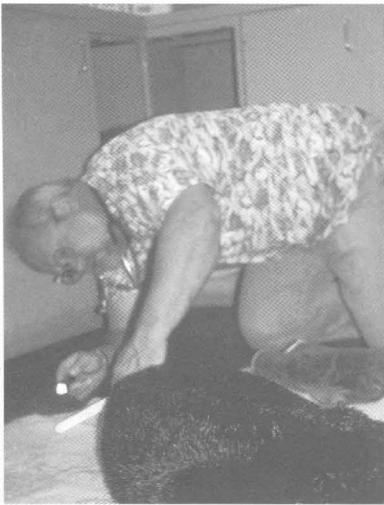
"When I first started at the aquarium I was here only about three to four hours a week," he says. "Now I'm here . . . well, my contract says I'm here 18 hours. The reality is a little different." Although he does have regular days—Wednesday and Thursday—Murray seems to have a reason to check in at the aquarium almost every day of the week. "Monday I came over here to take some blood from some penguins; we had some concerns about them coughing. Tuesday I had a colleague who's a veterinary dermatologist come down to look at Hailey [one of the exhibit sea otters] with me—the skin problem on her feet. Yesterday was a regular day, today's a regular day. Tomorrow I'll probably be back to look at an otter we did surgery on yesterday [a member of the aquarium's SORAC—Sea Otter Research and Conservation—program]."

His aquarium days begins at about 6:30 or 7. "The first thing I do is go through my emails as best I can. And then I walk around the facility and do rounds, and look

in every tank." What does he look for? "Anything that doesn't look right, that doesn't look normal—anything new, anything different. I don't like too much to look at the otters, because when someone approaches first thing in the morning, they expect to be fed, and I don't want to get them all wound up." If something doesn't look right, he writes it down in a composition book that he carries with him, so he can talk about it later with the appropriate aquarist. "I usually have a pile of laboratory data that I have to enter into our database. Then at around 8:30 I go back out onto the floor and again do a set of rounds and talk to the people I need to."

In all this, he pays particular attention to the aviary birds and the Splash Zone penguins. "They're much higher-maintenance critters. It may be that the birds have such a high metabolic rate that things manifest very, very quickly, and when they happen you've got to be right on top of it." As for the SORAC otters, he generally checks them on the monitor, doing a hands-on only if necessary. He has less involvement with the fish, "because they're Monterey Bay fish to start with and they're in Monterey Bay water. They seem to do pretty well." The invertebrates don't require much of his time either. "Occasionally I'll get some questions or help the aquarists process samples, but generally I don't have much to do with them. In part because we don't understand a lot. The majority of problems associated with them really are husbandry-related issues—water quality, water circulation, senescence-type things." As Mike was talking in the semishade of a bench on the aquarium deck, a man carrying a small child passed by. The child dropped a shoe, and Mike got up to retrieve it, saying, "Whoa, I think you lost something!" Wet animals, clearly, aren't the only things he pays attention to.

He sat back down, collected his thoughts, and continued: "At some point I have to touch bases with my bosses, and I have several—just to tell them what I'm seeing, what I'm not seeing, make sure there are or are not things I need to be aware of. And then we'll try and schedule medical things that need to be done. This morning it was take blood samples from all the penguins, and then try and anesthetize and do some surgery on one of the sharks. Yesterday it was take blood samples from two of the SORAC animals and put in a transmitter and try and sew up a wound on



Above: Murray treats an otter in the aquarium's veterinary surgical theater.

another otter. So I've got some very specific times I try and get all my medical procedures done."

Much of the work is a team effort, he said, and in that is "very different from what I'm used to in my regular day clinic, where you come to me, I tell you what's wrong, I tell you what to do, you go home, and hopefully you do it." At the aquarium there is much give and take. "The aquarists talk to me and I talk to them about what we see, what's going on, and we go through our options about what the potential diagnosis may be, what the implications are, how we can diagnose it. And okay, so we diagnose it, can we do anything about it, and do we *need* to do anything about it? So I can make some recommendations to them, and then it becomes their decision: do we want to follow those recommendations, or do we want to regroup and come up with another plan? Your professional ego has to take a backseat to what's best for the animal. Every time you grab a fish and pull him out of the water, you can kill him. So you have to decide, is the risk of apprehending this animal, pulling him out of the water, making him hold his breath while you do things, is it worth the potential that you can gain?"

Otterland

THE MONTEREY BAY AQUARIUM'S three biggest stars have arguably been the sea otters Roscoe, Goldie, and Hailey. Each

ROSCOE, HAILEY, AND MAE

HE WAS A TRUE AMBASSADOR, delighting visitors, educating people about his threatened species, and helping the aquarium spread its message of ocean conservation. On November 14, Roscoe the sea otter, 15 years of age, was euthanized after a brief illness.

He showed signs of distress only the day before, hauling out onto the deck and acting listless. When a male aquarist entered the exhibit and Roscoe—who

was known to get quite territorial with male humans—did little more than glance his way, his caretakers knew something was very wrong. Mike Murray was called in immediately.

Murray removed Roscoe from the exhibit, performed blood tests, and began administering medications. "He really rallied back," Murray said, "but he still wasn't right."

Murray and several caregivers stayed with Roscoe through the night. Further tests found blood in Roscoe's belly, a sign of internal bleed-

ing. After consulting with other experts, Murray decided to operate to try to stop the bleeding. Ninety minutes later, still unsure just what was wrong, Murray gathered "all the humans who were important to him"—a dozen or so people—and presented them with several options. "It was basically a unanimous decision," he said. Michele Jeffries, senior sea otter aquarist, told the group, "It's time to let him go," and everybody agreed it was the right thing to do."

The next day, signs were put up at the two-story otter exhibit notifying the public of his demise. Visitors stopped to write tributes in a memory book. Friday evening, the staff gathered for a wake, told Roscoe stories and drank a toast to him. There's so much we don't know about otters. But Roscoe taught us a great deal.

Meanwhile, Hailey's health had been declining and, about two months after Roscoe, she too had to be euthanized. In January, eight-month-old Mae was introduced to Goldie. She has transformed the exhibit.



KEN BACH, MONTEREY BAY AQUARIUM



RANDY WILDER, MONTEREY BAY AQUARIUM

Above: Roscoe

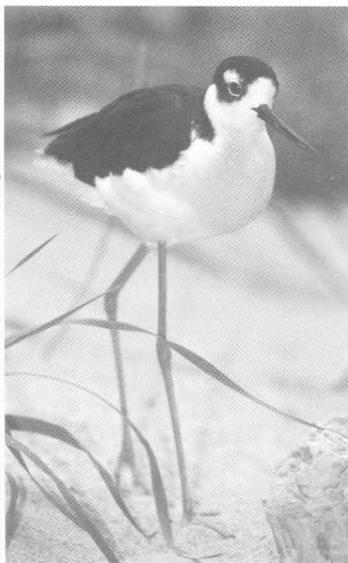
Left: Murray and aquarist Andy Case treat a young green sea turtle.

Birds in the aquarium aviary:

Top: Phalarope

Middle: Black-necked stilt

Bottom: Unidentified shorebird



PHOTOS THIS PAGE RICK BROWNE, MONTEREY BAY AQUARIUM



arrived as an orphaned pup—Roscoe in 1986, the girls in 1984. These animals are getting on, and with age, the veterinary challenges have increased. (Indeed, Roscoe died unexpectedly on November 14 at age 15.)

When Murray was first introduced to the sea otters, he was appropriately intimidated. “You’re working with three animals that almost every school kid in Monterey County knows, by name, and there’s a lot we didn’t know about them. But Dr. Tom Williams, who was working with them when I first came on, was very good at mentoring me along. And the sea otter team [of aquarists] was exceptionally patient in helping me catch up with the literature and teaching me what was normal for these animals—and that’s one of the hardest things. So once I overcame my shock and started getting into it, it wasn’t really too bad.

“They’re really not that different from a lot of other animals: they have to take oxygen from the environment, get it to their cells, get bad stuff from their cells, and get it back into the environment; they have to make babies, they have to raise babies. So the basic physiology is very similar to other species. And I’ve worked with enough mink and ferrets and other nontraditional animals. I just had to get behind the idea that everybody knows these animals, so if you screw up it’s really bad. But that’s faced by every zoo vet. You know, everybody knows Gordo the gorilla, and if you kill Gordo when you’re trying to remove a tooth, it’s not a good thing.”

Murray was introduced to the otters slowly and carefully. They are wild animals, after all, and can get anxious when someone new comes along. “Roscoe has politely asked me to leave the exhibit before. And if Roscoe comes out of the water when he’s not asked to, you leave. Because he’s not just coming to sniff your shoes; he’s a little concerned about something, and he’s a big animal.”

With the help of the aquarists, however, he made the transition. “Now, when I go out on exhibit, they say, ‘Big deal, it’s the bald guy again, who cares?’ which is really good, because if a stranger goes out and looks at a wild animal, they get a little excited, and the adrenalin that’s released causes them to act very normal—even when they’re ill. It’s a little like when you go to the doctor’s office when you’ve been feeling sick, as soon as you sit down in that chair in the waiting room you say, ‘Oh, I

feel pretty good! I can go home now!’ So they go through that catecholamine response. Well, now that they’re used to me, I can go out there and they’re going to behave the way they normally would.”

When he’s on exhibit, what does he look for in the otters? “There are some baseline things, overall health and overall appearance, activity, how they’re moving around, how they’re eating. A lot of it’s simply observing. There are things I can do tactilely with them, but there you’re really limited. If you cause them discomfort, they’ll do the mustelid [weasel family] thing, which is, first, turn around and let you know that that was not cool—they’ll flip around and growl, take away the part you were messing with; and then often the mustelid twist to it is, ‘Okay, I got your attention, now I’m going to come out and kick your butt.’ So they go one step further, and you just back way up.

“Most of the really hard diagnostic stuff is done with them under chemical sedatives. You can’t do a physical on them the way you do on a dog or a cat, where you can hold on to the head, lift up the gum, look into the eyes and the ears, look at the back of the throat. If you’re going to do a physical exam, they have to be out.

“Hailey’s been cold-cocked probably eight or nine times in the past two years, just to do really good exams, to do biopsies on her skin, to clean her teeth, take x-rays, take blood samples. She has skin problems, and she’s got very bad arthritis in her hips as well. You can’t put her in the squeeze box [animal carrier] the way they used to, because you’d have to pull her hips and pin them, and it must hurt like hell. So we decided that it wasn’t fair to her, that we had to come up with another way.”

Goldie has a head tremor that initially caused some concern, but it doesn’t seem to be causing her discomfort so remains untreated. “There are drugs that they use in humans,” says Murray, “but again, in my role I can present these drugs and I can say that in humans, these are the side effects. We have no idea what they’re going to be in a sea otter. Is the risk worth it? At this point, because she’s doing so well, the answer has been, we’ll keep them in mind.”

Several years ago Goldie’s condition was reported in the newspapers, and Murray got a number of phone calls. “The one that was most interesting was a lady who called me from somewhere in the 510 area code, and she had an essential tremor. And we

had an extensive discussion about what it's like, and does it get worse, does it get better, how they're treating it. I asked her, 'When your head is tremoring like that, does your world bob up and down?' She said, 'If I'm really stressed, my head tremor's worse and my head bounces a lot, then the world moves. But if it's just my normal one, the brain keeps up and levels things out.' So I always look at Goldie and wonder, 'Hey what's going on there? Are you seeing okay?' but you can't ask that question of Goldie."

Both Goldie and Hailey have some degree of arthritis, which Murray treats with glucosamine and chondroitin sulfate and with Cosaquin, a product in veterinary medicine of bovine, not shark origin, so it was environmentally appropriate. "I think it's made a difference. It's difficult to give a sea otter anything orally. They have such a keen sense of smell and taste, they reject stuff. We make up a little ice cube that has food material plus the medication; they get their vitamins the same way. Sometimes they're so cranky that they just drop it out of hand and look at you, like 'See? Make me!'"

Octopuses, Sharks, and More

AT THE AQUARIUM, Murray works with animals he never sees in his private practice. Octopuses, for example. "We've tried doing some surgeries on lesions that they get on the back of the mantle. Octopuses are weird because you don't anesthetize them the way you do a regular animal, you use magnesium sulfate to depolarize them. Basically it blocks the movement of impulses through their nerves. And they turn into this blob of jello. Literally, I was chasing this animal—it was alive, but it wasn't moving; but it was just so amorphous that we were trying to suture it and it was just oozing all over the table. The attempt failed miserably, because I think a lot of those lesions are senescence related. Octopuses don't live very long at all."

Some animals are so poorly understood that, despite aquarists' best efforts, they don't survive. Several elegant blue sharks—pelagic elasmobranchs—for example, briefly graced the million-gallon Outer Bay Waters exhibit of the aquarium. They died after a short time in captivity. Murray has a theory on that. "Out in the open ocean, if an animal wants to sleep, he can just keep going for-



MONTEREY BAY AQUARIUM

Rockfish in the aquarium's Monterey Bay Habitats gallery

ward and sink—he sinks a lo-o-o-ong way and rests. And then he can swim again and come back up in the water column if he wants to. But in a small tank he can't rest; he's got to continue to burn energy, either to go up in the water column or to turn. So he was just burning too much energy. Even though the shark would eat, we just couldn't keep up. So that's one that I don't know if they're ever going to go back to, but I would find it hard to believe they would do well. Which is unfortunate, because it would be nice for the public to appreciate the beauty of a blue shark."

Inverts, cartilaginous fish, marine mammals, birds, bony fish—exotic animals all. And what is Murray's favorite species at the aquarium? "Well, you know, actually, I think one of the ones that I enjoy watching the most are the little kids. They're such a hoot. Particularly when they see something really, really neat. Because I remember that excitement that I used to get when I was a kid. So that's what I like to see. As far as specific species here, I don't really have one that I like the best. I like the best the ones that I'm working on at the time, to me they're the most special ones."

Yes, Murray is definitely a man who's happy with his job: "It's pretty amazing," he said. "Working at a place like this is what I would do for a hobby. But I get to do it for real." ■

Ann Canright can be found some Wednesdays narrating the afternoon sea otter feeding and training session at the Monterey Bay Aquarium.

Choice between Cathedral or Greenway

How to Crown Oakland's Jewel?

BILL O'BRIEN

OAKLANDERS LOVE TO WAX rhapsodic about Lake Merritt. It's the heart of the city, they'll tell you—the country's first wild bird refuge, as well as a busy urban gathering place enjoyed by joggers, boaters, bicyclists, and park bench sitters. Out on the water you can view nearly a hundred avian species—drawn here, in part, by regular handouts—while on land you can meet people from the dozens of cultures and ethnic groups that make Oakland a proudly diverse metropolis.

If you looked at an early map of Oakland, you wouldn't see "Lake Merritt"; instead there would be a marsh known as San Antonio Slough. In 1869 a dam was built that divided this slough from the bay (except for a narrow channel), protecting the shoreline from seasonal flooding. The City began acquiring land around the lake in the 1890s, gradually turning the area into Lakeside Park.

Soon a bandstand was built, with regular concerts featured, and people rented boats by the hour (much as they do today) or took rides through the park in horse-drawn carriages. In more recent years, the annual Festival of the Lake attracted what was arguably the most diverse crowd seen at any Bay Area festival, with as many as 100,000 people of all ages gathering to enjoy a wide variety of music, art, and other entertainment.

It's no exaggeration to say that Lake Merritt is to Oakland what Central Park is to New York or Golden Gate Park is to San Francisco, and what the Los Angeles River is becoming to that city's people. Lake Merritt's southern shoreline, however, has long been a problem. While greenery and a trail surround the rest of the lake, there only a narrow, dirty strip of sand runs along the water. The walking trail is interrupted. A sidewalk runs across the dam, flanked on one side by a dozen lanes of fast moving traffic. Just across this "mini freeway" are the historic Kaiser Convention Center, the Oakland Museum, and the Lake Merritt Channel, which connects the lake to the Oakland Estuary. To get to these, however, you have to negotiate a dirty, wet, malodorous tunnel under the 12-lane roadway.

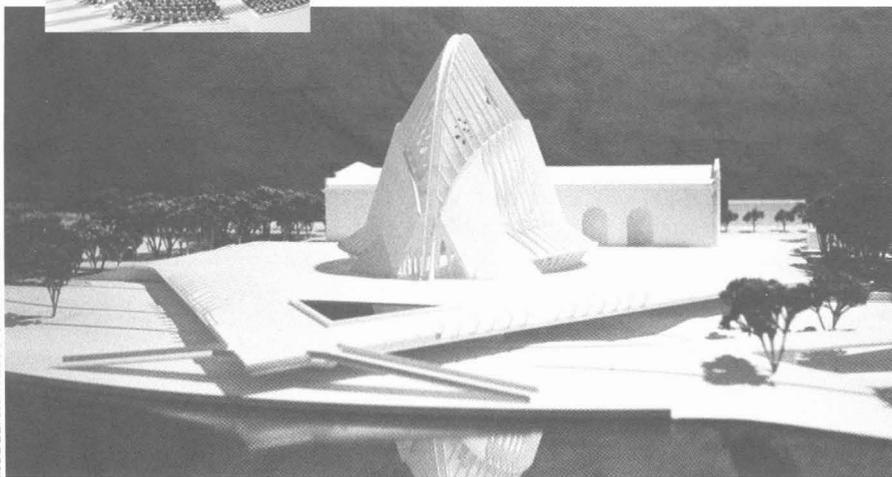
The City is now looking at two competing proposals to improve that section of the lake's edge. The first, by the Roman Catholic Church, calls for a glass and steel cathedral overlooking the water. The second, by a group of local activists, would reduce the width of the roadway and increase the amount of greenery and sand at the lake's edge. These are two vastly different choices. Either would have a major effect on the future of this treasured public park.

Last spring, the Oakland Diocese of the Roman Catholic Church came to the City with a proposal to construct a replacement for the cathedral that had stood at San Pablo Avenue and 21st Street but was torn down after being heavily damaged in the Loma Prieta earthquake in 1989. The church's architect, Santiago Calatrava of Zurich, suggested building on the parking lot of the City-owned Kaiser Convention Center, which offers a magnificent view of the lake. The 170-foot-tall structure would be surrounded by a three-acre grand plaza that would span the road and reach all the way to the water's edge. City officials responded favorably to this proposal. The church had already raised \$58 million toward the \$80 million project.

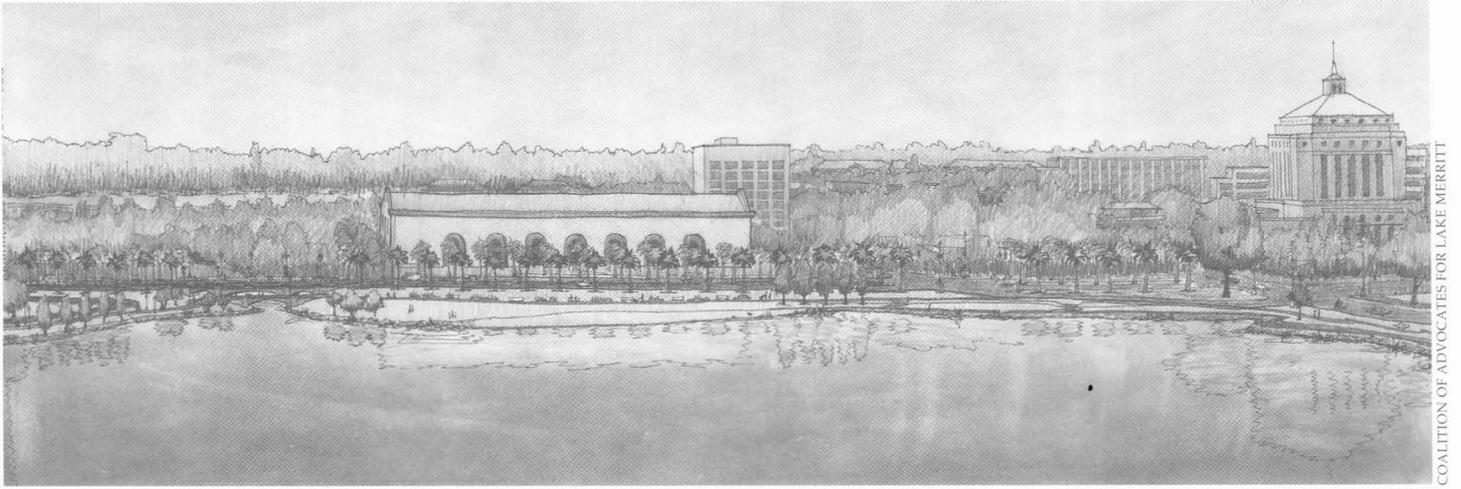
The Roman Catholic Church has proposed this cathedral, on a raised plaza.



DIOCESE OF OAKLAND



MODEL: SANTIAGO CALATRAVA



COALITION OF ADVOCATES FOR LAKE MERRITT

A group of local residents became alarmed. They had recently fought off two attempts by the City to sell public land near the lake to private developers, and saw this as yet another threat to the park. They formed the Coalition of Advocates for Lake Merritt (CALM) and drew up an alternative proposal that would increase the amount of green space next to the lake by reconfiguring the roadway and allow for better pedestrian access from the lake to the convention center, museum, and channel. They suggested that a bond act be put before the city's voters to help fund this project, which they estimated might cost up to \$60 million, and argued that federal and state funds might also be found.

Both sides have actively lobbied the mayor's office, city council members, and staff. At the turn of the year, the City was planning to convene a committee of architects, landscape architects, and planners to examine the proposals.

The controversy is taking place at the same time that the City is starting to draw up a \$500,000 master plan covering Lakeside Park and nearby public spaces. According to Kerry Jo Ricketts-Ferris, project manager for the master plan of the City's Life Enrichment Agency, any decision the City Council makes on the cathedral or CALM proposals will take precedence over the master plan.

Advocates of the cathedral and the green space proposals argue that their plans will create valuable public space and connect Lakeside Park to the estuary. "(The cathedral plaza) is going to be really high quality publicly accessible open space," says Norm Tuttle, attorney for the Diocese. The new cathedral, which would serve parishioners from Alameda and Contra Costa Counties, would become a signature building for the city, he contends. The plaza would be open to the public, and the cathedral building

would be available for concerts, lectures, and other nonreligious events.

CALM member James Vann, an architect who helped design his group's proposal, said his team, made up of volunteers, wants to complete the greenbelt and walking trail around the lake. The CALM design calls for pedestrian-activated traffic lights to allow people to cross the roadway more easily and get from the lakeshore to the Oakland Museum, the Convention Center, and to parklands along the channel. "We wanted to reunite those facilities," which the road has cut off from the lake, he said.

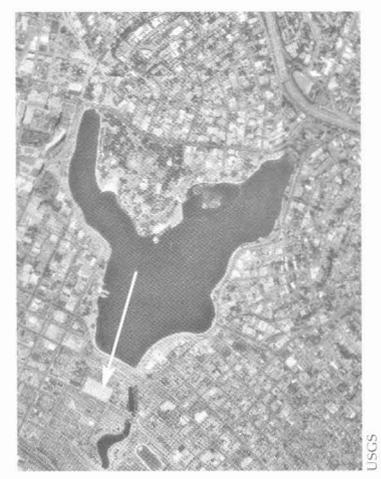
CALM claims that the land the church wants was bought by the City as part of a 1907 bond measure and that it would be illegal to sell it without holding another election. This is contested in a report by the city attorney's office, which states that it is "unclear" whether the bond money was actually used to buy the land at the lake's southern shore, and that even if it was, the bonds were paid off long ago. "Once paid, bond imposed restrictions are released," according to this report. CALM disputes those contentions, and the matter could well wind up court. The real issue extends beyond the legal arguments, however. Oaklanders care passionately about their lake and surrounding park, and have vigorously fought any and all perceived threats.

So far, there has been just one public meeting on the Diocese and CALM proposals, but the matter will have to go through extensive review by the Planning Commission and the City Council, both of which will hold public hearings before making any decisions. Which plan the City chooses—if it accepts either one—will dramatically alter the character of Lake Merritt. ■

Bill O'Brien, a freelancer who lives in Oakland, reports frequently on urban and environmental issues.

A local residents' group seeks to complete the greenway and trail around the lake. The only gap is at the site proposed for the cathedral.

The contested lakeshore site is in front of the Kaiser Convention Center, the pale rectangle at lower left.



USGS

Seaweed Adventures

IDA GEARY

Winter waves scour the beaches, taking away sand and exposing what's below. They also toss lots of stuff onto the shore, including ocean plant life. For beach walkers whose curiosity is aroused by seaweeds they find, here's some guidance from Ida Geary, who taught plant identification for nine years at the beach near Crissy Field in San Francisco.

DURING THE MID-1970s and early 1980s, when I taught California native plants for San Francisco Community College near Fort Point and Crissy Field, my students and I found about 70 of the 80 or more species of seaweeds known to grow nearby. We even found two species not previously recorded in San Francisco Bay, thus adding our little footnote to science.

In our outdoor classroom, the Coast Guard piers, some old storm-drain pipes, and a 1930s seaplane landing pier served as anchorage for both flora and fauna. The intertidal zone is narrow, and things grow where they can. Our success was greatest at very low tides, but even when high tide was going out we often found a great harvest of interesting specimens at the driftline.

The most common seaweeds visible without a microscope are divided into three large categories—green, brown, and red. Generally, green marine algae (*Chlorophyta*) look green, but brown (*Phaeophyta*) and red (*Rhodophyta*) algae can be confusing in the field, as the red often appear brown or olive green.

Algae are the oldest known plant form—

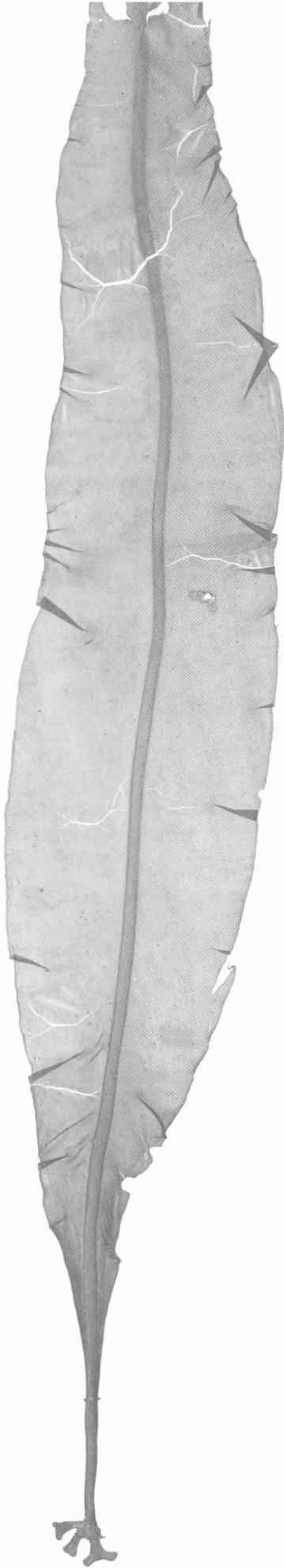
phycologists estimate they've been around for one to three billion years—and green algae are probably the ancestors of the more recent land plants. Of some 18,000 species of algae found worldwide, the green number about 5,000 and grow mostly in fresh water; the brown, the largest of algae, mainly grow in salt water and colder waters, and number about 1,000; and the red algae, mostly marine, number about 2,500.

In general, green algae such as the well-known sea lettuce (*Ulva*) grow near the high-tide line, where they are exposed most of the time; brown algae, commonly called kelps, grow mostly in the lower-middle zone, where they are under water more than half the time; and red algae are found submerged in the lower zone and just offshore; they grow in deeper waters and absorb a different part of the light spectrum.

Like land plants, seaweeds contain the green pigment chlorophyll, and make their own food through photosynthesis. Unlike most land plants, however, they do not have flowers, seeds, roots, stems, or leaves. The structure of a marine alga consists of a branched or disc-shaped holdfast that can anchor the plant to a rock, pier, piling, boat, shell, another marine alga, or even, as in one reported case, the fur of a sick harbor seal; a stemlike stipe, which may be long, short, or nonexistent; and flattened fronds called blades. Together, the holdfast, stipe, and blades are called the thallus. This structure, supported as it is by water, is highly flexible.

The holdfast of a brown seaweed such as giant kelp may look like a root, but it does not conduct water upward by means of specialized tissues as do the roots of land plants. Instead it absorbs the surrounding nutrient-rich water through all parts of the thallus. Giant kelps have sieve tubes—primitive conducting tissues in the form of elongated cells linked end-to-end—which serve as channels of transport.

Most seaweeds reproduce by means of spores, alternating generations much like fungi, mosses, and ferns, which also lack



on San Francisco Bay

flowers and seeds. A few of the brown algae, like the rockweeds *Fucus*, *Pelvetia*, and *Pelvetiopsis*, reproduce by means of male and female sex cells that escape from the tips of their blades and are then brought together by a strong sperm attractant produced by the female sex cells. Some brown algae also reproduce vegetatively: new plants grow from pieces broken off the parent plant.

Like land plants, seaweeds can be annual or perennial, though the majority, especially the smaller ones, are annuals. Seaweeds are also seasonal, becoming more plentiful in spring and summer. In the fall, annuals separate from their moorings and wash up on shore, so that is the best time for seaweed collecting. But any season has its own opportunities for observation.

The salinity and temperature of the bay at Fort Point are about the same as in the ocean, but we found ocean-growing algae such as *Postelsia* and *Cystoseira*—brown alga species which apparently need turbulence and the accompanying higher oxygenation to thrive—only occasionally in drift piles.

Most marine algae of the California coast do not have common names, because not many people know them. In countries such as Japan and Hawaii, where seaweeds are commonly used as food, many have common names. *Porphyra* species are called laver in Europe, where they are eaten in breads and soups, and *asakusa-nori* in Japan. In Japan, too, a species of the brown alga *Laminaria* is eaten under the name *kombu*, and the red *Gracilaria* is known as *ogo*. Sixty or 70 species of seaweeds are used for food in Hawaii, where *Gracilaria* is called *manauea* or chop-chop, because it is chopped up before being added to other foods.

On the West Coast of the United States foragers collect and eat *Ulva* and *Porphyra* species, and sometimes make a pickle of the long stipes of bull-whip kelp (*Nereocystis*), which are cut into rounds. West Coast Indian tribes are known to have eaten kelp dried and flaked like chipped beef, and *Porphyra* species baked or chewed raw. Practi-

cally all marine algae are edible—although some are tastier than others—except perhaps for species of *Desmarestia* (acid kelp), a brown alga containing sulphuric acid, and a few others. Seaweed for eating should be collected at low tide where the water is not polluted.

Ninety percent of the marine flora of the California coast is different from that of the East Coast. Algae of the northeast coast of the United States are more like those of the west coast of Europe, with which it forms an algal floristic province; and the marine algae of the northern Pacific coast are more like those of Japan.

During the years I taught at the beach, near Crissy Field, each season offered its own surprises. Winter storms would often wash away everything, including precious native plants, but then came spring, and here they were again. ■

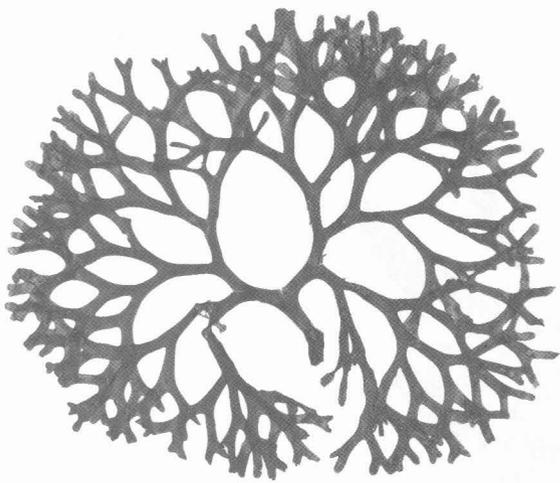
Ida Geary is an artist, naturalist, writer, and teacher known for her plant prints and collages. She has written columns for several Marin County newspapers, and is author and illustrator of four books. Parts of this article appeared in different form in Pacific Discovery in 1977.

Left page: Wing kelp, *Alaria marginata*, grows to eight feet long. Note the holdfast of this juvenile specimen.

Background: Oarweed, *Laminaria sinclairii*

Right: Acid kelp, *Desmarestia herbacea*, is inedible.





ON COLLECTING AND PRESSING SEaweEDS

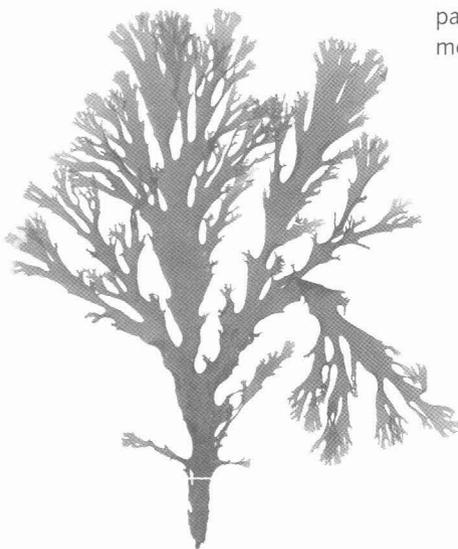
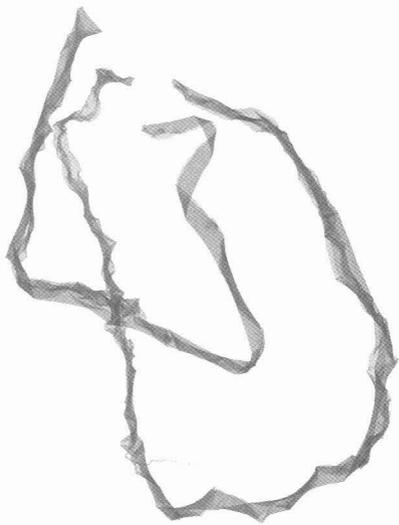
IT IS AGAINST THE LAW to collect native plants in California and many other states. With few exceptions, marine algae are natives. For that reason I do not take living marine algae still attached to rocks or piers for specimens, but limit my collecting to fresh driftline algae. This is not as scientific as it could be, because fragments of plants are harder to identify than complete plants, but even whole plants often can be identified only by experts, so we have to learn to live with ambiguity. Driftline algae are considered dead, especially the red and green algae, (since some brown algae can reproduce from fragments).

When going in search of seaweeds it is wise to start an hour or two before low tide, then follow the tide all the way out to its lowest point. Another good time is just as the high tide turns and starts to ebb, leaving a driftline of fresh marine algae on the beach.

Many thick or heavy specimens of marine algae can be pressed between folds of newspaper. First wash them to remove all sand and small invertebrates. Spread the seaweed on the paper so no blades overlap (sometimes a specimen must be trimmed). Write the date, place

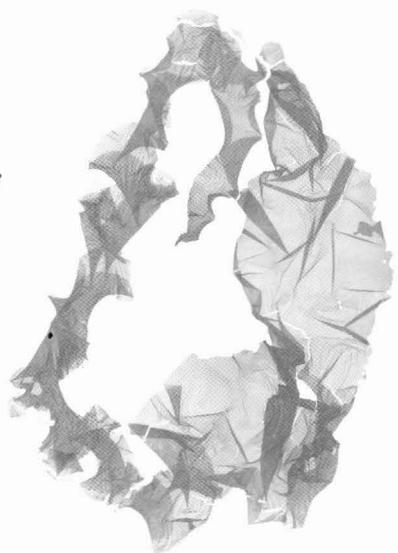
collected, and the name of the plant if you know it on the margin of the paper. Fold the paper over to cover the specimen, and place it between two blotters, then between two pieces of corrugated cardboard. Specimens can be stacked in a plant press, then tightly strapped or weighted until dry. Lacking a professional press, you can sandwich your specimens between boards, then weight them with bricks, heavy books, sandbags, or cans of earth or water.

Fragile and lacelike seaweeds must first be floated in a shallow pan of water, then, when fully opened, caught from beneath on a sheet of 100 percent rag herbarium paper. Once the plant is arranged, cover it with waxed paper or pieces of an old sheet, then place it between blotters or newspaper (to hasten drying), before sandwiching it between cardboard. Everything except the dated fold of newspaper must be changed daily during the week or more it takes for the seaweeds to dry, to prevent mold or loss of color. Some specimens seem to mold no matter how careful one is. The mucus that coats seaweeds to help them slip through waves without tangling or breaking will glue lighter specimens permanently to the paper.

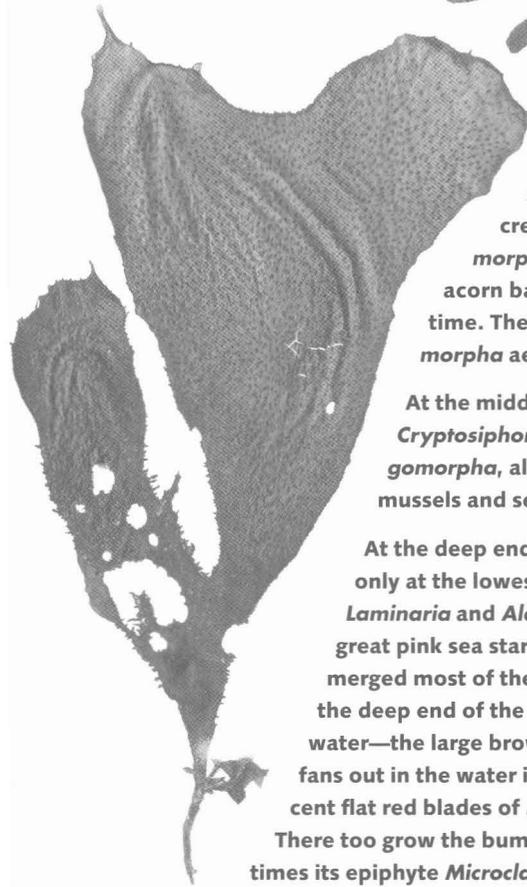
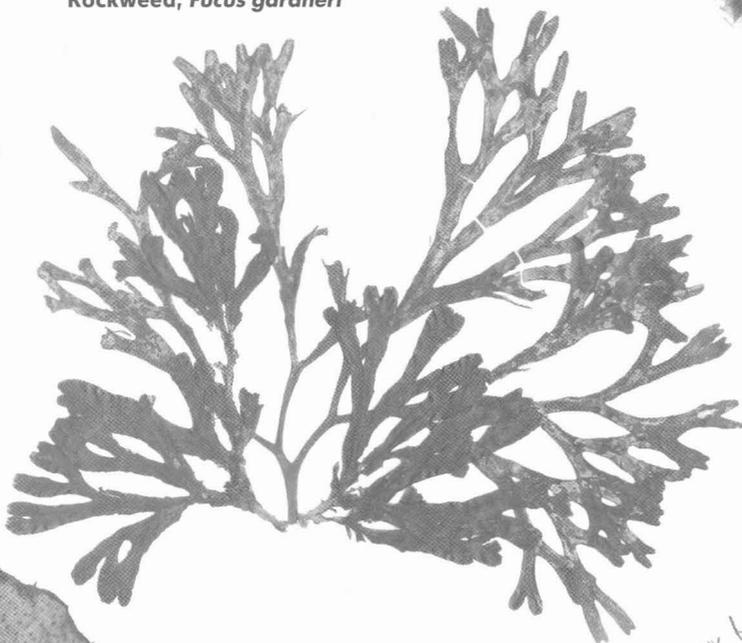




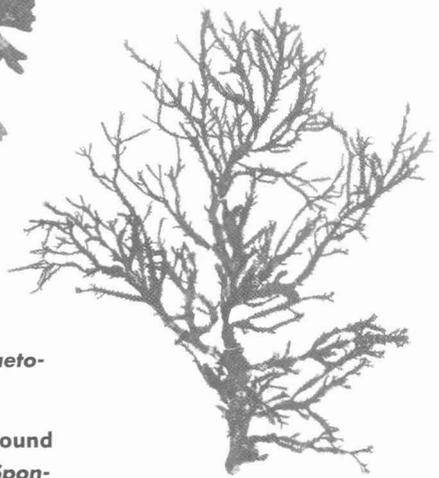
Opposite page, counterclockwise, from top left: *Gymnogongrus chiton*; *Enteromorpha linza*; *Callophyllis crenulata*; Feather boa, *Egrecia mezesii*; and (background) Sealace , *Microcladia coulteri*, which grows on other plants as an epiphyte.



This page, counterclockwise, from top right: Ruffled sea lettuce, *ulva angusta* is a common edible green alga; *Phycodrys setchellii*; *Gigartina* is rough to the touch; *Chaetomorpha aerea*; *Nienburgia andersoniana*; and (center) Rockweed, *Fucus gardneri*



At low tide at the upper, sandy end of the concrete pier we found species of *Ulva* and *Enteromorpha*, together with tiny littoral snails and white acorn barnacles, all well adapted to being dry most of the time. There too is one of our discoveries, the green alga *Chaetomorpha aerea*.



At the middle of the pier, exposed twice a day at low tide, we found *Cryptosiphonia*, a small tufted red alga, and the thready green *Spongomorpha*, along with clusters of small black mussels and sea anemones.

At the deep end of the pier, exposed only at the lowest low tides, we found *Laminaria* and *Alaria*, large brown algae, and great pink sea stars, all adapted to being submerged most of the time. Along the sunny side at the deep end of the pier—always covered by water—the large brown alga *Egrecia* (feather boa) fans out in the water in feathery ropes, and the iridescent flat red blades of *Iridaea* undulate in the waves. There too grow the bumpy fronds of red *Gigartina*, and sometimes its epiphyte *Microcladia* (sea lace), much sought for its beauty in pressings.



All pressings by Ida Geary



KURT KUTAY

WESLEY MARX

Top: A guided canoe wildlife safari in the Santa Clara wetlands

Bottom: A black-crowned night heron shelters in a palm tree near El Golfo de Santa Clara. These birds breed in the lower delta.



WESLEY MARX

BY ALL RIGHTS, the lush green wetlands that reach out to the desert horizon should not exist. This area is within Mexico's historic Colorado River Delta, which has dried up as dams in the United States have captured river flows that once extended into the Gulf of California. But the Ciénega de Santa Clara is very much alive, hosting thousands of birds and a growing parade of excited birders, ecotourists, schoolchildren, and surprised public officials.

To Edward Glenn, a University of Arizona environmental scientist, these sprawling wetlands are "accidental." They exist as an unintended consequence of a decision in cross-border water policy, a decision made for practical and economic reasons unrelated to this ecosystem's future.

Before the dams were built, the Colorado River delta extended over two million acres, an area almost the size of Rhode Island, rich with nutrients brought downriver with tons of silt. In 1922 the pioneer conservationist Aldo Leopold exulted in "all the wealth of fowl and fish . . . in this milk-and-honey wilderness" as his canoe wove through winding waterways and green lagoons. Leopold subsisted on quail and geese he and his brother harvested. Beaver, deer, and jaguar flourished, while shrimp and a 300-pound fish, the totoaba, migrated from the upper Gulf of California to spawn in the delta's brackish waters. Millions of waterfowl and shorebirds could be seen circling, then descending to feed and rest. The indigenous Cocopah people harvested seeds from an endemic saltwater

grass to process into grain, enjoying a bountiful way of life thanks to the natural richness of the delta.

Change began during the latter part of the 19th century. Ships traveling north from the Gulf of California would transfer their cargo to river steamboats that supplied U.S. Army outposts and mining camps along the lower Colorado River. The steamboats were fueled by cottonwood from riverside forests. By the turn of the century hunters and sport fishermen from north of the border were partaking of the delta's bounty. Fishing villages developed on the upper Gulf to supply Los Angeles and San Diego with shrimp, shark, turtle, and totoaba.

By the 1930s the demand for Colorado River water to sustain farms and cities in the expanding western U.S. seemed to be sounding the death knell for this aquatic wilderness. As the river was dammed and its water diverted, the riverside forests, green lagoons, and cattail wetlands receded. Waterfowl, fish, and beavers disappeared. Mudflats dried to barren salt flats, and dust blew where Leopold had canoed. With the loss of delta habitat, migratory waterfowl and shorebirds on the Pacific Flyway were forced to compete for stopover space along the California coast, the Salton Sea, and other stressed areas. At the time, such environmental losses did not impress public officials on either side of the border.

What did catch their attention was the need to secure rights to river flows. As dams proliferated, an anxious Mexico tried to make sure enough water reached the

The Surprise Return of the Colorado River Delta

border to supply its own farms and cities. In 1944, the U.S. and Mexico signed a treaty to divide up the flows of the Colorado and the Rio Grande. Mexico secured rights to 1.5 million acre-feet of the lower Colorado's annual average flow of 7.5 million acre-feet.

The treaty dealt only with water quantity. It did not mention water quality. Mexico came to rue this omission. By the time the Colorado reached the border, its salt content was toxic to farm crops. As a result of upriver use of river water and agricultural runoff, Mexican farmers saw their irrigated crops wither and die. Only 29 years later, after prolonged negotiations, did the U.S. agree to reduce salinity levels to more tolerable levels.

The new agreement went into effect in

1973—and, quite unexpectedly, set the stage for the greening of the delta. To comply with the requirement that salt content be lowered, the U.S. decided to build a desalting plant close to the border, near Yuma, Arizona. The plant was to treat salty irrigation runoff from the south Gila Valley before discharge into the river. While the plant was being built, the runoff was to be carried south by canal and discharged into a barren area in the eastern delta, from there eventually to drain into the Gulf of California.

Mexico was willing to tolerate this temporary solution because the discharge area was considered wasteland. Soon, however, that “wasteland” began to show signs of life. Without any assistance from wetland



JOSH SCHACHTER

Top: A young resident bird-watcher in Eijido Luis Johnson, Ciénega de Santa Clara

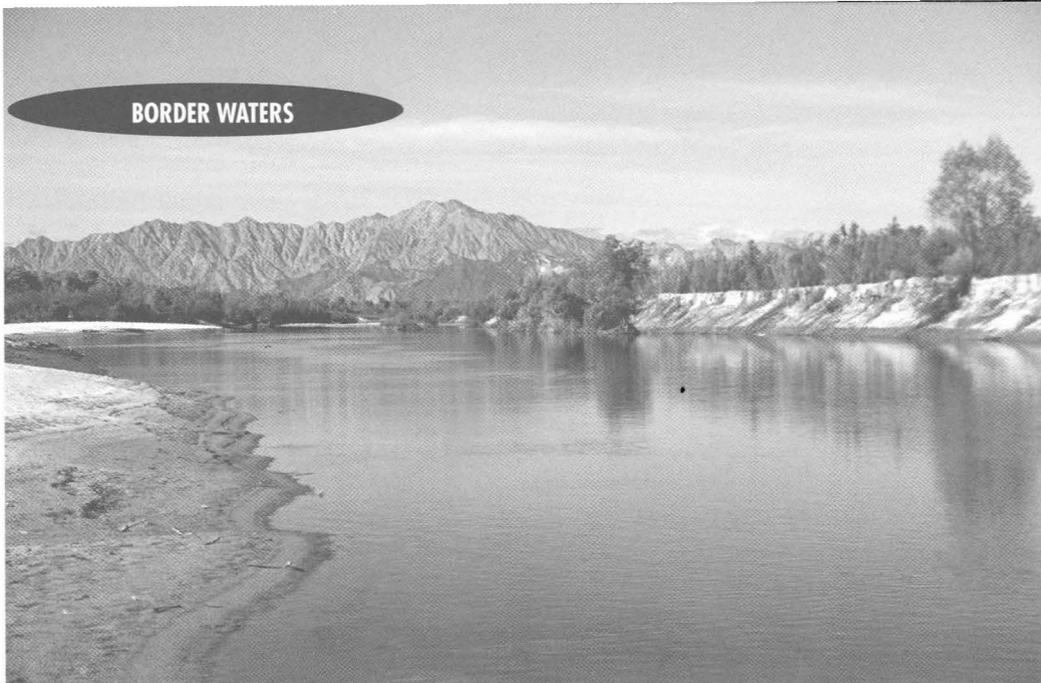
Left: This canal carries agricultural runoff from southern Arizona to the Ciénega de Santa Clara.



WESLEY MARX



José Campoy, director of the Delta Biosphere Reserve, designed this glyph of a shell inside a sun for La Ruta de Sonora.



JOSH SCHACHTER

consultants, mitigation experts, or environmental regulators, the drain water transformed 50,000 acres of dusty, salt-encrusted barrens into cattail wetlands and brackish-water marsh. The Ciénega de Santa Clara returned, and so did the wildlife, including 150 bird species and the endangered desert pupfish. According to Glenn, the Ciénega now shelters 6,000 Yuma clapper rails, the largest remaining population of this endangered bird.

Life-Giving Water Returns

IT TOOK TILL 1992—almost 20 years—to build the desalting plant, due to engineering problems, and it still has not been put into operation because the U.S. finds that it's cheaper to continue diverting the problem runoff south. As the custodian of the

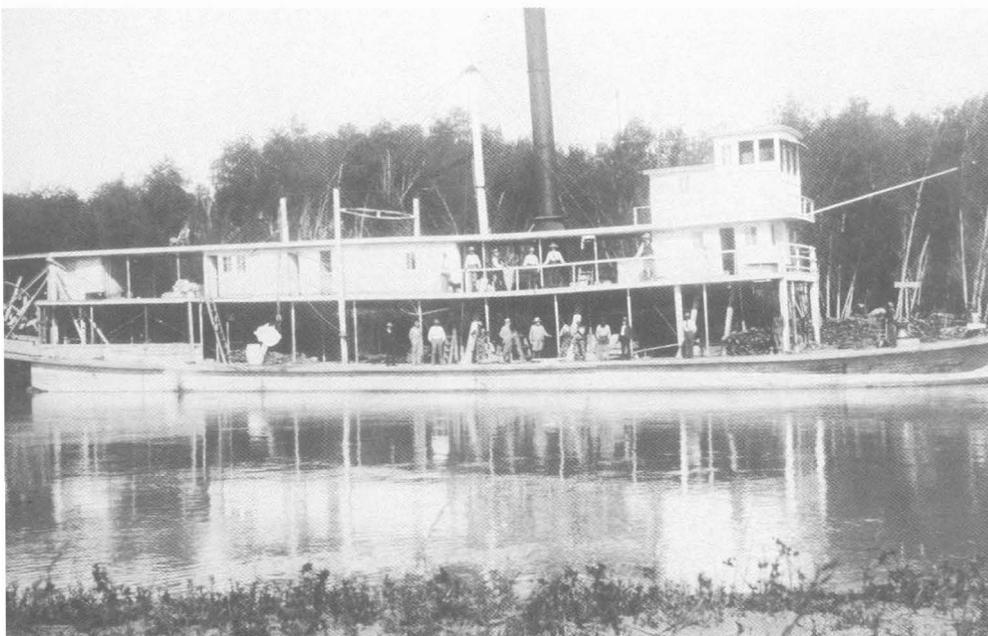
unexpected wetlands, Mexico is glad to see the drain discharge. In 1993, Mexico established the Upper Gulf of California and Colorado River Delta Biosphere Reserve to protect Ciénega de Santa Clara and similar areas. Now schoolchildren come here on field trips to see their first blue herons, egrets, avocets, and geese. José Campoy, the director of the Biosphere Reserve, showed me a calendar illustrated with drawings created by student visitors. "The children help educate their parents about the natural values of the delta," he said.

Meanwhile, more water arrived—thanks to overflow discharges from U.S. dams and Mexico's Morelos Dam, just south of the border—especially during the wet El Niño years of the 1980s and '90s. Nourished by these flows, the river again coursed for 100 miles below the border and reached the Gulf. Cottonwoods and willows returned, and with them also warblers, tanagers, vireos, and other migratory songbirds. The endangered southwestern willow flycatcher finds shelter here again. Beavers have returned too, thanks to individual animals "washed away from the United States during heavy runoff," and are now established, according to Eric Mellink of the Center for Scientific Investigation in Ensenada.

Delta habitat now extends over some 150,000 acres. That's just a fragment of the two million acres Spanish missionaries and explorers found, but it supports up to 60,000 waterfowl and 160,000 shorebirds each year. This habitat is about the same size as all of southern California's coastal wetland systems combined. The delta has reemerged as a key stopover on the Pacific Flyway, taking some pressure off the California coast and the Salton Sea.

Top right: Landscape of the Colorado River Delta, Mexico

Bottom: In the 19th century steamboats cruised the delta, fueled by cottonwoods from dense stands along the river.



SHERMAN FOUNDATION RESEARCH LIBRARY

The impact of the resurgent river flows extends into the Gulf of California. Mexican fishery officials have noted that catches of shrimp and corvina, a popular commercial fish, increase after overflow releases from dams. According to a 2000 report published in *Fishery Bulletin* by Glenn and researchers at the University of Baja California in Ensenada, the releases can expand brackish-water spawning and nursing areas for marine life. For El Golfo de Santa Clara, a small fishing community below the mouth of the delta that exports its catch to markets as far away as South Korea, the larger harvests serve as an economic shot in the arm.

Locals Become Nature Guides

THE WILDLIFE REBOUND also has brought new economic opportunities for delta communities in the form of ecotourism. El Golfo fishermen now take visitors out in their skiffs (pangas) to watch seabirds and see the Biosphere Reserve. They tell them that if they're lucky, they may catch a glimpse of the endangered vaquita, a small porpoise that breeds in the upper Gulf and along the margins of the delta. Small islands at the delta mouth host breeding colonies of royal terns, black skimmers, and black-crowned night herons.

People of Ejido Luis Johnson, a small cooperative farming community, have been commuting to better-paying jobs in border factories and fish packing plants. Now there is another income-producing alternative, nature tourism. A few years ago the ejido began to offer guided tours by panga to the nearby Santa Clara wetlands. Word of this reached La Ruta de Sonora Ecotourism Association, a nonprofit agency in Tucson, Arizona, and it offered to help by training local guides to host English-speaking visitors. Now, said José Juan Butrón, who launched these tours, "we handle about 20 tours during winter birding season." Five pangas and six canoes owned by the ejido ply the shallow waterways that wind through the six-foot-high cattail thickets. The skiffs use electric motors to minimize pollution and engine noise.

Local guides also take sport fishermen out to catch largemouth bass and other non-native fish that have colonized the waters. Butrón has refurbished one village home so visitors can stay overnight . . . and spend more money locally.

The government of the state of Sonora supports this new economic thrust. In a 2001



JOSH SCHACHTER

Top: José Campoy and an ecotourist canoeing in the Ciénega de Santa Clara

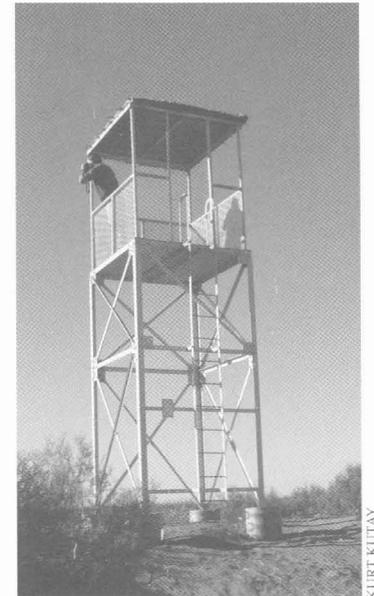
edition of a state tourist guide, Governor Armando López Nogales observed: "Above all, ecotourism may prove to be an essential emergent market within the tourist sector. We may count on the importance of the Biosphere Reserve on the Colorado River delta, a place where one can find animal species not found elsewhere in the world."

These new-found ecotourism opportunities can benefit communities north of the border as well. In April 2001, Yuma, Arizona, held its first Yuma Birding and Nature Festival, featuring field tours to the Santa Clara wetlands and El Golfo. The festival attracted over 300 participants, and plans are under way to make it an annual event. To expand wildlife-watching opportunities, the community is restoring wetlands along its riverfront.

Below: Waterfowl observation tower in the Santa Clara marshlands

Crossborder Delta Defense

A SIGN AT THE BASE of a tower in the Santa Clara wetlands clued me in to another form of cross-border cooperation. It declared that the tower was a joint project of wildlife agencies in the United States and Mexico. In 1997, the U.S. Department of the Interior and its Mexican counterpart, Secretaría de Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP), agreed to cooperate in cross-border projects. "As part of this program, we decided to donate a birdwatching tower to the Santa Clara wetlands," explained Mitch Ellis, superintendent of the Imperial National Wildlife Refuge north of Yuma. "We have also helped to repair storm damage to a field station in the Biosphere Reserve and participated in aerial wildlife surveys of the delta."



KURT KUTAY

BORDER WATERS



JOSH SCHACHTER, SONORAN INSTITUTE

Top: Ibis in an agricultural field, Colorado River Delta, Sonora, Mexico

Bottom: Young residents of Eijido Luis Johnson



JOSH SCHACHTER

The return of life-giving water to the delta generates another management responsibility: monitoring water quality. Jaqueline García, a research scientist in Guayamas, Sonora, has detected the presence of selenium in water samples taken from the Ciénega. This natural element can be toxic at high levels. A three-year study is under way to determine whether selenium bioaccumulates in the breeding population of the Yuma clapper rail and impairs breeding success, as it was found to do in the Kesterson National Wildlife Refuge in California's Central Valley. The study is being conducted by the a binational team of researchers from the University of California Institute for Mexico and the United States (UC-MEXUS).

The riverside forests and resurgent wetlands indicate that the delta, while beleaguered, is still very much alive. There is no assurance, however, that the life-giving flows will continue. Indeed, the U.S. has decided to designate another use for the water that sustains the riverside forests. In January 2001, in the last days of the Clinton Administration, Secretary of the Interior Bruce Babbitt approved so-called interim surplus criteria (ISC) for the Colorado River, which permit the Secretary to divert surplus flows to states with water needs that exceed their allowed allocation. This essentially means California, which uses up to 800,000 acre-feet a year above its allocation of 4.4 million acre-feet. Under the ISC, California will have access to these flows if it shows progress toward the reduction of its water usage to the permitted level by 2016.

The ISC generated considerable opposition from Mexico and from environmental groups on both sides of the border. For some time already, environmental organi-

zations and community groups had been urging the Department of Interior to allocate more water to environmental needs of the lower Colorado River and delta ecosystem. In November 1999, 38 organizations, representing over eight million U.S. and Mexican citizens, sent a letter to the governments of both countries making this plea. In June 2000, eight environmental groups, including the Center for Biological Diversity and the Sierra Club, filed a lawsuit against the Department of Interior contending that it had failed to protect the river and delta ecosystem under the Endangered Species Act. The nonprofit Pacific Institute, a research organization based in Oakland, submitted to the Department of Interior an alternative ISC plan that dedicated flows to delta habitat. The Department declined to analyze this alternative, asserting that "the United States does not mitigate for impacts in a foreign country"—an assertion that blatantly overlooks Article 17 of the 1944 water treaty: "Each government declares its intention to operate its storage dams in such manner, consistent with the normal operations of its hydraulic systems, as to avoid, as far as feasible, material damage in the territory of the other."

Although water interests on both sides of the border have traditionally been reluctant to dedicate river water to environmental needs, there appears to be a growing, if sometimes grudging, acceptance that the Colorado River delta's needs must be addressed on a binational basis. In a December 27, 2000, editorial the *San Diego Union Tribune* pointed to a need for "improvements" in the Colorado Delta, concluding that "with some innovation, including channeling more agricultural runoff water into the delta, and negotiating with all users to allow a little more water

flow into the Gulf of California, the United States and Mexico can improve somewhat the ecological health of this vast desert delta."

One possible proactive approach has been set in motion. In December 2000, the binational International Boundary and Water Commission (IBWC) approved a minute order that, for the first time, acknowledges the need to address the water requirements of the delta ecosystem. The Commission established a cross-border technical task force to develop cooperative delta projects "to ensure use of water for ecological purposes." In September of this year the Commission, along with United States and Mexican government agencies, sponsored a two-day Colorado River Delta Symposium in Mexicali, Mexico. It attracted some 300 participants.

Meanwhile, natural as well as political forces threaten the delta. The onset of drought could cut short its recovery, rendering any discussion of surplus flow allocations meaningless, at least temporarily. The pressure to restart the desalting plant in order to reclaim farm runoff for domestic use could also shrink the Santa Clara wetlands.

Anticipating such problems, the David and Lucille Packard Foundation has funded a study to explore short-term options for restoring flows to the delta. In May the study team, which includes water officials from both sides of the border, issued a report that singled out two options. The first is to divert farm runoff by canal from the Yuma and Gila Valley areas to the delta to expand wetlands. The U.S. Bureau of Reclamation is already considering this as a way to reduce salinity levels in the Colorado River. The second option is to acquire water rights to marginal farmland in the delta for use in restoration, which Mexico is considering as a means of making more efficient use of water.

Seventy years ago, few people worried about the fate of the Colorado River delta. Current efforts to sustain the living delta reflect a significant change in public attitudes on both sides of the border. Once regarded as expendable in the drive for development, coastal wetlands and riverside forests are now regarded as worthy of

protection and restoration. Does setting aside life-giving flows to natural systems mean we must stint on our own water needs? We are learning to stretch our existing water supply by reclaiming our wastewater, adopting water conservation measures, and cleaning up urban groundwater basins.

We are becoming more aware of the need to link new growth to the availability of future water supplies. In 2001, Governor Gray Davis signed into law a landmark bill that requires local governments, prior to approving new development, to verify with local water agencies that future water supplies will be available. The author of the bill was State Senator Sheila Kuehl (D-Santa Monica).

Because of such expanded policy perspectives, California's Mono Lake and the Sacramento-San Joaquin River delta enjoy a new lease on life. While its future is far from assured, the desert delta now has a chance to survive, thanks to its determined defenders. ■

Wesley Marx, author of The Frail Ocean (revised edition, 2000), has been observing the recovery of the Colorado River delta during repeated camping trips to the region with his family. He may be contacted at wmarx@primenet.com.



Top: Mark Briggs and Carolyn Gorman of the Sonoran Institute investigate changes in the river channel and vegetation with researcher Francisco Zamora.

Bottom: A dolphin swims in the Alto Golfo de California Biosphere Reserve.



PHOTOS THIS PAGE JOSH SCHACHTER



New Flood Warning System in Hazardous Mexico Border Zone

PHOTOS BY DAVID MAUNG

IN 1993, THE LAST really wet winter in the border region, 26 people died in Tijuana, and hundreds of horses on a dozen or more ranches in San Diego County were evacuated as floodwaters swamped the Tijuana River Valley. Yet there had been no "storm of the century," only a series of rainy days followed by a big downpour. Coming after a drought in this semi-arid, very disturbed landscape populated by more than a million humans, that was enough to bring disaster.

Residents of both countries share an interest in improved safety during storms. This winter, for the first time, some of them will at least get timely warning. Thanks to a binational agreement in June 2000, a flood warning system has been developed for the lower Tijuana River watershed, funded by governments on both sides of the border. It

is now on-line as part of a cross-border program to cut storm-related losses.

This warning system is a result of a two-year project to examine flood risk in the lower watershed using geographic information system (GIS) mapping and modeling capabilities shared by the two countries. It is a tangible product of the many new efforts to cooperate on issues of mutual concern in this binational watershed.

Soils in the border area are among the most erosive soils that exist. They fall apart and crumble with human disturbance, then dissolve in heavy rain. In an arid region, even the most extreme impacts to the earth's surface can occur without many repercussions . . . until it rains. Then a torrent of mud and water cascades to the lowlands in a flash flood.



Fast-paced urban development on both sides of the border has resulted in thousands of acres of impermeable surface and increased runoff where, under natural circumstances, water would have been absorbed into the earth. In Tijuana's poorest *colonias*, communities sprang up without any provisions for storm runoff. The city's best efforts to provide stormwater culverts and drains hasn't kept pace with its burgeoning population. On the north side of the international fence the scarred landscape hints at similar soil impacts from U.S. Border Patrol roads and vehicles.

During the 1993 flood disaster, the mesas and cañons of Tijuana were awash with mud and debris as flash floods whipped the area and filled the city's concrete river channel to the brim. People and animals were swept away in the middle of the night and entire communities were isolated for days. Hundreds of the poorest people were left injured and homeless, and scores of businesses and major transportation arteries were covered in a thick sheet of mud.

North of the border, rainwater flowed down mesas and cañons and through gutters and culverts. The Tijuana River floodway flowed full-bore with a thick coffee-colored torrent. Bridges were swept away and the river dug an entirely new channel, erasing productive farms forever.



VISION FOR THE VALLEY

THE TIJUANA RIVER VALLEY is a floodplain, an area protected under the City's Multiple Species Conservation Program, and a regional park. Steps are under way to create a contiguous river parkway from San Ysidro to the ocean. To date, San Diego County's Parks Department has purchased over 1,000 acres of land in the eastern half of the valley while state and federal agencies hold about 2,500 acres at the west end. Funds from the Federal Emergency Management Agency and the Coastal Conservancy are available to the County to purchase land from flood-prone areas on a willing-seller basis. The vision for nonstructural flood control, resource protection, and recreation improvements includes restoring a variety of habitats, removing structures from the designated floodway, and providing improved trails throughout the valley to the ocean.



GOAT CANYON ENHANCEMENT PROJECT

FLASH FLOODS are burying the Tijuana Estuary's southern saltmarsh in mud. The Goat Canyon Enhancement Plan prepared by the Southwest Wetlands Interpretive Association (SWIA) in 1999 proposes constructing big sediment management basins in Goat Canyon to protect the estuary. An environmental impact assessment was prepared by SWIA and was released in October. Plans call for constructing the project in 2002–2003 during a window of opportunity that avoids the breeding season for two resident endangered birds, the least Bell's vireo and the California gnatcatcher.

BORDER WATERS



NEW PUBLIC AWARENESS TOOL PLANNED:

River Voices CD-ROM

THE TIJUANA RIVER speaks through water gurgling over rocks, the roar of floodwater crashing down canyons, the whoosh that comes when a tap is opened and water long stored underground is pumped up and released. It speaks through the changing tone of the diminishing numbers of least Bell's vireos singing in willow thickets, and in the sign language of seasonal cottonwoods and willows invaded by exotic tamarisk. It is heard in the summer stillness of dry sandy washes and the slurred speech of sediment- and debris-choked waters moving down concrete canals and across the coastal plain to the ocean. Often its voice is drowned by the noisy pumps that bring Colorado River water over the mountains to city homes and industry.

"The River Speaks" is the theme of a binational outreach project designed to bring awareness of the natural processes and benefits of the Tijuana River to the millions of citizens living within this 1,700-square-mile watershed straddling the international border. The connectivity the river provides is masked by a diversity of living and working conditions in the cities and farmlands of the region, not to mention three impounding reservoirs.

"The River Speaks," funded by several governmental agencies and a private foundation, with the San Diego Museum of Natural History taking the lead, will first appear as a CD-ROM telling the river's story from the perspectives of its physical geography, biological diversity, cultural heritage, and governance. The graphic interface will be colorful and lively, with sim-

ple menus and icons to help the user navigate through the various sections. It will allow for interactive use of recent and historical photos, videos, GIS (geographic information system) data, graphic displays, animation, and interviews, as well as providing printable documents, maps, charts, and other relevant resources in English and Spanish.

Two public meetings, in Chula Vista and in Tijuana, have been held to bring together people from the communities to discuss their needs and concerns before the project goes into production. Continued contact with advisory committees on both sides of the border should ensure a useful product and the relationships necessary to distribute it to a wide audience in many venues. Other products, such as videos and printed materials, will be produced as funding becomes available.

This outreach project is modeled on one produced by the Bureau of Land Management for an area with issues similar to those in the Tijuana River watershed: "The Miracle of a Desert River/El Milagro de un Río en el Desierto: Conservation of the San Pedro River of Sonora and Arizona." Funders of "The River Speaks" include the U.S. Environmental Protection Agency, Border Liaison Office; U.S. Fish and Wildlife Service; U.S. Forest Service; Cleveland National Forest; U.S. Bureau of Land Management; and Fundación La Puerta.

—Pat Flanagan

People and livestock were evacuated, some in deep floodwaters laden with sewage. Massive amounts of sediment and debris remain in the valley to this day and everyone is left to wonder what the next big flood will do. Bridges have been replaced, and today the City of San Diego is undertaking a program to remove people and structures from the floodway in a willing-seller land acquisition program.

Because of the size of the lower Tijuana River Watershed and its large population, the flood warning project was launched as a pilot project in a high-risk cross-border region to test the feasibility of the new integrated flood warning system. It includes the Rio Alamar corridor and the associated Cottonwood, Tecate, and Campo Creek subbasins. National Weather Service rain and stream gauges were installed in November, and other gauges have been upgraded. Communication equipment was put in place to enable warning system staff in both countries to communicate with other agencies to create a seamless exchange of real-time data on rain and flow throughout the watershed.

Researchers in universities in San Diego, Tijuana, and Ensenada will have access to the data for modeling purposes. The real-time weather information will be overlaid with other GIS data on roads, topography, and human population centers. Such information is intended to enable emergency response providers on both sides of the border to use the interactive program for decision-making during flood emergencies.

The new system will not prevent flooding, but it should help people to make their way to safe quarters when serious danger arises. The harder work required to reduce flood risk in the Tijuana River watershed has only just begun. ■

—Jim King

FOR MORE INFORMATION, contact in the United States: Rand Allan, County of San Diego Department of Public Works (858) 495-5557, and Nina Garfield, NOAA project coordinator (301) 563-1171; in Mexico: Mario Rodriguez (011-52-6) 681-5027, and Alberto Castro (011-52-6) 634-9360.





Time For a Park Bond?

THE ECONOMY is in the doldrums and the State is facing a budget shortfall of over \$10 billion, and

California's voters passed a \$2.1 billion park bond act, Proposition 12, just two years ago. Yet on the March 2001 ballot voters will be looking at another bond measure, Proposition 40, with \$2.6 billion for parks and natural resources. Is this good or bad timing?

Well, in terms of boosting the economy, the timing is excellent. "Bonds are the fastest way to get money into the California economy," Fred Main, senior vice president and general counsel of the California Chamber of Commerce, argued recently in the *Los Angeles Times*.

Tourism is now the number one industry in California, and support for that industry is crucial to an economic rebound. Proposition 40 would make money available quickly to stimulate the economy through jobs and improvements to parks, beaches, and other tourist destinations.

Proposition 40 would not result in higher taxes. Moreover, the bond money would be paid back at a time when experts believe California's economy not only will have rebounded itself, but will be leading the nation's economic recovery. State Treasurer Phil Angelides has said that this measure is well within the State's capacity for general obligation bonds. With interest rates lower than they have been in decades, this is a great time for the State to sell bonds: by acting now we will have to pay much less in the long run.

Between 1960 and 1988 California passed a park bond about every four years. Then came a 12-year gap. Between 1988 and 2000 unmet needs piled up. Beaches were degraded,

water supplies were increasingly polluted, state parks had to raise rates just to stay open, and important acquisition

opportunities had to be passed over while the state's population kept growing, putting ever greater pressure on deteriorating facilities. In 2000, Proposition 12 helped alleviate some of the backlog, but almost all of that funding will be either spent or committed within the next year.

If we want to keep pace with growing needs, we need a new bond act, and

we need it now.

Proposition 40 would provide over \$800 million in local assistance to improve and create parks, nature centers, and other community facilities in all parts of the state. Almost \$450 mil-



If we want to keep pace with growing needs, we need a new bond act, and we need it now.

lion would be directly allocated for work in some of our most important natural resource areas, including the coast, the Santa Monica Mountains, the south Central Valley, and Lake Tahoe. Well over \$1 billion would be available to alleviate water and air pollution,

restore wetlands and other wildlife habitats, and protect farmland from inappropriate development.

Proposition 40 guarantees that funding will be available throughout California. Many programs included in this measure require that money be distributed on a per capita basis, with minimum grants available to every city and county.

As for the Coastal Conservancy, Proposition 40 would enable us to continue the work that we've been doing for 25 years. Here's where, in just three years, we have spent or committed Proposition 12 funds:

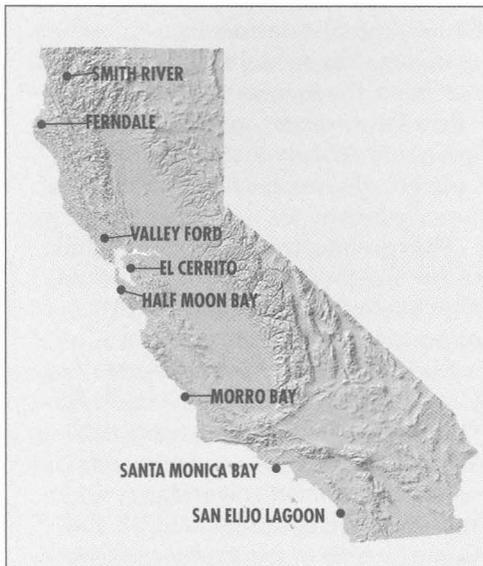
- Over \$11 million to restore salmon habitat in coastal rivers and streams
- Over \$1.9 million to add to the California Coastal Trail
- Over \$7 million to restore wildlife habitat on the south coast, almost \$1.5 million to restore south coast beaches, and \$4.9 million to purchase a new public beach in Malibu
- Almost \$7.2 million to restore the environment, improve recreational opportunities, and protect farmland in Santa Barbara, San Luis Obispo, Monterey, and Santa Cruz Counties; almost \$39 million for similar projects in the nine-county San Francisco Bay Area; and over \$8.2 million for projects from Mendocino County north.

Proposition 40 was placed on the ballot with strong bipartisan support from the State legislature and the approval of Governor Davis. It particularly benefited from the leadership of Assembly Speaker Robert Hertzberg, Speaker pro tem Fred Keeley, and Senate President pro tem John Burton.

Proposition 40 will improve the lives of all Californians, and the timing couldn't be better.

Sam Schuchat is the executive officer of the Coastal Conservancy.

COASTAL CONSERVANCY NEWS



PROTECTION FOR FORESTS AND SALMON IN DEL NORTE COUNTY

IN AMERICA'S EARLY days of salmon management, the concept of salmon refuges gained some currency as a surefire way to protect salmon from man's many creative forms of habitat destruction and over-harvest. In an address to the American Fisheries Society in 1892, fish culturist Livingston Stone proposed refuges as a way to ensure that the abundant Pacific salmon didn't go the way of the Atlantic salmon which, by Stone's day, had been severely depleted. One refuge was established in the Uganik River on Atognak Island, near Kodiak Island in Alaska. It lasted only 31 years before being eviscerated by decree and legislative opportunism. Now, almost a century later, a broad alliance is working toward a similar goal in Del Norte County's Smith River watershed, by protecting 25,000 acres of forest land and streams by purchasing it from the Stimson Lumber Company.

Spearheaded by the Save-the-Redwoods League, this effort moved forward in September when the Coastal

Conservancy approved \$5 million in Proposition 12 funds to help purchase the land, which includes two Smith River tributaries, Mill and Rock Creeks. Both support salmon spawning and rearing.

The Smith River is the only major river in California to flow freely, unimpeded by a single dam. It is a National Wild and Scenic River, and most of its watershed is protected within the Smith River National Recreation Area. The Mill and Rock Creek watersheds, however, are not protected. Along with coho salmon, the two creeks support Chinook and chum salmon, steelhead, coastal cutthroat trout, and lamprey.

Despite a history of intensive logging on this land, Mill and Rock Creeks remain relatively free of the high sediment loads that impair salmon habitat in most of California's other coastal rivers and streams. Part of this is due to the area's geology, but credit must also be given to Stimson, which has designed and maintained a stable road system for harvesting.

At least 23 species of animals that are listed as imperiled have been recorded on the Stimson property, including the marbled murrelet, northern spotted owl, Pacific fisher, and Del Norte salamander.

The Save-the-Redwoods League now has raised \$55 million of the \$60 million purchase price. Del Norte County is also seeking a tax replacement fund, and the League has said it will work hard to secure that, if it can. When the project succeeds—and the League is confident it will—the Pacific salmon in all its splendid forms will have a lasting sanctuary in the

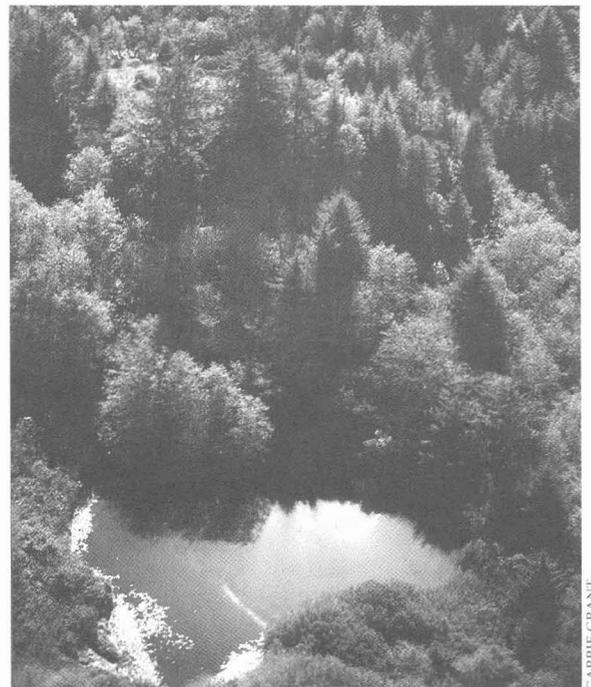
Smith River and its tributaries, as envisioned by Livingston Stone more than a hundred years ago.

—Michael Bowen

MORE LOST COAST FOR PUBLIC

IN DECEMBER the Conservancy approved \$962,000 to the Conservation Fund to purchase the 180-acre Barri Ranch, about five miles west of Ferndale, in Humboldt County. To complete the acquisition, the state Wildlife Conservation Board is expected to contribute \$413,000.

The Fund will convey the property to the Bureau of Land Management (BLM) to be added to the Lost Coast Headlands, expanding that protected area to 405 acres, including nearly a mile and a half of coastline. Last June,



CARRIE GRANT

This pond is on Lost Coast Ranch, acquired in June 2001. It lies adjacent to Barri Ranch and will be part of the Lost Coast Headlands protected area.



Barri Ranch will become part of the Lost Coast Headlands protected area.

with \$1 million from the Coastal Conservancy, the Fund purchased the 225-acre Lost Coast Ranch, which adjoins the Barri Ranch to the south, and in July conveyed it to BLM to establish the Lost Coast Headlands.

The Barri property contains a flat bluff top, steep ocean cliffs, a wide and open valley surrounding Fleener Creek, and a sandy pocket beach at the creek mouth. The Fund will acquire all but a five-acre homestead parcel with a residence and farm buildings. The purchased land will be leased for grazing to reduce the risk of fire and allow the ranch's continued contribution to the local agricultural economy.

Protection of the Lost Coast Headlands follows a Conservancy-funded study completed by the Fund earlier this year. It showed strong local interest in maintaining the historic landscape, continuing grazing of cattle, and improving public access to the coast. If the property were not purchased for public use, it could potentially be subdivided into four homesites.

SAN FRANCISCO BAY AREA FARMLAND PROTECTED

THE COASTAL CONSERVANCY has approved \$1,895,000 in Proposition 12 funds to two local land trusts to pro-

tect a total of almost 600 acres of scenic open space and farmland in two Bay Area counties.

With the help of a grant of \$395,000, the Marin Agricultural Land Trust (MALT) will buy an agricultural conservation easement on 326 acres of a family-run dairy ranch on the banks of the Estero Americano near the village of Valley Ford. This land is part of a 1,526-acre farm that straddles the Marin-Sonoma County line. It is operated by the Ielmorini and Moody families, who lease the land and have obtained option agreements to buy it. The families also hope to sell a conservation easement over the 1,200 acres in Sonoma County to help finance their land purchase and ensure the continued operation of the dairy.

Marin dairies provide about one-fifth of the San Francisco Bay Area's milk supply and are the backbone of the county's agriculture. Agricultural conservation easements preserve scenic open space, wildlife habitat, and cultural aspects of the region's agricultural heritage while protecting productive uses of private property.

In San Mateo County, the Conservancy's grant of \$1.5 million to the Peninsula Open Space Trust (POST) will help to protect the 267-acre San Gregorio Farms property, south of Half Moon Bay near the intersection

of Highways 1 and 84. The grant reimburses POST for part of \$3.95 million it paid for the property last June.

San Gregorio Farms lies between San Gregorio State Park and Pomponio State Park. Eventually, California State Parks is expected to assume ownership. POST bought it because it was able to move more quickly than the State within the narrow time frame established by the sellers. Had POST not acted, the owners would have offered the property on the open market, and it is likely that it would have been bought for private residential development.

The coastal terraces and rolling hills of San Gregorio Farms offer outstanding views of the coast and present opportunities to create new trails, including a piece of the California Coastal Trail. San Gregorio Creek, historically a coho salmon stream, runs through the property and supports several threatened and endangered species. The Department of Fish and Game intends to reintroduce coho as part of its plan to restore salmon fisheries south of San Francisco.

TEAMWORK ON CERRITO CREEK

WITH \$350,000 IN Proposition 12 funds from the Conservancy and \$75,000 of its own money, the City of El Cerrito will restore a three-block section of Cerrito Creek, which has been restrained by concrete and riprap. Friends of Five Creeks, a volunteer organization, will remove an undermined section of a parking lot, regrade the banks, and install native plants and trees to hold the soil. The owner of El Cerrito Plaza, Regency Centers, Inc., will cover the cost of concrete removal from the damaged parking lot and donate the land—more than one acre, valued at \$158,000—for the project. Until it received the Conservancy grant, the City was reluctant to accept the property because it lacked the money needed for restoration.

ONE MORE PIECE FOR MORRO BAY GREENBELT

A \$1,175,000 GRANT approved by the Conservancy to the Bay Foundation in December will protect almost 18

acres of scenic wildlife habitat on Morro Bay's south shore, for eventual addition to Montana de Oro State Park.

This acreage provides habitat for endangered plants and animals, and will provide an important new access-way to the state park, minimizing disturbance to the mudflats frequented by thousands of resident and migratory birds. Current zoning would have allowed a 17-unit townhouse complex to be built on this property.

The Morro Estuary Greenbelt Alliance (MEGA), formed by local residents, is leading a partnership of public agencies and private groups to establish a greenbelt connecting Montana de Oro and Morro Bay State Parks. Five properties have already been acquired and negotiations are under way for others. MEGA has helped raise almost \$10 million for acquisitions—a substantial accomplishment for a grassroots organization run by volunteers.

Of the funds approved by the Conservancy for this project, \$550,000 were provided by the U.S. Fish and Wildlife Service, \$425,000 by Caltrans; \$250,000 comes from the Morro Bay National Estuary Program, \$190,000 from the Wildlife Conservation Board, and \$100,000 from the Resources Agency.

TRASH COLLECTORS FOR SANTA MONICA BAY

ALSO IN DECEMBER, the Conservancy approved over \$2 million in Proposition 12 funds to the cities of Los Angeles, Santa Monica, and Manhattan Beach for systems to collect trash from storm water and urban runoff, two of the most serious sources of pollution in Santa Monica Bay. Treatment controls will be installed at: four locations along Ballona Creek and an industrial area near the Baldwin Hills, Los Angeles; Centinela/Ballona Creek Storm Drain, Santa Monica; and three locations in Manhattan Beach. The projects are all part of the Santa Monica Bay Restoration Plan.

OVER \$1.7 MILLION FOR SAN ELIJO LAGOON

THE COASTAL CONSERVANCY provided \$1.5 million to the San Elijo

Lagoon Conservancy in October to purchase a 19-acre property on the lagoon's northeast shore, and \$224,000 to remove nonnative plants and replace them with natives along the lagoon's perimeter. The property is habitat for the San Diego gnatcatcher, the San Diego horned lizard, the two-striped garter snake, and several other animals listed by the federal and state governments as endangered, threatened, or of special concern. Most of the habitat is currently of poor quality but highly suitable for restoration.

San Elijo Lagoon is one of the most important feeding areas for migratory birds on the San Diego County coast. Over 290 varieties of birds have been seen at the lagoon, including many endangered and threatened species.

In 1999 the Conservancy provided SELC with \$1 million to maintain an open ocean inlet to the lagoon to improve tidal circulation. Last year the Conservancy awarded \$63,000 to SELC for a pilot exotic plant removal program that was successfully completed this summer.

The Conservancy's actions are part of its work with the Southern California Wetlands Recovery Project, a coalition of 17 state and federal agencies working in concert with local officials, businesses, and nonprofit organizations. The purpose of the project is to devise and carry out a regional wetlands restoration strategy in southern California's five coastal counties.

OTHER RECENT PROJECTS

AMONG OTHER projects approved by the Coastal Conservancy in September–December for Proposition 12 funding:

- For 13 projects to extend or improve

the San Francisco Bay Trail, \$2.8 million to the San Francisco Bay Trail Project. See the *Coast & Ocean* web site (www.coastalconservancy.gov/pubs) for the complete list.

- For design of a regional center for the study and teaching of nonviolence, conflict resolution, and environmental education, to be built on the Martin Luther King, Jr. Regional Shoreline near Oakland International Airport, \$250,000 to the nonprofit Martin Luther King, Jr. Freedom Center.
- For the purchase of the historic 76-acre Wright Ranch on Morgan Territory Road just east of Mount Diablo, \$590,000 to the nonprofit Save Mount Diablo. This organization has raised \$50,000 from nearly 1,000 individual donations toward the \$640,000 purchase price. The long-term goal is to transfer the property to State Parks.
- To obtain a 130-acre property in Carmel's Hatton Canyon from Caltrans, \$963,000 to State Parks. Most of these funds are available through Proposition 12. Hatton Canyon extends from steep hills to the Carmel River. The Coastal Conservancy, Caltrans, and others were recently sued to prevent the transfer, and they plan to address the suit.
- For studies to improve trails along Ballona Creek, and to restore the natural environment of the creek, \$170,000 to Culver City, plus \$20,000 to the nonprofit Ballona Creek Renaissance to develop and coordinate government and public participation. Supporters of this project envision a trail that will one day run from ocean beaches to Baldwin Hills Park and, eventually, to downtown Los Angeles.

Wright Ranch property, near Mount Diablo



STEPHEN JOSEPH, SAVE MOUNT DIABLO



Making Better Environmental Decisions: An Alternative to Risk Assessment, by Mary O'Brien. Environmental Research Foundation/MIT Press, Cambridge, Mass., 2000. 286 pp., \$55 (hardcover), \$22.95 (paper).

Making Better Environmental Decisions will interest anyone who wants real-world, responsible approaches to decision-making that affects both the public well-being and the environment. The author, Mary O'Brien, argues that risk assessment, the traditional approach to making decisions on issues ranging from herbicide spraying to auto emissions to toxic chemicals in the workplace, is inevitably political and value-laden. Yet because it is presented as "scientific" and "objective," it enables decision-makers in government, business, and the corporate world to hide behind "dollar" and "risk" numbers and, ultimately, abdicate responsibility for choices that affect us all.

O'Brien presents the possibility of a superior method for making environmental decisions, one that she calls "alternatives assessment." Simply put, alternatives assessment calculates the pros and cons of all reasonable alternatives to risky activities and products. Instead of asking: What is the acceptable risk of this technology? she suggests asking: Do we need this technology? and: Why accept harm when safer alternatives are available?

The book is divided into three parts. The first two provide the real meat: present-day examples galore, full of facts and hard analysis. Part 1 provides a wide array of case studies—on issues that range from inadvertent poisoning of wildlife by industrial effluents to establishing "acceptable" levels of nuclear radiation to addition of chemicals to our food—to explore the question: "What is wrong with risk assessment?" In all cases, she finds that risk assessment can provide some

answers, but unavoidably overlooks reasonable alternatives that the proponents of the issues in question (the industry leaking dioxins into the water, the power plant whose workers must work with radioactive materials, the food producer wanting bigger chickens) do not consider viable options.

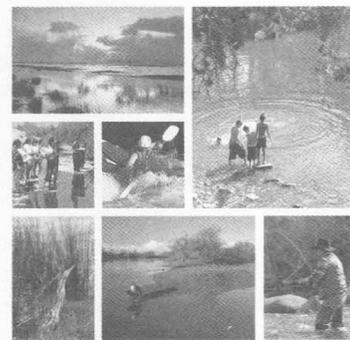
Part 2 begins by demonstrating alternatives assessment by means of a detailed example: use of bovine growth hormone vs. rotational grazing. After exploring a broad range of topics that include animal health, human health, consumer response, and the viability of rural communities, O'Brien offers lists of pros and cons for each approach to milk production. She thus makes it easier to see all that we know—and to recognize what we do not and perhaps cannot know—about the potential consequences of various decisions and choices.

As O'Brien demonstrates through short case studies, we do assess alternatives now. The challenge is to greatly expand this practice. That is the subject of Part 3, a short section that is perhaps intended more as inspiration than as edification, in that the discussion relies less on real-world scenarios than do the preceding 15 chapters. Here, O'Brien looks at the "barriers to" and "forces for" alternatives assessment, and makes the important point that governments (or corporations) will not shift from the status quo method of risk assessment unless pressured by the people.

"Alternatives assessment," O'Brien sums up, "offers the vision of humans behaving as decently as possible toward all of the Earth and its future. Most of us deeply want and need such a vision. Through alternatives assessment, you help people have hope." She underscores our democratic responsibility to exert that pressure on the powers that be by ending the book with a simple instruction: "Speak plainly."

—Anne Canright

THE STATE OF
CALIFORNIA RIVERS



THE STATE OF
CALIFORNIA
RIVERS

The State of California Rivers, prepared by Elise Holland. Trust for Public Land, San Francisco, 2001. 118 pp., free (spiral bound).

FOR READERS INTERESTED in the growing number of community-based river restoration and river parkway projects, *The State of California Rivers* will be a welcome reference.

Prepared by TPL's Western Rivers Program, the volume, while focused on long-standing TPL projects within California's 80 major river drainages, provides good overviews of current conservation and restoration efforts on many of the state's most important coastal rivers.

Biological and physical aspects of each watershed are described, as are major threats to river system health, and restoration and protection efforts. Presented as an inventory of community river restoration efforts, the information and maps are well-suited to being accessible on line. Contact information puts the reader a phone call away from principals involved in each project. To order copies, contact Elise Holland, (415) 495-5660 or elise.holland@tpl.org.

—Marc Beyeler

continued on page 40

**Editor:**

I enjoyed reading your article on the efforts to green the Los Angeles River (*Coast & Ocean*, Spring 2001). Frankly, however, I did not enjoy two things I noticed:

1. There was no mention of the years of work by the Trust for Public Land and (TPL) along the River. As you may know, we have been working in tandem with many of the individuals and organizations you mentioned on acquiring land for parks, including the pocket parks in Elysian Valley, along the Arroyo Seco, and south of downtown L.A. We worked successfully to convey the Cornfields to California Parks Department. I would recommend that you check our website for more information on our work on the River (www.tpl.org).
2. There was no coverage of the work being done south of downtown Los Angeles, along the stretch of the River that runs through the gateway cities of southeast L.A. County and through Long Beach. While it is easy to focus on the understandably more appealing natural-bottom portion of the River northeast of downtown, it is important to consider the impact of the work beginning to take shape downstream, where the River runs through some of the lowest-income, most park-poor and densely populated portions of the entire state. The work that some of these communities are doing is as heroic as that of the worthy individuals you profiled. Today, TPL is working with the City of Maywood on assembling contaminated industrial land for a riverside park (thanks in part to important funding support from the Coastal Conservancy), with the City of Paramount on expansion of Ralph Dills Park along the River, and with the City of Long Beach on a 40-acre project along the River that will be as

important to the watershed as the Cornfields and Taylor Yard.

I would be happy to enlighten you and your writer further. Please feel free to call me.

Larry Kaplan

Trust for Public Land

Editor:

Hey, I enjoyed Michael Bowen's article "Salmon Power" (*Coast & Ocean*, Autumn 2001). In general I greatly enjoy paging through *C&O*. I usually read every single word of every issue.

One thing though. The mouth of Alameda Creek is NOT "just a few miles from downtown Oakland." It's, I dunno, maybe 30 miles. It's unfortunate that this article started out with an obvious misstatement in the first sentence, when the truth could have been easily verified.

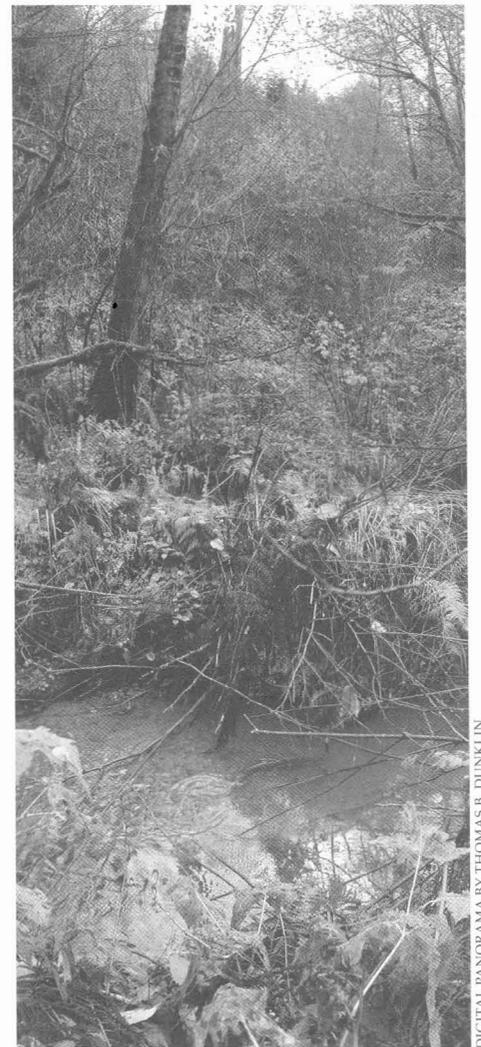
Alison Chaiken

Alameda Creek Alliance

Measured on the EcoAtlas map, it's about 20 miles—that's "a few" for many commuters.—Ed.

Editor:

I enjoyed the article on Salmon Power and the quote "you can now almost cross rivers on the thicket of private and government programs designed to bring the fish back. Yet questions remain." Complicating these efforts is the regulatory arena, where it is frequently the compliant who suffer delays and increased costs of implementation, while the non-compliant are ignored and get away with little or no mitigation. In our experience of over 20 years of implementing fisheries restoration work, we have seen in this past year a ten- to one-hundred-fold increase in design and permitting costs, and an increase in delays of getting the work done on the ground. It is time that we stop hammering the compliant and instead give them incentives



DIGITAL PANORAMA BY THOMAS B. DUNKLIN

Spawning coho salmon have reached Morrison's Gulch in Humboldt County for the first time in many years.

to accomplish this valuable work. Let's focus our regulatory effort on the non-compliant and streamline the process for the rest.

Sungnome Madrone
Redwood Community
Action Agency

Editor:

In "The Artificial Reef Debate" (*Coast & Ocean*, Spring 2001) Christina S. Johnson states that "Port and harbor projects tend to damage wetlands." I would like to make one correction. While it may be that some ports develop in wetlands, the Ports of Los Angeles and Long Beach construct projects in the deeper waters of San Pedro Bay. Coastal embayment habitat which may include wetlands is the agency-preferred mitigation because these

LETTERS

areas are in critical need of restoration, and because the wildlife species (mainly marine fish) that benefit from such restorations are so similar ("in kind") to the types of fish in San Pedro Bay. The ability of ports to restore coastal embayment areas inevitably results in a side net benefit of wetland

enhancement as a result of renewed tidal flushing. The mitigation banks that result from our restoration projects cannot be used to mitigate impacts to jurisdictional wetlands. While the Port of Los Angeles is interested in artificial reefs as mitigation, it is unlikely that artificial reefs will be available for port

mitigation as long as there are questions regarding the production value of artificial reefs, and as long as embayment areas in southern California are available that would benefit from restored tidal flushing.

Ralph G. Appy
Port of Los Angeles

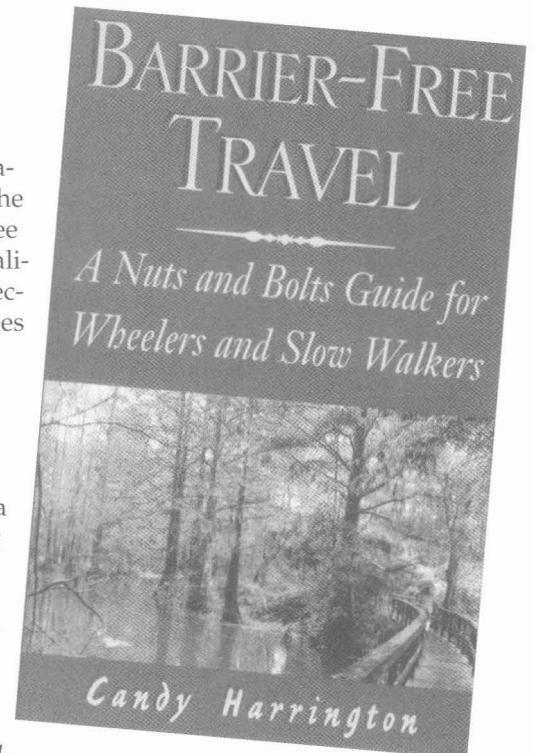
BOOKS

Tijuana 1964: A Photographic and Historic View, by Harry Crosby, Paul Ganster, David Piñera Ramírez, and Antonio Padilla Corona. San Diego State University Press, 2000. English/Spanish, 58 pages, \$18.50 (paper).

YOU AND THE crew can still have your photo taken with sombreros and a burro on Avenida Revolución in Tijuana, but a lot has changed in this big border city. This refreshing work features a photographic view of Tijuana in 1964 by Baja California photographer and historian Harry Crosby. Its 42 black and white photographs portray Tijuana as a small tourist town closely aligned with the pulse of south-

is the theme of the book. Thoughtful essays help the reader understand Tijuana's development and come to terms with the city of today, a place where meteoric growth, industrialization, and urban sprawl have seized the day. The story is expertly told by three authorities on the San Diego/Baja California border area: Paul Ganster, director of the Institute for Regional Studies of the Californias at San Diego State University, and Piñera Ramírez and Padilla Corona, leading Baja California historians from the Universidad Autónoma de Baja California in Tijuana. For those who appreciate "la frontera" and take solace in recalling a simpler time, this is a sure bet for the coffee table.

—Jim King



Barrier-Free Travel: A Nuts-and-Bolts Guide for Wheelers and Slow Walkers, by Candy Harrington. Emerging Horizons, 2001. 230 pp., \$18.69 (paper).

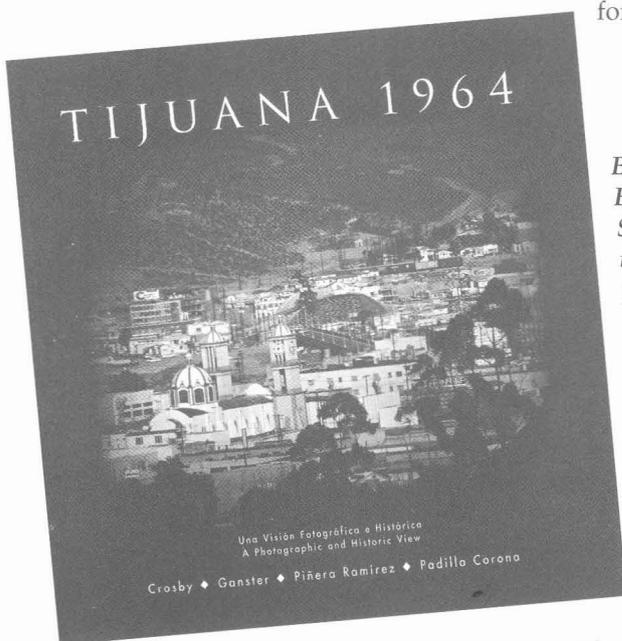
I'M GOING TO Puerto Rico! I use a wheelchair, and I just learned from *Barrier-Free Travel* that Luquillo Beach is wonderfully accessible and one of the most beautiful beaches in the Caribbean.

Although a few particular destinations are suggested in this travel book for people with disabilities, it focuses more on broader principles of travel—from how to get the most out of a travel agent to tips and a few personal stories about hotel accommodations, outdoor recre-

ation, and travel by air, car, bus, train, and cruise ship. Issues such as traveling with guide animals or ventilators are discussed, and recommendations given. The book also summarizes what to expect when you venture beyond the helpful reach of the Americans with Disabilities Act (ADA) in Canada, Europe, and Australia.

Not all people's specific needs can be addressed in one book, but this volume presents crucial principles and resource lists with phone numbers and web site addresses. It will enable most readers to feel ready and able to pack their bags and make their plans for a hassle-free vacation.

—Erick Mikiten, AIA



ern California and, at the same time, a city steeped in the national life of Mexico. This dualism, in 1964 and in 2000,

CHECK THIS OUT!

Some back issues of *Coast & Ocean* are still available. Themes include:

- Los Angeles River Revival (Autumn 2001)
- Secrets of San Bruno Mountain (Spring 2001)
- California's Wild Islands (Autumn 1999)
- Nibbling at the Public's Coast (Summer 1999)
- Citizen Power (Spring 1999)
- The Year of the Ocean (Winter 1997-98)
- Nature Tourism (Summer 1997)
- Coastal Recreation (Autumn 1996)

Also vintage issues including:

- Crops vs. Condos (Winter 1995)
- Coastal Access (Summer 1995)
- Morro Bay (Autumn 1992)
- Environmental Education (Summer 1992)
- Ocean Special (Winter/Spring 1991)
- Plant Wars (Winter/Spring 1990)
- Climate Change (Autumn 1989).

Other available Conservancy publications include:

- *San Francisco Bay Shoreline Guide*, 1995 (\$16.18 includes CA sales tax and shipping)
- *A Wheelchair Rider's Guide: Los Angeles and Orange County Coast*, 2001 (free)
- *A Wheelchair Rider's Guide: San Francisco Bay and Nearby Shorelines*, 1990 (free)
- *Happy Trails to You: How to Accept and Manage Offers to Dedicate Access Easements*, 1997 (free)
- *Limitations on Liability for Nonprofit Land Managers*, 1997 (free)
- *Wetlands of the Los Angeles River Watershed: Profiles and Restoration Opportunities*, 2000 (free)

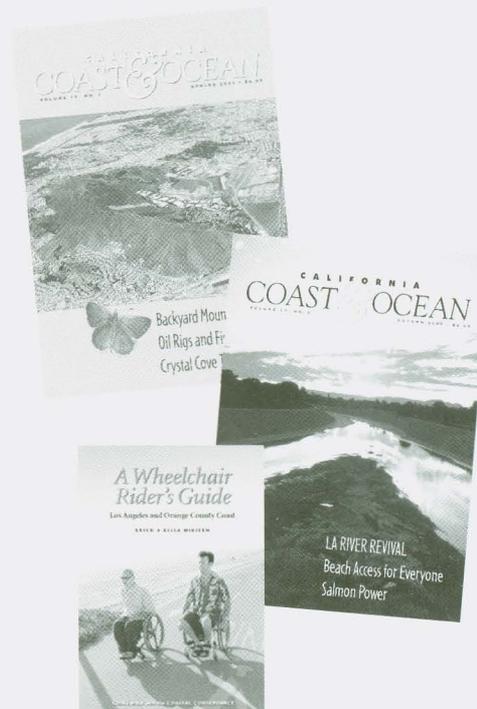
Write or e-mail us for a complete C&O index.

Also available are photocopied packets of all C&O articles on California/Mexico border issues and on beach erosion/sand management.

Back issues and packets are \$2.50 per copy or \$2 each for five or more, including shipping. Offer is good till September 1, 2002 if our supply lasts that long. Ask about further discounts for teachers and schools.

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