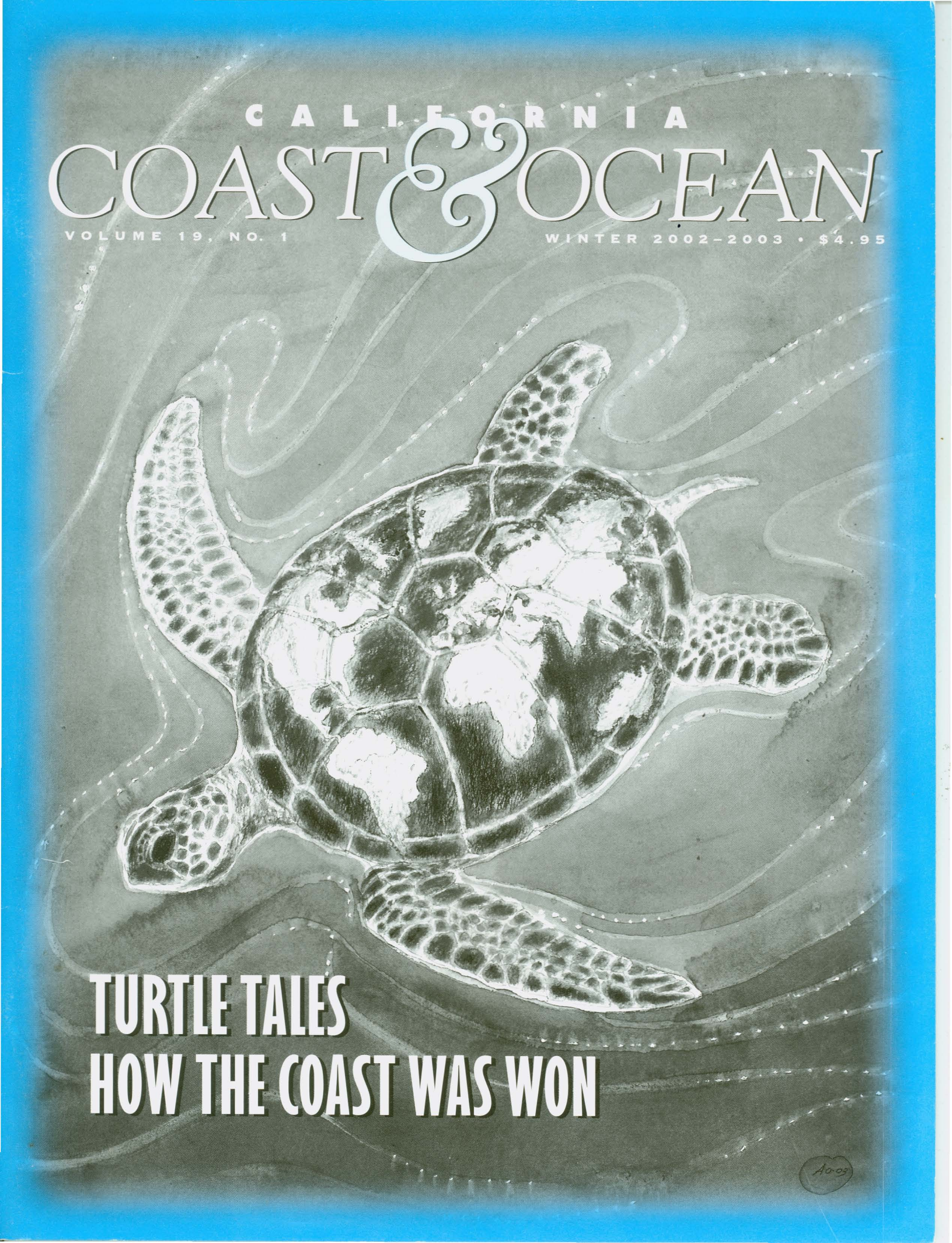
CALIFORNIA
COAST & OCEAN
VOLUME 19, NO. 1 WINTER 2002–2003 • $4.95



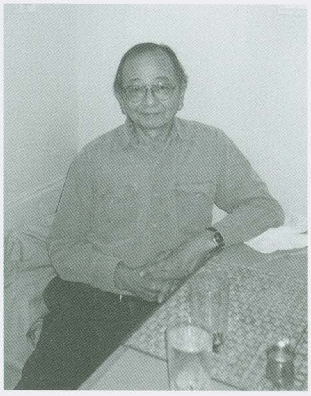
TURTLE TALES
HOW THE COAST WAS WON

Visit our Internet web site at:
www.scc.ca.gov.

Our web site includes most of the articles from the print edition (some abridged), many color photos, back issues, and some supplemental information.

To subscribe to
CALIFORNIA COAST & OCEAN
for one year (four issues), $18 ($15 for teachers); for two years (eight issues), $33 ($30 for teachers), send a check payable to "Coastal Conservancy" to:

COAST & OCEAN
Coastal Conservancy
1330 Broadway, 11th Floor
Oakland, CA 94612



Cover: Arthur Okamura lives and paints in west Marin County. Some of his recent work captures the multi-layered play of light on water and the shore—translucent fog on the ocean, the gleam of pebbles in mudflats at ebbtide, the deep glow of a lagoon. When *Coast & Ocean* invited him to create a cover for this issue, he said, "What immediately came to mind was a sea turtle with the world on its back."

Back cover: Black sea turtle at Estero Banderitas, Baja California, by David Barron

Coastal Conservancy

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

CONSERVANCY MEMBERS:
Paul Morabito, Chairman
Larry Goldzband, Vice-Chairman
Tim Gage
Gary A. Hernandez
John J. Lormon
Mary Nichols
Mike Reilly

ALTERNATES:
Susan Hansch
Fred Klass
Mike Spear

EXECUTIVE OFFICER:
Sam Schuchat

CALIFORNIA COAST & OCEAN
California Coast & Ocean is published by means of a Coastal Conservancy grant, in association with the California Academy of Sciences.

Rasa Gustaitis, Editor
Dewey Schwartzenburg, Managing Editor
Hal Hughes, Senior Associate Editor
Anne Canright, Associate Editor
Phyllis Faber, Wesley Marx, Contributing Editors
Tom White, Circulation Consultant

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

CALIFORNIA COAST & OCEAN (ISSN 1052-5823) is published quarterly at $18 for four issues. Copyright © 2003 Coastal Conservancy, all rights reserved. No part of this issue may be reproduced by any mechanical, photographic, or electronic process or otherwise copied for public or private use without written permission of the publisher. All opinions expressed are the responsibility of the authors, and do not necessarily reflect the positions, official or otherwise, of the Coastal Conservancy, the California Academy of Sciences, or the editors. Direct all correspondence, including editorial submissions and subscription requests, to:

CALIFORNIA COAST & OCEAN
1330 Broadway, 11th Floor
Oakland, CA 94612
e-mail: calcoast@igc.org
Subscription information: (510) 286-0515
Editorial: (510) 286-0934

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

Printed on recycled paper with soy-based ink.

CALIFORNIA

COAST & OCEAN

VOLUME 18, NUMBER 4 WINTER 2002–2003

CITY OF MONTEREY

3 Our Turtle Coast
Serge Dedina
Securing a future for sea turtles

12 Beach Water Pollution: Learning What We Need to Know
John Largier
An oceanographer's perspective

20 Seeing the Fractal Coast
Hal Hughes
Repeating patterns across scales

22 Murres, Come Back to Your Rocks!
Anne Canright
Schoolchildren help murre recovery

27 How the Coast Was Won
Rasa Gustaitis
An interview with Lew Reid

33 Next Steps along the Coastal Trail
Richard Nichols

DON NIERLICH

DEPARTMENTS

2 COASTAL VIEWPOINT
The Future Has a Past

34 EBB AND FLOW
- *Better Access to Humboldt Bay Dunes*
- *Fort Bragg's Glass Beach*
- *Bodega Bay Trail Planning*
- *Another Working Ranch near Tomales Bay Protected*
- *Petaluma River and Marsh*
- *Progress on San Francisco Bay and Ridge Trails*
- *Delta Slough to Become Marsh*
- *Eco Village for Youth in Richmond*
- *Pacifica Pier Repairs*
- *Santa Cruz Depot Site Renovation*
- *War on Giant Reed along San Luis Rey River*

38 BOOKS

40 LETTERS

The Future Has a Past

NOT LONG AGO, I PICKED up a fine story collection by J. California Cooper, partly because of its title, *The Future Has a Past.* It set me to thinking about the way an understanding of history affects our perception of the present, and of something I heard the sociologist and peace activist Elise Boulding say years ago: that the image young people have of the future affects what transpires three decades later.

It's now more than three decades since the first images of Earth from space brought the awareness that we live on a small and fragile planet. "We are all island people," said ecologist Raymond Dasmann in 1971, during a talk on a Pacific island, New Caledonia. "Most of us did not fully realize this until we sent our astronauts into the skies and were shown a picture of island earth against its background of a black and star-specked sea of space. . . . There is no continent to which we can flee, only other island planets where the environments are hostile and forbidding. We must do the best we can with what we have—other resources are not available. If we destroy those elements that we need for survival, we cease to exist."

Inspired by that realization, crowds of young people moved out of cities in a quest for life in harmony with nature. Throughout the country, citizens joined in campaigns to safeguard our commons: the air, rivers, wetlands, forests, parklands, wildlife habitat, and our coasts and nearshore waters. It was an expansive, promising decade; positive change was on the move, and the direction of public policy changed. The myth that jobs and environmental protection were incompatible was unmasked as a sham. Developers were required to consider the environmental costs of their projects.

So it can be said that the vision at the dawn of the space age was translated into action, however imperfectly, and has affected the course of affairs. Over and over again, voters have shown that they value environmental protection. Elise Boulding's theory has been borne out.

How, then, to explain the current federal government's attack on our shared values? Our right to breathe clean air, drink clean water, enjoy ourselves as part of nature within a diversity of species is increasingly threatened. The powers that be in Washington appear to be bent on undoing three decades worth of environmental protections against destructive human behavior.

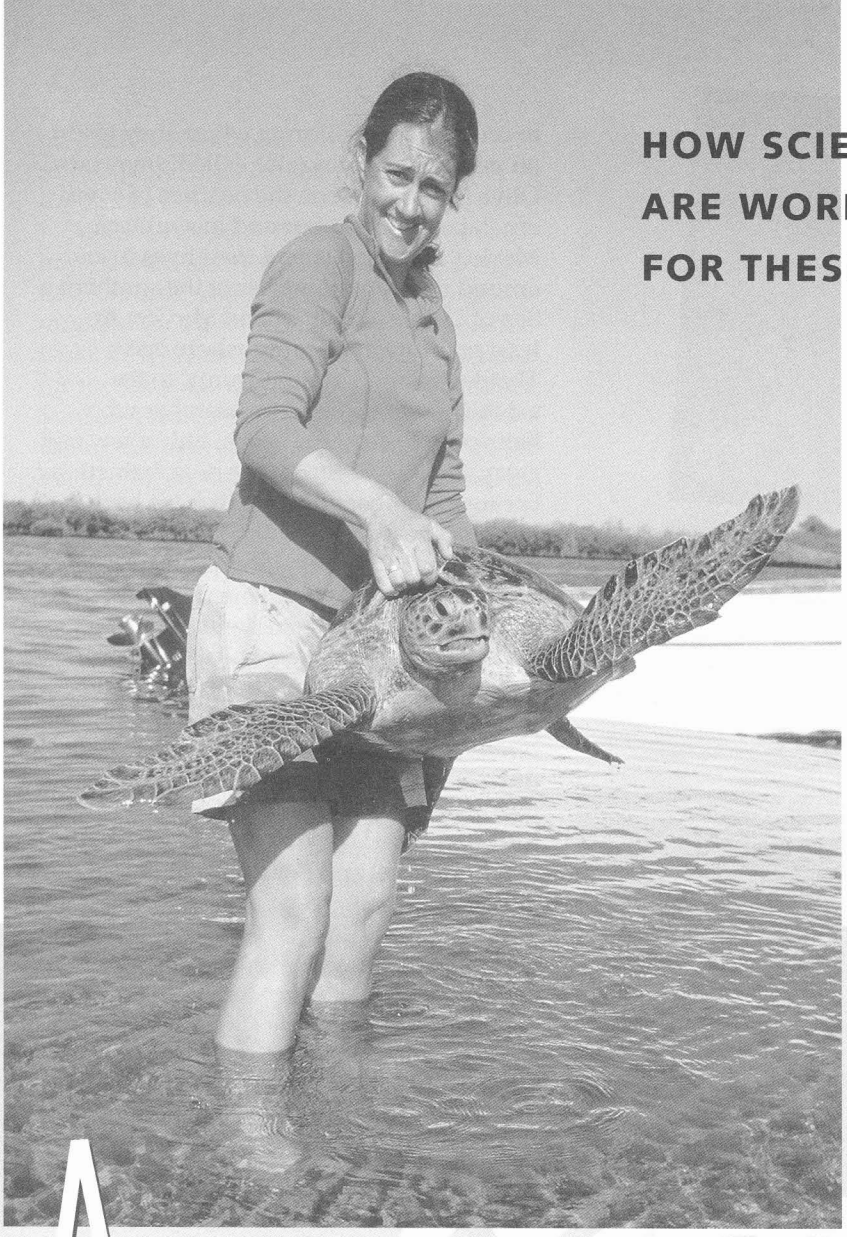
At a February 1 gathering in the Monterey Bay Aquarium to celebrate the 30th anniversary of Proposition 20, the 1972 Coastal Initiative, leaders of that successful grassroots campaign warned that everything that has been won is now again threatened, and urged activists to prepare to fight again for the coast. Richard Charter, of the Natural Resources Defense Council, saw a "most insidious and multi-layered attack," and Coastal Commissioner Sara Wan saw a threat of "death by a thousand cuts," and warned that "government doesn't work without public involvement."

Because the future has a past, it's helpful to look at how the coast was won in 1972, with little more than "shoe leather and cauliflower ears from the telephone," as Lew Reid tells us in the interview on page 27. Thousands of citizens were involved—all volunteers. They worked hard and played hard. You can't fight for life if you're grim and fearful. They used their imaginations and had fun. Warner Chabot of the Ocean Conservancy recalls that when opponents plastered Los Angeles with a thousand billboards reading "Don't lock up the coast, vote No on Proposition 20," some high school students, equipped with stickers reading "Yes," went cruising one night. By the following morning, half of the opponents' signs were urging people to vote Yes in Day-Glo red. And they did. The landmark "Save Our Coast" initiative passed and was embodied four years later in the California Coastal Act. Reid points out that Proposition 20 carried a lesson: "When the legislature is not courageous enough to face a critical issue . . . the people are likely to do so."

I tracked down Elise Boulding, now 82 and living in Needham, Massachusetts, to ask her: What future might the people currently in power in Washington possibly have imagined 30 years ago? What might have made them so angry and fearful? "An image of infinite power, superpower, a very sad image," she suggested, "not the image that would fulfill the dream on which the United Nations was founded."

Boulding's latest book, published in 2000 by Syracuse University Press, is *Cultures of Peace: The Hidden Side of History*. For many years she held workshops that brought people together to think a hundred years ahead and envision a world at peace, then work backward to the present to find the way to get there. Though her health does not permit her to travel much now, she continues to participate in efforts to transform war cultures into "an interconnected localist world of adventurous but peaceful problem-solvers."

—*Rasa Gustaitis*



DAVID BARRON

HOW SCIENTISTS AND CITIZENS ARE WORKING TO SECURE A FUTURE FOR THESE ANCIENT MARINERS

Our Turtle Coast

SERGE DEDINA

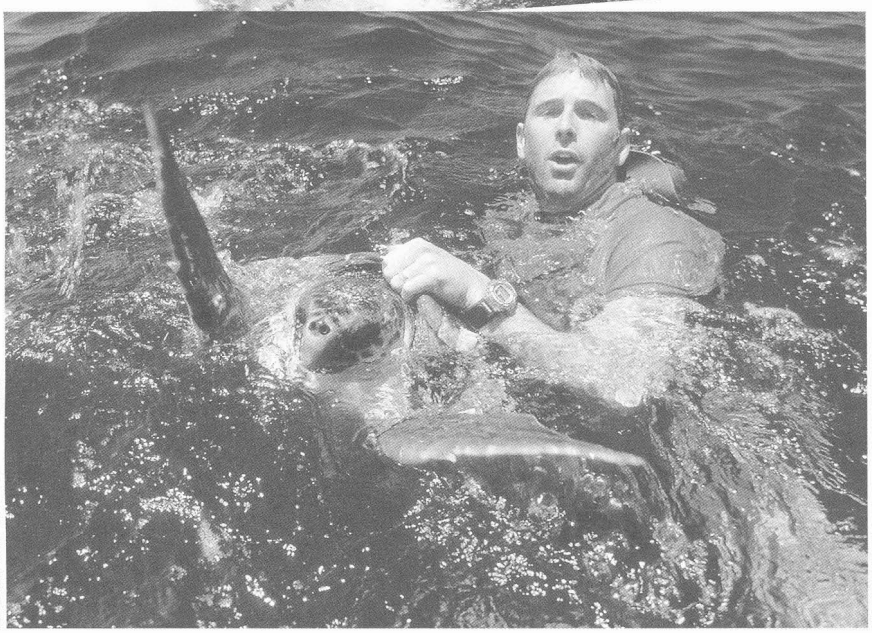
AT THE END of a mud-lined canal at the southern end of San Diego Bay, there is a wildlife hotspot that has long been kept secret. This canal is a conduit for 500 million gallons of hot chlorinated water discharged daily from a power plant operated by Duke Energy. It is also the hidden home of up to 60 Eastern Pacific green turtles (also known as black turtles because of their dark carapaces)—a species that once faced extinction, but now may be on a slow road to recovery.

To get to San Diego Bay, where they feed on eelgrass, the animals swim thousands of miles from nesting beaches in southern Mexico and in the Revillagigedo Islands south of Cabo San Lucas. Along the way, they must avoid poachers in the Pacific lagoons of Baja California (turtle meat is part of Mexico's traditional cuisine), the longlines and nets of the shark and shrimp fleets, and the cargo containers and destroyers that move in and out of San Diego Bay. The canal where they rest between forays around San Diego Bay to search for eelgrass is at the edge of the South San Diego Bay National Wildlife Refuge.

The green turtle is one of five species of sea turtles that live or spend part of every year in the Californias, between the Upper Gulf of California Biosphere Reserve in the Sea of Cortez and California's northern border. All are listed as either threatened or endangered in the United States and Mexico. All are long-distance swimmers.

Giant leatherback turtles travel from as far as Indonesia to feed on jellyfish in Monterey Bay. Loggerhead turtles swim from Japan to the North Pacific and travel south, along the entire length of California's coast,

Above: Louise Brooks holds a green sea turtle at Estero Banderitas, Baja California.



PHOTOS THIS PAGE: DAVID BARRON

Wallace J. Nichols "rodeos" a loggerhead turtle in Magdalena Bay, Baja California. After capture, the turtle was fitted with a satellite-tracking transmitter.

to central Baja California where they feed on pelagic red crabs (also called tuna crabs). Olive Ridleys nest on the beaches of southern Baja California Sur and in southern Mexico, and most spend their lives in and around the tropical waters of the southern Sea of Cortez and mainland Mexico. At least one, however, came ashore last Thanksgiving in Marin County, to the astonishment of a turtle researcher who happened to be at the beach, only a few feet away. Hawksbill turtles are near extinction because their beautiful shells have been used for the making of "tortoiseshell" products. Remnant populations survive in the Sea of Cortez and embayments of the Mexican states of central mainland Mexico.

The lagoons and bays of Baja California and southern California once harbored thousands of sea turtles. In the mid-19th century, as whaling ships began to take them in huge numbers for export, one U.S. whaler reported filling a ship with 60 green turtles in Magdalena Bay alone. Later, gillnets, longlines, and poachers continued the destruction.

In 2000, fewer than 1,000 green turtles nested on the main nesting beaches of Michoacán in southern Mexico. In 2001, however, biologists saw a hopeful sign: almost 2,500 came ashore and laid their eggs, the highest number in 20 years.

The story of sea turtles of the Californias is also the story of a tenacious international team of Californian scientists and activists who are working to rescue them from oblivion. Working across the international border, they merge research and conservation in ways that could serve as a model for others in the struggle to preserve our marine heritage. Their work includes protective measures, such as the reporting of poachers, carrying out a Spanish-language binational "Don't Eat Sea Turtle" campaign, and developing protected areas in key sea turtle feeding sites in California and Baja California.

Captain Eddie's Turtles

AMONG the most fascinating sea turtles in the Californias are the green turtles that inhabit the warm waters of south San Diego Bay. Marine biologist Margie Stinson, assistant professor of marine biology at Southwestern College in Chula Vista, has been studying them since 1976, when Eddie McEwen, 84, the longtime skipper of the sportfishing and natural history tour vessel *Pacific Queen,* tipped her

off to their presence in the canal of the power plant, then owned by Southern California Edison.

"Without Captain Eddie, I would never have known about sea turtles in San Diego Bay," Stinson said. We were standing on a muddy bank, a few hundred yards from the Duke Power Plant in Chula Vista, watching for turtles in the discharge canal while 25 of Stinson's students, deployed nearby, were timing the intervals of turtles coming up for breath. "Eddie was the first person to tell me about where the turtles were hiding out."

Captain Eddie's tip led Stinson to develop a personal interest in the sea turtles. With the assistance of power plant staff, she continued to observe them. This work led to a master's thesis project—an encyclopedic two-volume tome about the turtles, completed in 1982. "The operators of the power plant and I were always worried that if more people knew about the turtles, there would be a greater chance that someone would harass them or even steal one," she said. As far as they could tell, that did not happen, although a high school swim coach once "borrowed" a turtle to show to his team.

As Stinson continued her observations, she began to understand that some of the turtles were staying year-round. Instead of swimming south to the warmer waters of Baja California and the Sea of Cortez, they were burrowing into the mud around the canal during the winter. It appears that 60 to 80 turtles are now in residence, and some of them are large, mature adults.

Stinson later embarked on a career as a naturalist on the *Pacific Queen* and spent thousands of hours in the waters of Baja California, often observing sea turtles.

In the 1980s, Peter and Donna Dutton, who had previously researched sea turtles in French Guiana and St. Croix, also discovered those in San Diego Bay. Expanding on Stinson's research, they determined that among the turtles that continued to migrate, most came from the Revillagigedo Islands and from the nesting beaches in Michoacán.

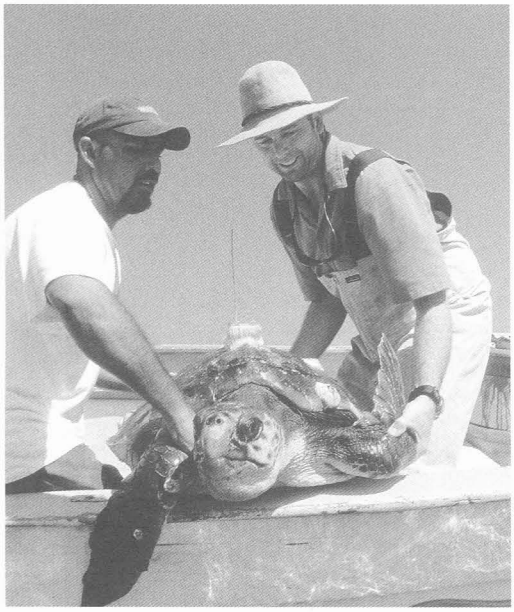
The Duttons also learned that green turtles, herbivores that favor eelgrass and algae, made ample use of the south San Diego Bay eelgrass beds—one of the few remaining eelgrass beds in the bay. After spending time in the discharge canal, they would swim out into the open bay, then make a circuit around the eelgrass patches south of the Coronado Bay Bridge.

Now the Duttons, Stinson and her students, and a squad of citizen monitors have embarked on a long-term project, calling themselves the San Diego Sea Turtle Team. Stinson continues to monitor the turtles immediately around the power plant, while the Duttons track turtle movements around the bay, using radio transmitters provided by a grant from the Port of San Diego. Dutton is also analyzing green turtle DNA to determine where they migrate from. He believes that the presence of a stable but small population of healthy green turtles in San Diego Bay could be important to recovery of the species, given the pressures on green turtle populations from poaching and bycatch, especially in Baja California.

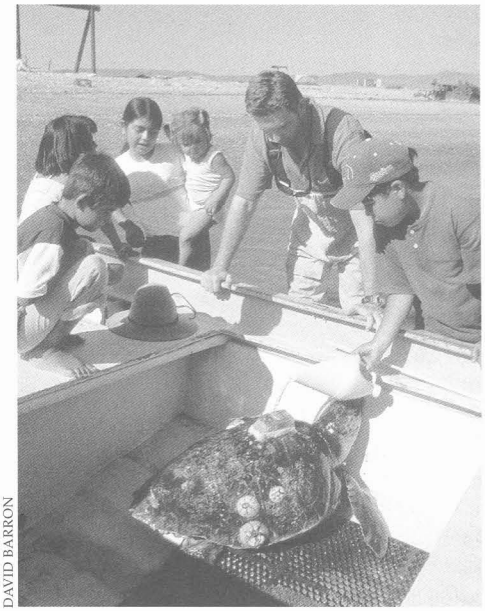
The Sea Turtle Team is greatly assisted by Gerry Adler, an avid outdoorsman, and a squad of his friends who kayak on the bay two or three times a week. They keep a lookout for turtles and report sightings to Peter Dutton by e-mail. The animals generally concentrate in known feeding areas near the Sweetwater Marsh and around the eelgrass beds south of the Coronado Cays.

TERRI GARLAND

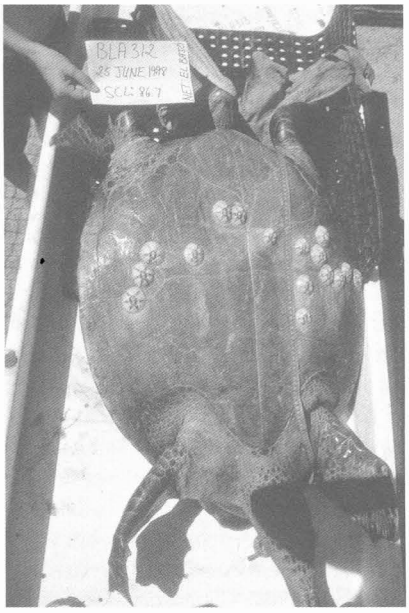
Margie Stinson on the lookout for San Diego Bay's green turtles



DAVID BARRON



DAVID BARRON



JEFFREY SEMINOFF

Top left: Nichols and Rodrigo Rangel Acevedo release a loggerhead turtle outside Magdalena Bay.

Top center: Children check out a loggerhead turtle with transmitter and barnacles, and help Nichols to keep it cool.

Top right: The plastron (undershell) of a green sea turtle

Adler first heard of the turtle project from a local television news broadcast. Worried that the turtles' presence, combined with the then newly established wildlife refuge, would lead to prohibitions on kayaking in the southern part of the bay, he contacted Dutton and volunteered to record his observations on sea turtles. His contribution not only has demonstrated the effectiveness of citizen monitors as reliable sources of data on sea turtles, but more important, it has made him and his fellow kayaker-observers into vocal protectors of these remarkable creatures. In December 2002, Adler successfully organized kayakers in San Diego to lobby the California Coastal Commission for a resolution supporting turtle conservation.

The San Diego Sea Turtle Team is a vital link in a growing conservation network spanning the U.S.–Mexico border to assist the recovery of sea turtles and create a culture of sea turtle conservation in the Californias.

NICOLE STODUTO/DEFENDERS OF WILDLIFE

During the 1999 meeting of the World Trade Organization in Seattle, people dressed as turtles protested a WTO ruling that a U.S. law to protect sea turtles violated WTO regulations. The law forbade shrimp from being sold in the U.S. if the country it came from did not require turtle-excluder devices on shrimp nets.

Don't Eat Sea Turtle Stew

IF THE turtles are to survive, cultural changes will be essential. In Mexico, sea turtle is valued, even revered, as a traditional dish, *caguama*. Consequently, a 1990 presidential decree forbidding the killing of turtles has been largely ineffective; indeed, it has perhaps only served to stimulate a thriving black market. A large turtle can bring up to $1,000, says Wallace J. Nichols, a biologist at WiLDCOAST, who began studying sea turtles in Baja California while a doctoral student in wildlife ecology at the University of Arizona. He estimates that some 35,000 sea turtles are netted each year in the waters of Baja California and the Sea of Cortez and sold in Mexico, Arizona, and California.

San Diego Bay, oddly enough, "is probably the only the place along the black turtle

LEATHERBACKS OF MONTEREY BAY

WHILE GREEN TURTLES ARE ARRIVING in San Diego during late summer and early autumn, a group of giant leatherback turtles completes its 10,000-mile cross-Pacific journey from nesting areas in Indonesia and gathers silently in the deepwater National Marine Sanctuary at Monterey Bay.

"Leatherback migration is amazing because the distance is enormous, even longer than that of most large whales that I'm aware of," says Scott Benson, a research fisheries biologist with the National Marine Fisheries Service (NMFS) Sea Turtle Program at Moss Landing. "Leatherbacks have evolved to take advantage of travelling on ocean currents and they traverse all those fishing nets and predators." Killer whales, white sharks, and crocodiles prey on these turtles. The fact that leatherbacks travel to Monterey Bay "says something about the quality of foraging resources here—that it is predictable enough for the animals to evolve to do this long migration."

Benson is a member of a tight-knit team, including some of the most distinguished sea turtle researchers in the U.S., which conducts a long-term monitoring program throughout the leatherback's entire range in the Eastern and Western Pacific. From Indonesia it travels northward, then across the Pacific and south along the entire California coast.

KIM CLIFFTON

Leatherback turtle hatchlings

Meanwhile, in Indonesia, Peter Dutton, of NMFS, and Scott Eckert, of Hubbs Sea World Research Institute, are training researchers and working with local scientists to understand the size of the nesting population. They direct the team's long-term leatherback-monitoring program throughout the turtle's entire range in the Eastern and Western Pacific. As the coordinator of the La Jolla–based NMFS West Coast Sea Turtle Program, Dutton is responsible for managing federal sea turtle programs along the coast of California, Mexico, and South America, and for sea turtles that feed in California and nest in Asia.

In Monterey Bay, Benson and his team are observing and tracking behavior of turtles in their feeding grounds. Although leatherbacks inhabit most of the coast between northern California and Baja California, Monterey Bay is an ideal location for this study. The Monterey National Marine Sanctuary and several marine science institutions are nearby.

To track a leatherback, Benson's team attaches a $4,000 satellite transmitter held by a webbed harness designed by Eckert to fit over the turtle's carapace. This is no mean task. First the leatherback must be captured.

These turtles are not easy to see in Monterey Bay at water level, as they tend to blend into the water and stay just below the surface. Researchers use a special airplane, a twin-engine Italian Partavania Observer with bubble windows and a belly window, flown at 600–700 feet, to spot the turtles. They radio the location to a waiting boat, which speeds toward the turtle and does the work—very carefully.

Leatherbacks are the largest sea turtles. They average 800 pounds and about six feet in length, although a ten-foot leatherback has been recorded. They lack the hard carapace of other turtle species, instead being covered by a layer of black cartilaginous material, with seven ridges which are believed to act as keels for efficient swimming. On land these marine giants move awkwardly, snorting as they exhale, emitting a sound reminiscent of whales. Researchers find the sight and sound endearing.

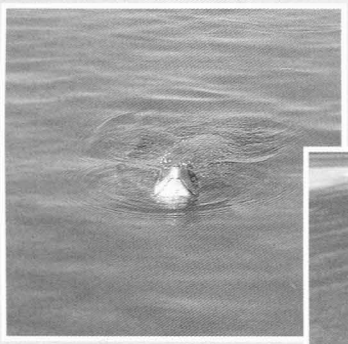
To the Seri Indians of Baja California, the leatherback was one of the original kinds of humans (along with the boojum tree and the teddy bear cholla, among others), and figured prominently in their ceremonies. The Seri believed that leatherbacks understood their language, so they always whispered in these turtles' presence.

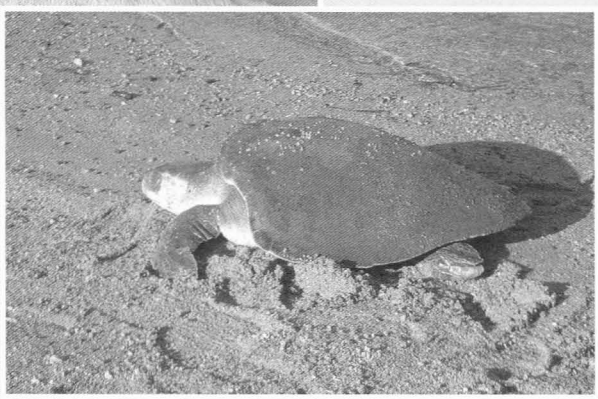
OLIVE RIDLEY

ON THANKSGIVING DAY 2001, Reuven Walder of the Turtle Restoration Network was sitting on Shell Beach in Inverness, Marin County, enjoying the sunshine with his wife and small daughter, when he noticed something swimming toward the shore. Moments later, to his surprise, an olive Ridley turtle came ashore, almost directly in front of him. Fortunately a camera was close at hand, so there is evidence of this highly unlikely event.

Olive Ridleys had not been known to come this far north, as they prefer the warmer waters many miles to the south. This visit may be related to El Niño shifting warmer waters northward. Whatever the reason, to Walder this was an amazing gift.

This is the smallest of the sea turtles (averaging 100 pounds and two feet in length) and of the five California species it appears to be doing the best, in part because its meat has been found to be foul-tasting. Its leatherlike skin is highly prized, however. Beach development is the greatest threat to this turtle. In southern Baja California, researchers are actively protecting nesting beaches, with the help of tourism operators and government officials.





PHOTOS THIS PAGE: REUVEN & DEVORAH WALDER

migratory route where they are not at risk from being caught by a poacher, butchered, and served at a restaurant for $40 a plate," Nichols said. Federal agents in Mexico and the United States have documented the importation of sea turtle meat into the United States. Some restaurants in Chula Vista are reported to occasionally serve *caguama* stew. So far no one has reported the theft of turtles from San Diego Bay. However, when San Diego Bay turtles return to Baja California they immediately face the grave danger of being captured by poachers.

Sea turtle consumption is traditional to the culture and economy of Baja California's fishing communities, much the way salmon is to the Yurok and other northern California tribes. Fishing families often traded sea turtles for staple items at inland markets. Weddings, baptisms, and birthdays are still highlighted by the consumption of sea turtle stew. The starry-eyed way in which fishermen and their families talk about eating sea turtles might suggest that it would be impossible to carry out monitoring and conservation programs in these communities. But it is precisely this reverence for sea turtles that has allowed Nichols to partner with a new generation of activists and battle the poachers who slaughter sea turtles by the thousands. They are working together to transform tradition, so that instead of eating these endangered animals, communities work to save them.

Punta Abreojos (population 1,000) is on the Pacific Ocean, about 700 miles south of the U.S. border in Baja California, 60 miles from the Transpeninsular Highway on a car-killing dirt road. It is a community that depends on fishing for its survival. Because the local fishing cooperative was granted an exclusive concession to almost 200 square miles of ocean adjacent to the town, local fishermen have an incentive to manage their fishing grounds over the long term. And because the cooperative brings in almost $5 million a year from the lucrative trade in abalone and lobster alone, it has adopted strict regulations to govern local fishing and to keep outsiders from stealing local resources. Consequently, a culture of marine stewardship has developed. Enforcement of anti-poaching measures has meant that sea turtles are left unharmed in the waters of Punta Abreojos.

This local culture of stewardship met its test when the Mitsubishi Corporation of Japan and the Mexican government announced plans in 1995 to build a 500,000-

acre industrial salt facility in and around Punta Abreojos and neighboring San Ignacio Lagoon. Concerned about the impacts to their fishing grounds, local fishermen, including lobster fishermen Javier Villavicencio and Isidro Arce, allied themselves with an international coalition of environmental groups fighting the salt project. It was defeated in 2000, so Villavicencio and Arce looked for new ways to stimulate the town's economy, ways that would not damage the environment. Prompted by Nichols, who had been amazed at the numbers of turtles he found in the area, they thought sea turtle tourism might be a compelling alternative to industrial development.

Poacher Joins Campaign

ON AN OVERCAST AFTERNOON in July I watched Villavicencio, Arce, and Miguel Valenzuela expertly weigh five sea turtles they had caught in the mangrove- and dune-lined Estero Coyote, an uninhabited wetland south of Punta Abreojos. They treated each turtle with the speed and precision learned in a lifetime of handling fish and lobster. Each turtle was measured, weighed, tagged with a metal flipper tag, and returned to the shallow, eelgrass-lined waters of the estero. As Villavicencio was recording a turtle's measurements, Arce—who at 6'3" towers over most of the fishermen in town—turned to me with tears in his eyes: "I never believed that we could be so successful at saving these *tortugas*," he said. "I am so proud of my town."

Arce and Villavicencio, who is also a passionate surfer, are founders and members of the Punta Abreojos CoastKeeper, a member of the International WaterKeeper Alliance. They are also members of a six-site, peninsula-wide sea turtle monitoring program, coordinated by Nichols and funded by the National Marine Fisheries Service and U.S. Fish and Wildlife Service.

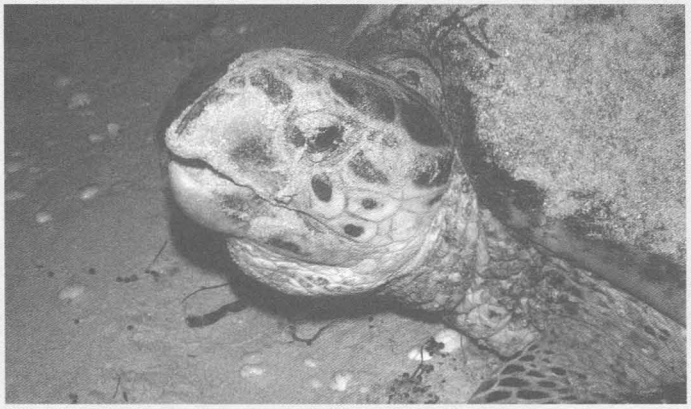
The surveys are carried out monthly, and data are tabulated, then faxed to Nichols. Of the six monitoring sites—Bahía de los Ángeles, Loreto, Scammon's Lagoon, San Ignacio Lagoon, Bahía Magdalena, and Punta Abreojos—the highest records consistently come from Punta Abreojos. Nichols initiated the monitoring program last year to document the status of the green turtle population in their feeding grounds in Baja California. "For years, it was commonly believed that the only reason that black

HAWKSBILL SEA TURTLE

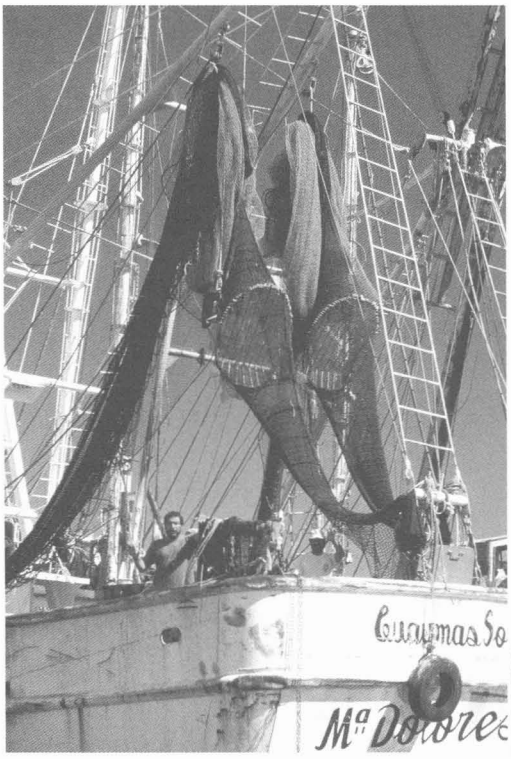
HAWKSBILL TURTLES ARE NEARLY EXTINCT in the Eastern Pacific. They are almost impossible to find, even in their traditional haunts, the shallow waters along the coast of Baja California's Sea of Cortez, where there once were thousands. The plates of hawksbill carapaces are used as "tortoiseshell," and are highly valued.

"Stuffed hawksbills are the turtles most likely to be found displayed on restaurant walls and in people's homes in Baja California," says Wallace J. Nichols, "even though they are now the least likely to be found in the wild." He is not optimistic about these turtles' survival. In 2001, a rare hawksbill–green turtle hybrid was stolen from a Mexican government research center in Bahía de los Ángeles and eaten by the thieves. The average hawksbill weighs just over 100 pounds and measures up to three feet long. Little is known about its nesting habits on this side of the Pacific.

Some information in this and the two preceding turtle descriptions is from *Amphibians and Reptiles of Baja California,* by L. Lee Grismer. University of California Press, Berkeley, 2002. 399 pp., $95 (hard cover).



JEFFREY SEMINOFF



DAVID BARRON

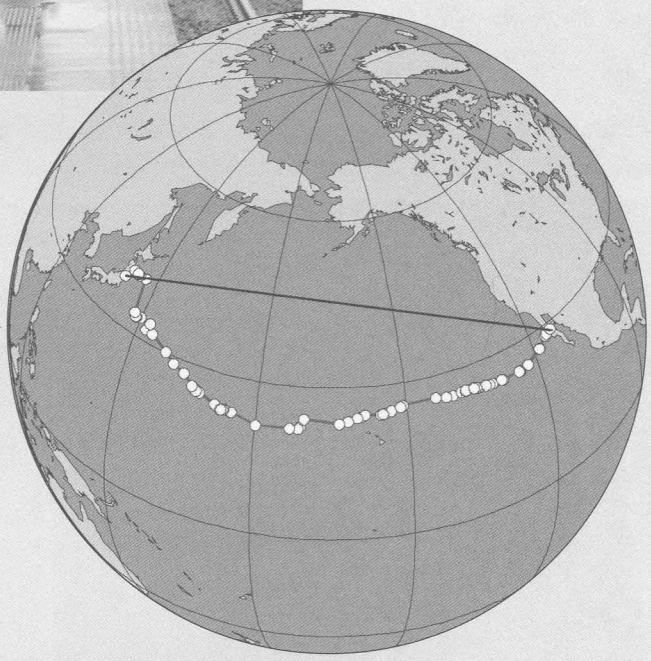
The nets on this fishing boat are designed to keep turtles out.

LOGGERHEAD SEA TURTLE

THESE LIGHT BROWN AND YELLOWISH TURTLES hatch on Yakushima island in southern Japan, and swim 8,000 miles to feed on pelagic red crabs off the Baja California coast. They bask at the surface for hours, often with birds perched on their backs. Adult loggerheads weigh 200–500 pounds and average three feet in length.

Loggerheads are prey to humans who hunt them illegally for meat and take their eggs. Many perish as bycatch in lobster nets, shrimp trawl nets, and entangled in longlines. Recently, more than 1,000 dead loggerheads have been washing up each year on the barrier beaches of Magdalena Bay. Peter Dutton of NMFS is working with biologist Nichols of WiLDCOAST, Mexican fishermen, and government biologists to monitor the population of loggerhead turtles that swarms the central Pacific coast of Baja California.

PHOTOS THIS PAGE: DAVID BARRON



MAP: WALLACE J. NICHOLS

Top left: Adelita, the first loggerhead turtle tracked by satellite from Baja California to Japan, swam 7,456 miles across the Pacific but did not make it to her birthplace on Yakushima Island. She was picked up by a squid boat 200 miles offshore and taken to Isohama, near Sendai. Nichols used a GPS system to follow her. Here he is in a train station near Sendai.

Top right: Japanese turtle tag found by a fisherman in Baja California five years after a six-month-old loggerhead was released in Okinawa in 1988.

Bottom: The map shows Adelita's trans-Pacific trek.

turtle populations had declined was egg poaching on the nesting beaches," Nichols said, "But researchers at the University of Michoacán demonstrated that for the most part, the nesting beaches have been subject to stringent anti-poaching efforts for the past 20 years, and that nesting-beach protection efforts were working." Although bright lights from nearby resorts now present a growing problem, Nichols determined that the decline in the nesting-beach population in Michoacán was due to the illegal trade in grown sea turtles.

Villavicencio now travels to each monitoring site to assist local turtle monitoring teams and talk with residents about why they shouldn't catch and eat sea turtles. "These animals are more valuable alive than dead," he said. "But I also want my children and grandchildren to be able to swim with them. I don't want to lose these animals from the ocean."

Villavicencio and Arce enjoyed their greatest success so far when they assisted in the capture and arrest of Baja's most notorious sea turtle poacher, Francisco "Gordo" Fischer. The infamous *pirata* later confessed from his Punta Abreojos jail cell that he had killed around 15,000 sea turtles over a 15-year period. Nichols believes that the dramatic improvement seen in the 2001 green turtle nesting-beach census is due to the arrest of Fischer who, he estimates, killed 1,500 adult females. But poaching continues. "There are probably about eight to ten poachers out there right now who are doing 90 percent of the damage to the black turtle population," said Nichols.

If the turtles are to survive, poaching must be stopped. Just as essential is cultural change: human consumption of sea turtles will have to end. With that goal in mind, Villavicencio, Nichols, and Rubi Moreno, a former folksinger now working on sea turtle education for the Vizcaíno Biosphere Reserve in San Ignacio Lagoon, traveled to Mexico City in July 2002 and mounted a weeklong "Don't Eat Sea Turtle" campaign on national television and radio. When the community of Punta Abreojos turned on their satellite dish–powered televisions on the morning of July 29 and watched one of their own on *Primeras Notícias* (the *Good Morning America* of Mexico) talking about the efforts of his neighbors to protect sea turtles, "It was one of the greatest days in the history of Punta Abreojos," Arce declared. "It made

us all want to work that much harder to protect our *tortugas.*"

During his recent visit with Fischer in prison, Villavicencio convinced the now repentant poacher to join the next "Don't Eat Sea Turtle" campaign on its next stop in Mexico City in March 2003. Villavicencio plans to take Fischer onto the country's major news programs and to expose the poaching networks that allow the black market trade in turtle meat to flourish in Baja California.

"If Gordo can help us stop the worst pirates," Villavicencio said during a recent telephone call from a monitoring site in Magdalena Bay, "and we continue our efforts to show people that eating turtle is wrong, I think turtles are going to come back for good."

Local people working with conservationists and scientists are key to the future of the Californias' sea turtles, those in Baja California as well as those in Monterey and San Diego Bays, and even along the wild coasts of Indonesia and the Western Pacific, where the leatherbacks that come to feed in Monterey Bay are most at risk. On December 10, 2002, the California Coastal Commission passed a resolution supporting efforts to protect these ancient mariners. It stated, in part, "Sea turtles are part of California's natural heritage and marine biodiversity, are valued and appreciated by people of all cultural backgrounds, and as such possess inestimable intrinsic value to current and future generations." ■

Serge Dedina is co-director of WiLDCOAST and the author of Saving the Gray Whale *(University of Arizona Press, 2000). He is currently writing a book on marine piracy and wildlife poaching in Mexico.*

A Turtle Story for Children

Chelonia—Return of the Sea Turtle, *by Dawn E. Navarro, Robert E. Snodgrass, and Wallace J. Nichols, (Sea Challengers, 2000) for ages 6 and up.*

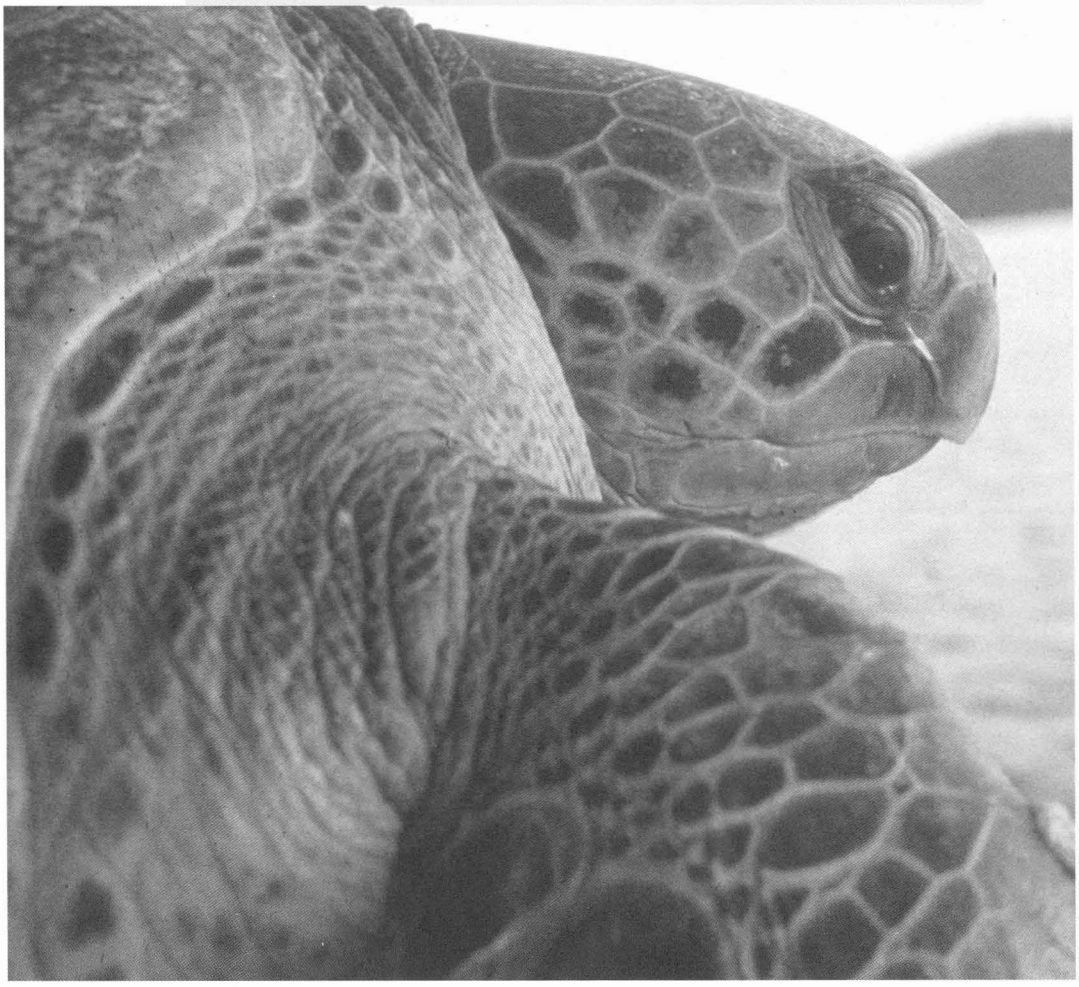
WANT TO KNOW MORE?

TO LEARN MORE ABOUT sea turtles, organizations working to protect them, and to find out what you can do, check out these web sites. You will find photographs, migration maps, descriptions of various projects, and opportunities to volunteer.

- Sea Turtle Restoration Network: www.seaturtles.org/about_strp.html
- Sea Turtle Conservation Network of the Californias (includes records of the Sea Turtles of the Pacific Tracking Project): http://cccturtle.org/sat14.htm
- Turtle Trax (Hawaiian marine turtle site): www.turtles.org
- Hubbs-SeaWorld Research Institute: www.hswri.org
- WiLDCOAST: www.wildcoast-usa.com/index2.asp
- Defenders of Wildlife (10 things you can do to help protect marine environments): www.defenders.org/wildlife/new/marine/10.html

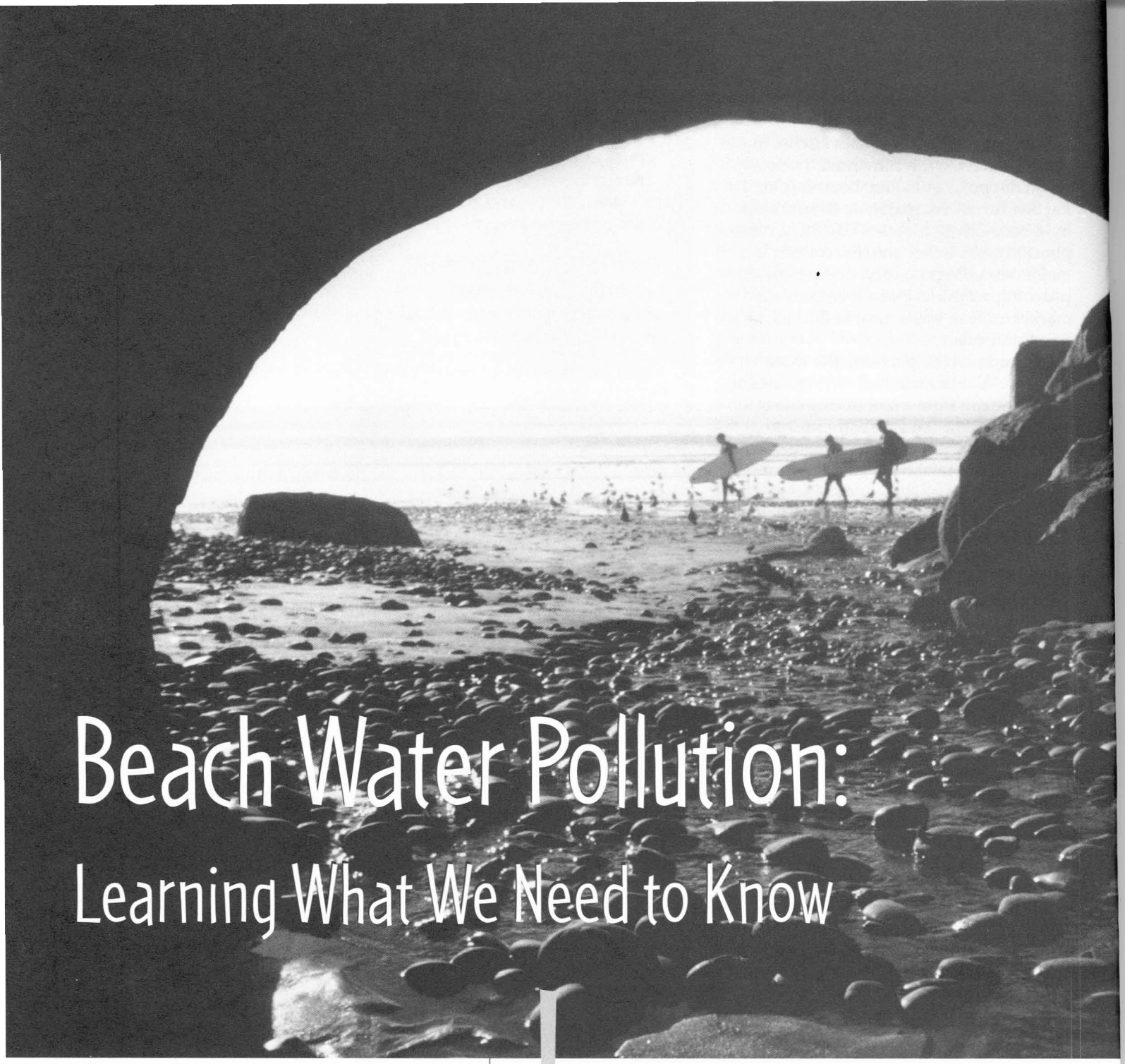
Sea Turtle Tours

- Hike Bike Kayak San Diego offers kayak tours with turtle-watching opportunities: www.hbksandiego.com/new3893.html
- Info on turtle tours at Cuyutlán Turtle Sanctuary in Colima, Mexico: www.gomanzanillo.com



WALLACE J. NICHOLS

Closeup of a green sea turtle



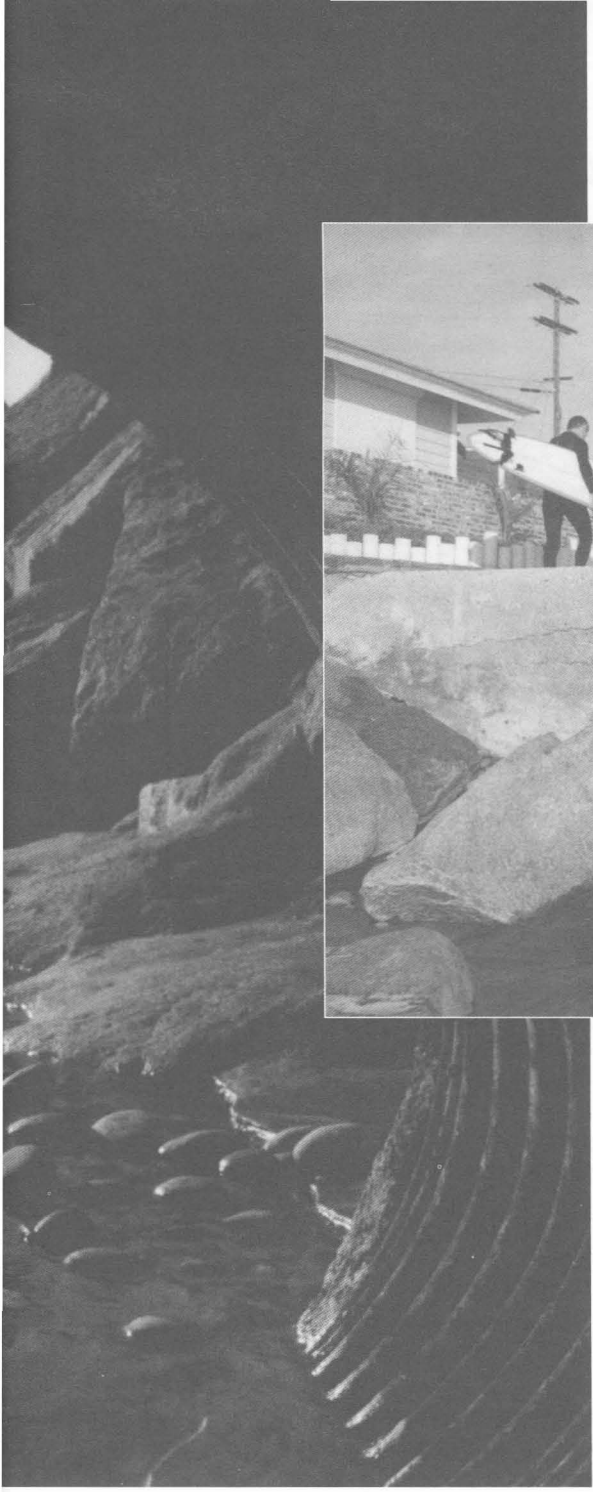
Beach Water Pollution:

Learning What We Need to Know

AN OCEANOGRAPHER'S PERSPECTIVE

JOHN LARGIER

IN 1999 THE CITY of Huntington Beach in effect canceled summer by posting signs warning that the beach was contaminated with fecal bacteria. Three years later, the problem continues, although postings are now less frequent. The major source of the bacteria remains elusive. Although those of us who have studied the problem can offer many ideas as to what the source—or sources—might be, no clear cause has been identified. Meanwhile, the city continues to weather the economic impact of fewer visitors.



PHOTOS THIS SPREAD: JOLENE THOMPSON

Above and opposite: Cottonwood Creek emerges at Moonlight Beach in Encinitas.

The absence of a single cause, of a single villain polluter, is frustrating to experts, managers, and beachgoers alike. But the search for that cause has laid the foundation for a new understanding of coastal waters. We have acquired valuable information about the ways bacteria and viruses can be transported and how long they may pose a danger to human health. We have also identified critical knowledge gaps that must be filled if we are to deal effectively with the public health threat of beach water pollution. (See sidebar, p. 16.)

That bacterial contamination is a widespread problem became clear—or at least official—in spring 1999, when state legislation (AB 411) went into effect requiring local authorities to test popular ocean swimming waters regularly and to post a warning if any of three indicator bacteria concentrations exceed prescribed levels. Excessive levels of these bacteria, which signal the presence of human and other fecal matter, are interpreted as indicating the presence of pathogens and the risk of getting ill.

The monitoring and posting that resulted from AB 411 drew attention to an alarming number of beaches where contamination was systemic, including Huntington Beach, Imperial Beach near the Mexican border, and beaches in enclosed bays, such as Mission Bay and Newport Bay, that are popular with families.

Although the incidence of illness associated with high levels of these fecal indicator bacteria is not well quantified, the mere idea of fecal wastes polluting our beaches was enough to spur public outcry and political action. The identification and elimination of sources of fecal pollution have become major priorities statewide. After all,

JOLENE THOMPSON

In dry weather, 85 percent of the outflow of Cottonwood Creek is sterilized before it reaches the beach.

HEAL THE BAY

California's beaches receive more visitors than the beaches of all other states combined. In addition to the reality of pollution and illness, the intermittent presence of signs warning of bacterial hazards in the water creates a perception among beachgoers (and potential beachgoers) that the posted beaches are always polluted. A flurry of local and state actions, including the Governor's Clean Beach Initiative, followed AB 411 and, during the past two years, resulted in many improvements. Numerous beaches were spared from contamination events as leaking sewers were repaired and rogue storm drain flows were diverted to treatment plants. At other beaches, however, the sources were not obvious, so managers and researchers started looking at populations of birds and seals, river outflows, and wastewater discharge from ocean outfalls as possible sources.

Alarming Responses

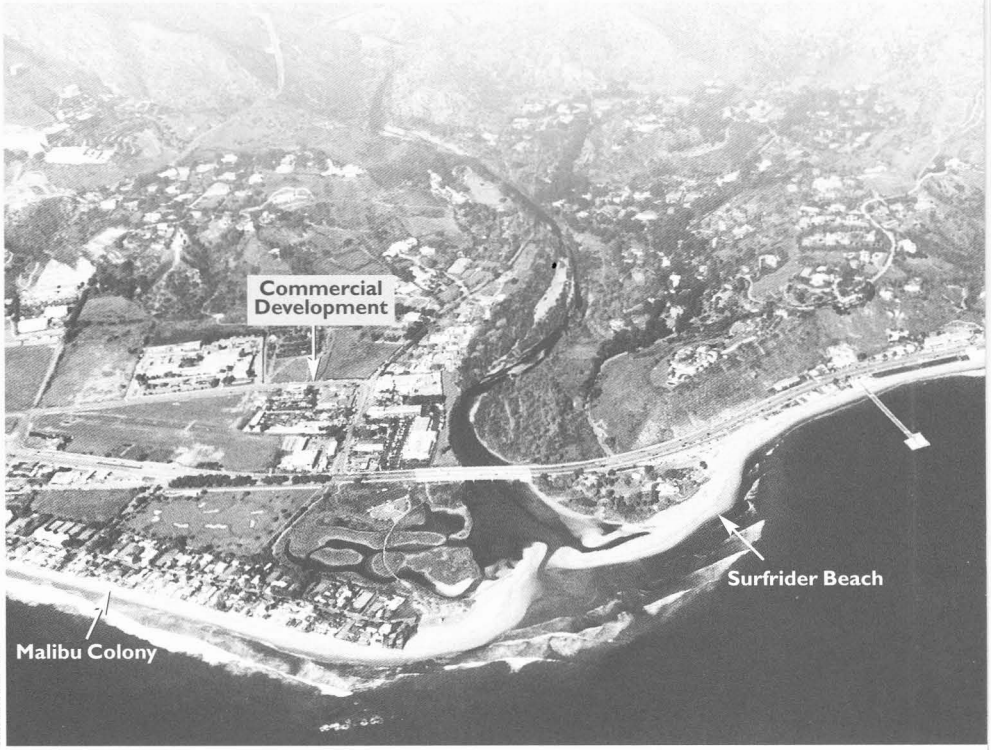
THE IMPACT OF BEACH pollution on local economies and communities has led to a strong push to lower fecal indicator bacteria levels. With this comes the possibility that drastic measures are taken—measures that could significantly harm living coastal systems (and, in turn, humans) while providing an equivocal public health benefit. In many coastal cities, "nuisance" birds are being chased away from some beaches, but already the idea has been raised that we could improve coastal bacteria levels by chasing all birds away from the coastal waters where we want to swim, and from nearby wetlands. While the focus is on "nuisance" birds, there is no clear line between keeping these birds at bay and chasing away birds or seals that play key roles in coastal ecosystems. Further, the idea of disinfecting streams of bacteria is being implemented through an ultraviolet-treatment facility on Cottonwood Creek in Encinitas, San Diego County. While this process will render fecal bacteria harmless, thereby reducing contamination of beach waters, it undoubtedly kills other microbes and planktonic organisms as well; and more generally, it interrupts the ecological continuum of the ecosystem from stream to estuary to ocean. These approaches are in addition to the commonly accepted practice of removing water from creeks (diverting polluted flows to treatment plants) or of capturing urban runoff before it enters creeks. While very effective in lowering fecal bacteria levels in streams, estuaries, and along beaches, the water and other waterborne material is also removed from the downstream aquatic environments with little knowledge of the environmental impact.

Coastal environments are complex interwoven systems and, as history has repeatedly proven, drastic actions taken to remedy problems before they are fully understood often do more harm than good. As a society, we cannot make informed decisions about gains and losses, nor

develop smart strategies, without improved knowledge of coastal oceanography, coastal and wetland ecology, microbial ecology, epidemiology, and detection technology.

AB 411 is an important step toward our acquisition of that knowledge. Now we need to move forward: We need to know much more precisely than current monitoring can tell us when and where swimming waters are polluted; where and how contaminants enter the ocean and by what routes they arrive at beaches where people swim and surf; how the presence of fecal bacteria actually relates to human health; what specific pathogens are found in polluted water; and how to reduce both the discharge of and people's exposure to contaminants that endanger human health.

The association between illness and fecal bacteria in beachwater has barely been studied (see p. 16). Citizen monitoring has shown that there is a relatively high incidence of illness among surfers, who spend much time in coastal waters, but we need to find out more. For example: Do high levels of fecal bacteria always correlate with an increased incidence of illness? Does the source of the fecal material have an effect—can humans just as easily contract illness from seagull droppings or seal feces? Before jumping to responses that may be ill-advised, we need to develop a fuller appreciation of the richness and complexity of the coastal ocean and of the risks that contaminants in the water pose to human health and ecosystem vitality.



HEAL THE BAY

© 2002 KENNETH ADELMAN, CALIFORNIA COASTAL RECORDS PROJECT

Top: Possible sources of bacterial pollution at Surfrider Beach include poor circulation in Malibu Lagoon, polluted urban runoff, and septic tank pollution of groundwater.

Above: Might some of the bacterial pollution at Huntington Beach be drifting back to shore from the end of an ocean outfall pipe, or are these bacteria washed out of watersheds and wetlands?

A Living Soup

THE COASTAL OCEAN contains a rich mix of bacteria, viruses, and decaying organic material in addition to plankton, nutrients, fine sediment and, of course, larger marine plants and animals. It is this soup of dissolved and particulate material that accounts for the large fisheries and amazing biodiversity of our coastal oceans. Throughout time, these waters have been further enriched with nutrients and organic matter washed into the ocean from humans and human activities along the coast and in coastal watersheds. With the growth of modern society, however, anthropogenic inputs have become so large that they can knock natural systems off balance. The most severe disruptions to coastal ocean ecosystems result in a degradation of coastal waters, both in terms of ecological function and in the value they offer society. This degradation, in the form of pollution, is evident in California, as it is around the world.

It is sensible to recognize two kinds of coastal pollution: that which threatens the integrity and health of the coastal ocean ecosystem, and thus many ocean-based resources; and that which directly threatens human health. Nationwide, the single biggest threat to ecosystem health is nutrient pollution—the overfertilization of the coastal ocean due to human activities, leading to algal blooms and oxygen deficiencies. Other threats are due to discarded organic

THE BIG UNKNOWNS THE PRIORITIES FOR IMPROVED KNOWLEDGE ARE:

Detection technology— *to identify the type and level of contamination rapidly:*

To properly profile the nature of contamination events in place and time, we must have quicker, better, and more measurements of levels of fecal bacteria and viruses in coastal waters.These measurements need to include identification of the source type (human, bird, dog, or seal?) so health risks can be properly assessed before beach postings. These measurements also need to provide results in "real time," i.e., quickly enough that beaches can be posted before people swim there (at present, results are available from 1–3 days after the water is sampled!).

Microbial ecology— *to quantify survival of pathogens in the ocean:*

Little is known about the survival/mortality and possible growth of pathogenic bacteria and viruses in the ocean. The rationale of using fecal bacteria as indicators depends on assumptions that all pathogens have similar life expectancies in the ocean. This is not true, and besides, survival of any given microbial species depends on the environment in which it is immersed, related to levels of light, temperature, food, and predators. We need to determine the survival and associated pathogenic ability of specific microbes that pose the greatest threats to humans, and to define the association between these microbes and organic matter such as fine particles.

Coastal oceanography— *transport routes and environments:*

Oceanographic studies off Huntington Beach and the current study off Imperial Beach are providing a much improved view of possible transport routes. However, we are still unable to predict where stormwater runoff or lagoon outflows will be transported. Under what conditions may polluted runoff or wastewater discharge come ashore, and where? What is the typical impact zone of a given source? Our knowledge of environmental conditions along specific transport routes is limited, and thus also our ability to determine the survival of microbial pathogens. We need to better quantify and improve our understanding of nearshore movements of water and fine particles.

Epidemiology— *linking illness with exposure to pathogens in the ocean:*

Only one limited study has been conducted on the association between fecal indicator bacteria concentrations and illness in southern California. While logic suggests that a link exists, it has not been defined. It is not clear that there is a health risk at every beach where high levels of fecal bacteria are found. Further, is it the risk of an upset stomach, or of contracting a serious illness, such as hepatitis? We don't know. Is the risk of an upset stomach greater than in day-to-day activities? We don't know. Is the risk of an ear infection worse there than from swimming in waters off a deserted coast? We don't know. Is there a health risk if the fecal indicator bacteria come from bird droppings? We don't know. There is a great need to understand the connection, if any, between swimming in nearshore waters and illness, and between the presence of specific pathogens and illness.

—John Largier

compounds, including pesticides and other poisons, detergents, and industrial chemicals. Thirty years ago, the Clean Water Act sharply reduced the flow of pollutants through wastewater systems and pipes, but that flow continues from "non-point" sources, via rivers, storm drains, and other routes. While the importance of non-point pollution for the ocean has been recognized for some time, and much work is under way in coastal watersheds to reduce this flow, only now are we beginning to seriously examine the destination of these pollutants in the coastal ocean itself.

Detective Work

THIS IS WHERE OCEANOGRAPHY enters the stage and where we encounter major gaps in knowledge. One can think of pollution as being the story of the S and the 3 T's: Source, Transport, Transformation, and Target—there are more conventional technical terms, but this is how I tell the story. S is the baddie and our ultimate game plan is to get rid of him. However, realism indicates that with population density and economic development being what they are, we will always have some pollution sources, be they intentional or accidental. In recognition of

this, and in concert with our efforts to reduce pollution sources, we need to give attention to the 3 T's. Where are pollutants being transported? How are they being transformed en route? Which targets are susceptible?

When it is not obvious where fecal wastes enter the ocean, the first priority is to find this point of entry, and thus the ultimate source of the pollution. This requires an analysis of transport. In some cases, bacteria in polluted runoff are transported along the shore. For example, off Imperial Beach one can often find water that has moved north from the mouth of the Tijuana River. In other cases, like off Huntington Beach, we are trying to find out whether fecal bacteria is transported shoreward from the Orange County Sanitation District (OCSD) ocean outfall, which discharges wastewater 4.5 miles offshore. In the case of sheltered bays, such as Mission Bay, pollutants could be building up because of a lack of tidal flow or other currents, i.e., an absence of transport.

The transport of polluted water between the place where it enters the ocean and the place where it poses a threat to the health of humans or the ecosystem (the target) can be approached from two directions. Where one knows of the impact—a polluted beach—the challenge is to trace backward along the transport route to the origin (backtracking). This is difficult because once the contamination event has occurred it is too late to measure the currents that carried the pollutants to the target.

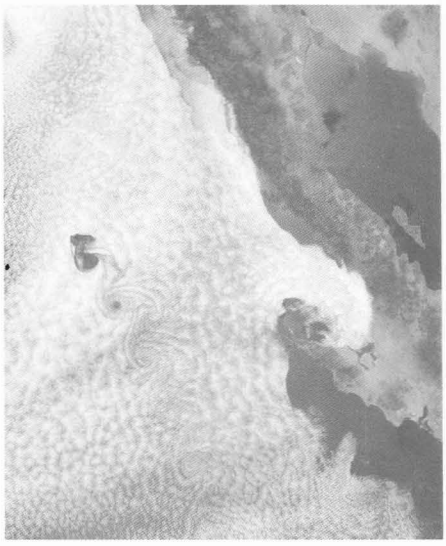
The other approach is to identify all possible origins that might have led to a specific beach pollution problem, and then trace forward along the various possible transport routes to the target. This is costly, however, as most of one's effort is used studying transport routes that go nowhere near the beach and pose no threat to public health.

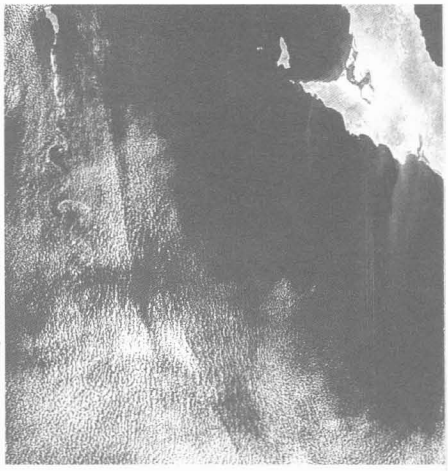
Exploring multiple origins is effective where there are limited possible sources or one probable source, as in the case of Malibu Creek discharging to adjacent beaches, or Tecolote Creek discharging to Mission Bay. In these cases, the study becomes one of determining the zone of impact: how far the pollution is transported and for how many days it remains a problem. This in turn pinpoints which beaches should be posted and for how long. However, this approach has limited results where there are multiple origins, as in the case of Huntington Beach pollution. Given the allegations that the OCSD wastewater plume was being transported ashore, Scripps Institution collaborated in a major oceanographic study to examine this hypothesis. While the study concludes that the outfall is not the dominant route by which fecal bacteria are transported to the beach, it sheds little light on possible transport routes from other sources; for example, tidal outflow from small wetlands like Talbert Marsh and Newport Slough, discharge of cooling waters from the power plant in Huntington Beach, and outflow from the Santa Ana River (now considered the most likely primary source). Further, the conclusions of the OCSD study are weakened by a lack of knowledge on bacteria transformation, i.e., how many bacteria survive en route from the outfall to the beach, and how this may vary depending on water temperature, clarity, and the presence of organic matter.

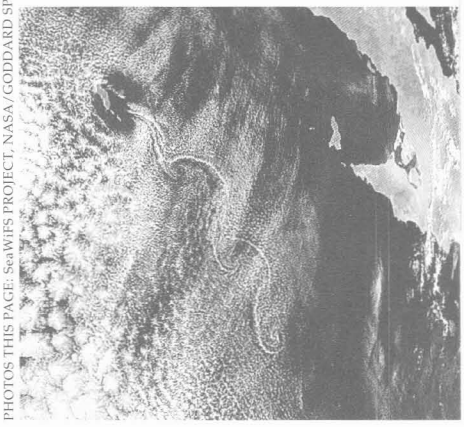
To have confidence that any of the sources identified in Huntington Beach account for beach contamination events, it is necessary to capture an event "red-handed"—not only once, but several times—to know whether it is a primary or an occasional source. In spite of intense efforts to do just this, we have no direct observations of contamination events originating from the outfall off Huntington Beach and we are left looking for evidence of what causes the recurrent high bacterial counts there.

Off Imperial Beach we are using the method of backtracking from the target beach. We are monitoring currents continuously and over an area large enough to include all major sources, so that when a beach contamination event is observed, we will have the data necessary to identify the transport route, working from the beach back to the origin. Not only does this approach hold the promise of locating the source pollution, it also offers a monitoring system that can provide early warning of contamination events.

For example, once a specific type of onshore flow has preceded contamination events on a few occasions, the observation of a similar onshore flow will warn of the likelihood of another contamination event occurring. Further, if that onshore flow pattern can be predicted in terms of tides, winds, and seasons, then the likelihood of future contamination (say, the next day) can also be predicted—along the lines of the air quality advisories published in the daily newspaper.







PHOTOS THIS PAGE: SeaWiFS PROJECT, NASA/GODDARD SPACEFLIGHT CENTER, & ORBIMAGE

By observing natural phenomena across a wide range of scales, we may discover basic principles about the processes that generate the phenomena (see page 20). These photos show a "vortex street" trailing away from Guadalupe Island, off the coast of Baja California. Note the dust trails in winds off the peninsula in the center photo.

STERILIZING CREEK WATER

DURING THE DRY MONTHS OF THE YEAR, when people are most likely to swim and surf in San Diego County, Cottonwood Creek used to carry elevated levels of bacterial pollution to Moonlight Beach, in Encinitas. Not anymore. In December 2002, the City began to sterilize 85 percent of the creek's outflow with ultraviolet (UV) light, so that it will be "almost clean enough to be drinking water" as it empties through giant culverts onto the sand, according to Kathy Weldon, stormwater program administrator in the City's department of engineering. The system bypasses 15 percent of the flow to make sure there are nutrients to keep "polliwogs and whatever else is in the creek alive."

Designed to operate during the dry season, when discharges from storm drains make up much of the creek's flow, the system "worked fabulously" during its first 60 days, Weldon said. It was shut down for the winter and will be activated again after the wet season ends, probably in April.

Encinitas is the second southern California community to opt for UV treatment in response to permit requirements regarding non-point source pollution, which contaminates beaches and leads to closures. A similar treatment system has been in operation for two years in Orange County, capturing and treating the flow of a major storm drain that discharges into Aliso Creek in Laguna Niguel. Orange County is about to install a second such system on this creek, on a storm drain about a mile upstream, in Aliso Viejo. All three systems are products of Clear Creek Systems, Inc., a small family business in Fresno.

This treatment destroys microbes, including viruses and both undesirable and benign bacteria. The stated goal is to meet state standards for body contact recreational use, including swimming and fishing. "The advantage over chlorine treatment is that UV has no residual effect," said Clear Creek vice president Tim Gannon. "It doesn't kill anything after the water leaves the system." It is also less expensive, safer to use, and returns water to the stream, added the firm's president, Joe Gannon, who is Tim's son. UV treatment has been gaining acceptance for wastewater treatment, Joe Gannon said, but Clear Creek is pioneering in applying it successfully to urban runoff into creeks.

Most southern California coastal communities are taking steps to reduce urban runoff that flows into streams. Some have opted for sterilization with ozone instead of UV. "That's a judgment call," said Tim Gannon. Some have diverted dry-weather flow to sewage treatment systems.

As population growth and development continue, so do the water pollution problems, pointed out Bob Morris, senior engineer with the San Diego Regional Water Quality Control Board. "Everyone is in the same boat and there are no easy answers." The basic choices are "in-the-pipe treatment, diversion, or going into the community and changing habits. That's the nitty-gritty."

Cottonwood Creek flows year-round from Encinitas Ranch golf course to Moonlight Beach, draining a watershed of some three square miles. Most of it is buried under strip malls, residential communities, and streets. It surfaces west of Highway 101, flows through a block-long wetland, then goes under the volleyball courts. It empties onto the beach through giant culverts.

Aware that the creek's water exceeded state standards for fecal coliform bacteria about 90 times a year, Weldon did not wait for an abatement order. She applied for and won a grant from Governor Gray Davis' Clean Beach Intitiative, matched by the City, and had the UV system installed for $470,000, agreeing to maintain it for 20 years. Monthly costs are expected to be "well under $1,000," Weldon said.

Three blocks from the beach, all but 15 percent of the creek's water is pulled from a box culvert into a 14-foot-deep wet well, "catching everything that would come down," Weldon said. When the well fills up, the water runs through a process that removes sediments, heavy metals, and oils, then is piped through a closed chamber where it is exposed to ultraviolet light.

The treatment system on Cottonwood Creek has the same capacity as the one on the storm drain known as JO3P02, which serves a watershed with 14,000 homes and flows into Aliso Creek. Each can process 200,000 gallons a day. On Aliso Creek, however, water is collected not from the creek itself but from the storm drain, and it pours not into a well but into a pond built on an easement provided by the Kite Hill Homeowners Association. The system was installed in response to a cleanup and abatement order from the San Diego Regional Water Quality Control Board, after excessive levels of fecal coliform bacteria were found to be spilling into the creek from this storm drain. Clear Creek Systems provided and installed all the treatment equipment, operates the system, and charges the City $664 per million gallons treated—averaging $3,000 a month, according to Ken Montgomery, director of public works and city engineer. This is a temporary system. The City will soon replace it with a system that will carry dry-season flow from gutters into a series of constructed wetlands for treatment.

To clean up Aliso Creek, however, more than these installations will be needed. After excessive coliform levels were found in JO3P02, Morris said, "we sampled major storm drains on the creek [there are about 50], monitoring weekly. We found that pollution was widespread and that, for the most part, it exceeded standards for body contact recreation." State law requires that warnings be posted on beaches when the fecal coliform count is over 200 per 100 milliliters of adjacent ocean water. On Aliso Creek, levels 50 times that high were found. The sources were "just urban runoff," Morris said, "pet waste, birds, fertilizer, perhaps a bag of steer manure on a lawn with bacteria that perhaps regenerated in the stormwater system." Drain JO3P02 was not the worst. It was simply the one subject to an abatement order.

"We're taking it a step at a time," Morris said. "The permit process gives the permittee flexibility to take incremental steps and see if they help. Most cities try to address the issue by encouraging good practices. They are going up storm drains looking for sources and taking reasonable measures to eliminate them. They are asking, for instance: Are dumpsters covered? Is steer manure being applied in a manner that stormwater or irrigation doesn't wash it down the gutter? We need to prevent pollution and control its sources. Otherwise, what's the alternative? A treatment plant at every storm drain?"

The treatment plant at the end of Cottonwood Creek supplements a comprehensive pollution-prevention/source-reduction program," Morris said.

—Rasa Gustaitis

This is the approach being developed by Scripps, in partnership with the City of Imperial Beach, the County of San Diego, and the State of California. The newly established San Diego Coastal Ocean Observation System (www.sdcoos.ucsd.edu) uses surface-current mapping and in-water instruments to create a real-time record of water movement that can be correlated with high fecal bacteria levels along beaches. In this way we expect to be able to link contamination events with potential sources, including the South Bay International Wastewater Treatment Plant, the Tijuana River, sewage discharge in Mexico, and rainwater runoff from city streets.

Again, as in the case of Huntington Beach or Mission Bay, we have little idea about transformation (growth and death of bacteria). How long do fecal bacteria survive in ocean environments—perhaps less than a day, perhaps several days? Recent work on marine microbial ecology (see sidebar) points to a complex world in which long-lived populations may be possible under specific conditions, presenting an expanded radius of contamination (zone of impact) around any given source.

In conclusion, attempts at cleanup must be based on solid knowledge: decisions have to be made regarding not only which problems are real, but also which problems can be fixed and how best to fix them. We do know that coastal waters are contaminated, and we know that there is a possibility of contracting illness from swimming and surfing in contaminated waters, but the detection of fecal bacteria and the causative link between concentration and illness needs to be better grasped before we adopt drastic strategies that may do more harm than good.

Further, the strategies need to be smart. They must protect nearshore ecosystems as well as public health. As we build our capacity to devise such strategies—through research in coastal oceanography, detection technology, coastal and microbial ecology, and epidemiology—our focus should remain on stopping pollution where it is generated, up in the watershed, along the shore, and in the water as well. It is still a safe bet that we can do the environment and ourselves no better service than to stop pollution where it begins, at its source. ■

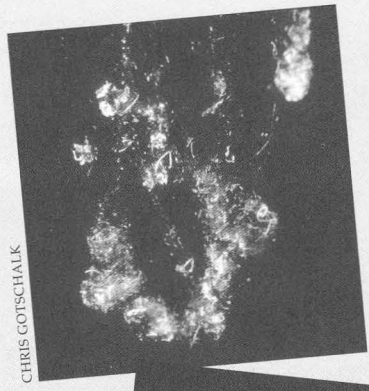
John Largier, faculty member of Scripps Institution of Oceanography since 1988, conducts research in coastal oceanography, focusing on nearshore water movement and its importance to ecological issues.

THE WORLD WITHIN A MILLILITER

MICROBIAL OCEANOGRAPHER FAROOQ AZAM, at Scripps Institution of Oceanography, studies marine ecosystems at the smallest scale: that of marine microbes. Seawater is "an organic matter continuum," he points out, where millions of bacteria, viruses, fungi, protozoa, and phytoplankton live in complex ecosystems. It's essential, he says, to understand the dynamic interaction of microorganisms in seawater before taking actions that could have far-reaching consequences for the structure and functioning of marine ecosystems. A close look at a single milliliter of nearshore seawater can reveal a great deal.

Take "marine snow," for example. Bits of dead matter aggregated with phytoplankton form flakes that slowly fall to the ocean floor to become sediment. Citing a model developed by T. Kiørboe and G. A. Jackson, Azam describes how these flakes are colonized by bacteria that secrete enzymes that then break down the flakes, creating plumes of dissolved organic matter that trail behind the falling flakes. These plumes are a rich source of food for other bacteria—so rich, in fact, that bacterial populations explode, multiplying many times faster than in the surrounding water. This attracts bacteria-eating protozoa, which in turn become food for larger animals. "It would be worth investigating whether human pathogens and sewage-derived enteric bacteria might also sense and swim into snow plumes and experience explosive growth," Azam suggested in "Sea Snow Microcosmos," published in the November 29, 2001, issue of *Nature*. Also worth considering is what happens when bottom sediments are disturbed, he said during a talk at the 2001 California Shore and Beach Association conference, in Huntington Beach: "Bacteria may have colonized sinking particles and thus sunk to the bottom, maybe accreting in sand. When we take a water sample we might not detect them, but someone walks through, stirs them up, and there they are."

Although microbes make up most of the planet's biomass, our awareness of what occurs in nature on the microbial scale is just dawning. Here, as in so many areas, much of nature is still beyond our understanding. As Azam puts it: "There is an urgent need for oceanographers to embark on a bold exploration of the oceans—this time at the millimetre scale."



CHRIS GOTSCHALK

JAMES M. KING

Many small crustaceans and other planktonic animals seek out marine snow—tiny islands of concentrated organic matter in the sea—and either consume it or sit on the partices and scrape off algae, bacteria, and other organic matter for food.

Top left: This aggregate of marine snow, composed of diatom chains, fecal pellets, and other debris, is about 2 cm in diameter. It was photographed *in situ* in California seawater.

Bottom left: Copepods of the genus *Oncaea* feed on a particle of marine snow.

Seeing the Fractal Coast

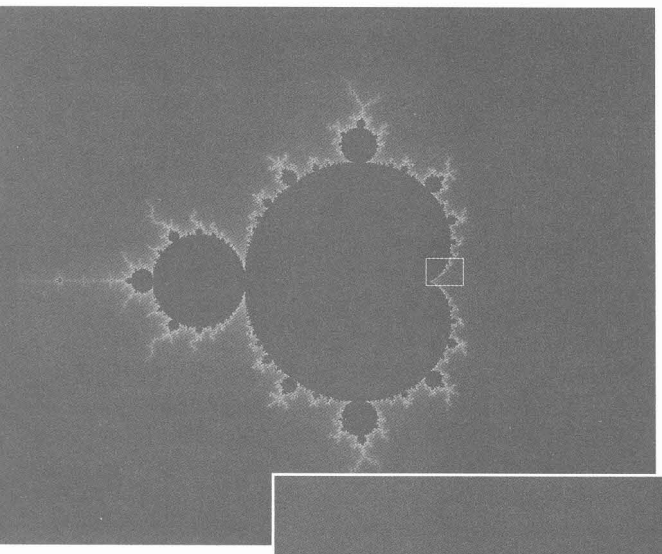
HAL HUGHES

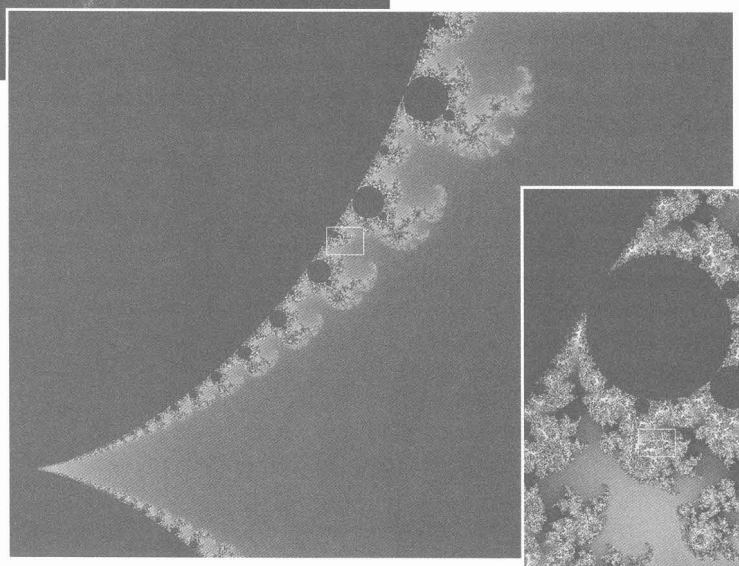
This fractal sequence shows progressive zooms deep into the Mandelbrot Set. Each small rectangle shows the area enlarged in the next image. Images were generated by Hal Hughes, using Fractint. For more information on fractals and related subjects, and to download Fractint and other free fractal programs, see http://spanky.triumf.ca.

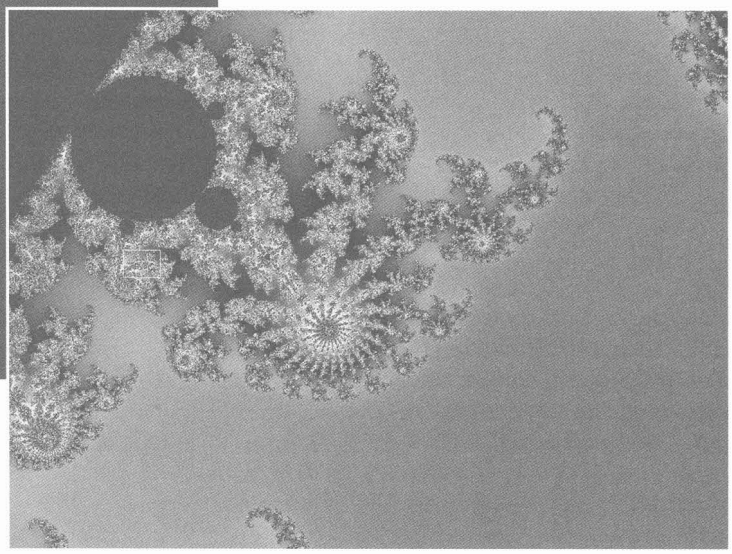
ON A RECENT FLIGHT from Oakland to Los Angeles I watched the waves of the Pacific crashing against the shore as the plane gained elevation. After a few minutes of distraction, I again gazed down at the interface of land and water. We were much higher now, well on our way to cruising altitude. I was puzzled when I noticed that although I could still see the long lines of the waves, they seemed motionless, frozen in space. It took a while for me to realize that I was now watching waves on an entirely different scale—these were many miles long: the grandparents of the breakers we'd see if standing on the beach. Those waves now appeared as faint, miniscule ripples between the vast swells that arced and crossed each other, moving too slowly for perception from such a distance.

I understood that this was a dramatic illustration of "fractality"—self-similarity across scales. This principle, first articulated and explored by mathematician Benoit Mandelbrot in the 1950s, is the basis of fractal geometry, a new approach to mathematics that has profound implications and widely diverse applications. Fractal geometry grows out of iteration: the solution of an equation is fed back into the equation as one of its terms, yielding a second solution, which again is fed back, replacing the previous solution, and so on. The development of fast computers and high-resolution graphics has made it possible to calculate large numbers of iterations rapidly and to map them as patterns on a video screen. One highly significant attribute of fractal geometry is that it can come very close to describing the complex or chaotic forms found in nature—far closer than Euclidean geometry, which has trouble with forms that require more than straight lines and simple curves.

One of the standard models of fractal geometry in nature is a coastline. Whether viewed from a satellite orbiting Earth, a jetliner cruising several miles high, the observation deck of a skyscraper, a blufftop, the rocky edge of a tide pool, or through a magnifier, the place where sea meets land has a similar shape—though generally the closer we look, the more detail we find. As I'd observed, the same is true of the waves of the sea across a wide range of scales.





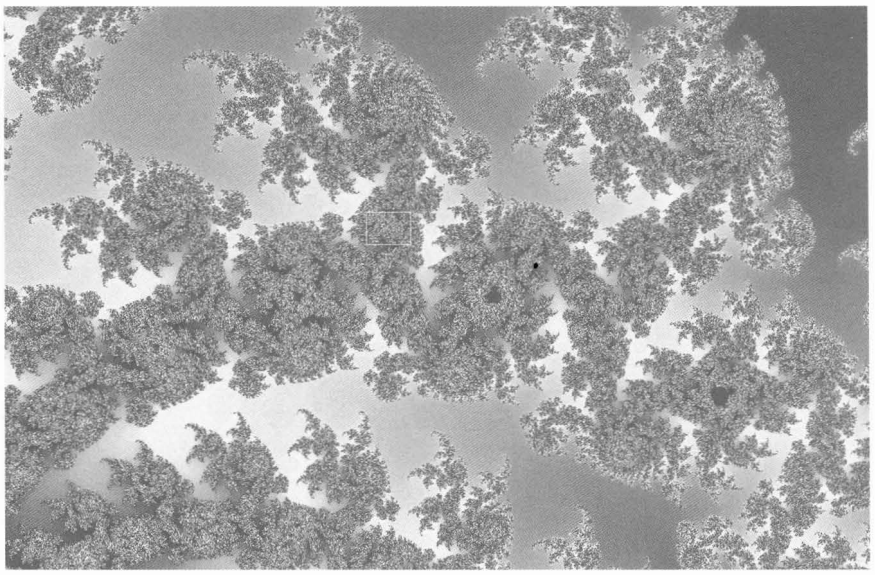


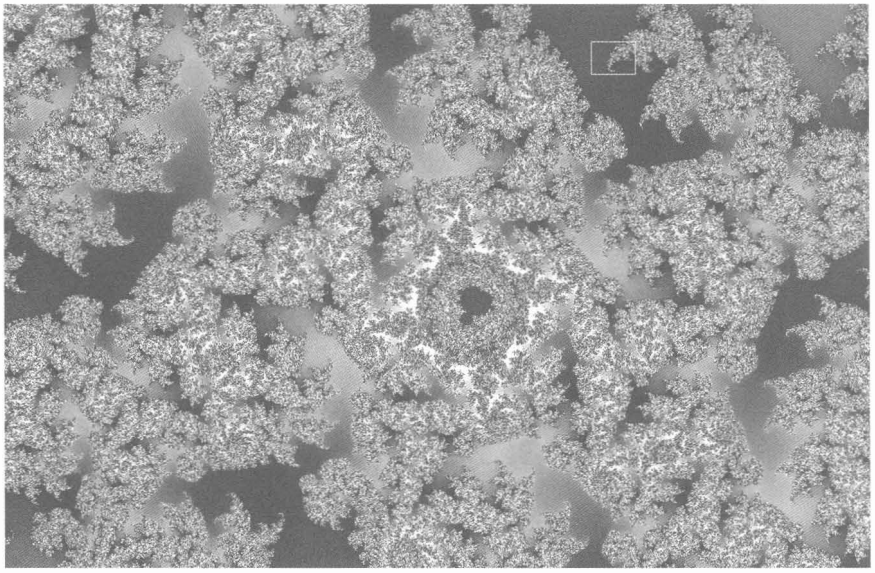
Once we become aware of this fractal dimension, we can recognize it in many places, and begin to see how it reveals many of the organizing principles of growth and of natural forms. It is easy to note the similarity between a head of broccoli and a leafy tree, a sponge and a cauliflower, or the repeated patterns of fern fronds. Mycologist Paul Stamets recently showed a comparison of a scanning electron microphotograph of a fungal mycelial network to one of an animal's neural network, and to a projected mapping of intergalactic "dark matter." Not only did they appear remarkably similar, but within a day I'd come across a photograph of lightning activity that fit the same pattern.

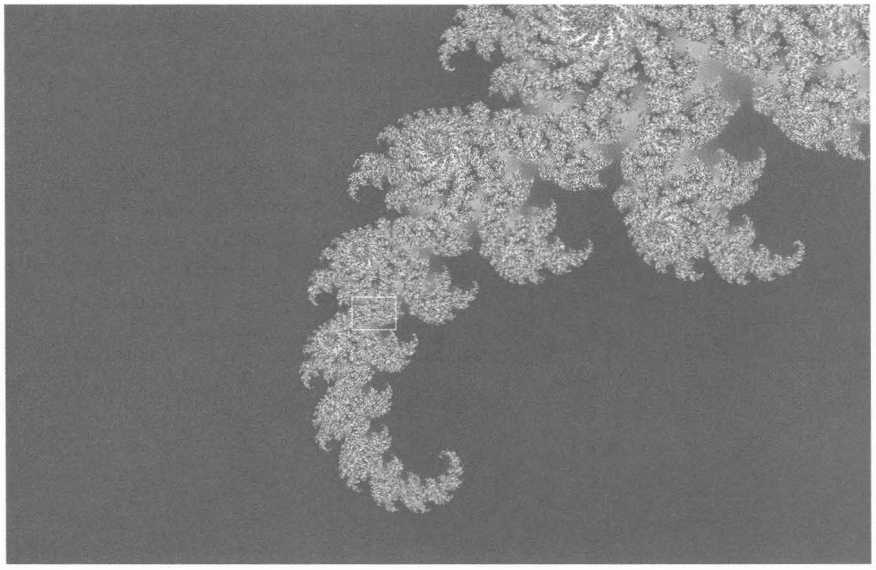
The fact that immensely complex patterns can be generated by iteration of very simple equations has led to many new insights into and understandings of natural processes. The principles of fractal geometry even help us begin to understand such chaotic and extremely variable systems as turbulence, and has applications in economics and other fields. Fractal geometry is at the heart of much computer-generated "natural" imagery, and at the core of some computer image-compression systems.

The beauty of fractally generated images interfaces closely with the world of art. And through its clear connection to the ancient Hermetic axiom "As above, so below," it can lead us to the realm of spirit, where the wonders of Nature meet the beauty of Science—a most marvelous coastline.

On my way back to Oakland, I intended to watch the waves more closely, to see if I could perceive the shift from one scale to the next. At first I was disappointed—the plane took an inland route! Before long, however, I noticed that the same phenomenon occurred with the rounded, golden California hills. At cruising altitude, the familiar contours of valleys dark with oaks that we see from the ground were minute details that punctuated the larger forms of the ranges, which still appeared smooth, rounded, and golden. ■







ANNE CANRIGHT

Murres, come back to your rocks!

ANNE CANRIGHT

ONE BRIGHT OCTOBER morning I arrive at Warwick Elementary School in Fremont and make my way up some stairs to Room 1, science teacher Jonathan Greathouse's fourth grade classroom, where Karen Peluso and an assistant are setting up what look like forlorn brown penguins on sticks.

Not penguins—common murres. On sticks because these are decoys, carved out of wood or molded from plastic. Forlorn-looking because they've been out for months on a seastack called Devil's Slide Rock, south of Pacifica, battered by wind, sun, and storms, on hardship duty in behalf of live murres.

They're here to be spruced up so they can be put out on that rock again as lures to entice living murres to settle among them, nest, and raise chicks. Mr. Greathouse's students are participating in the project: they, together with students from nine other schools—782 youngsters in all—are an army of sprucer-uppers. Outfitted with paintbrushes and small containers of dark brown paint (for the back and head) and white paint (for the breast), they are working to help scientists restore a colony of these seabirds that was wiped out by an oil spill in 1986.

Before they exercise their painting skills, though, they learn about these personable little birds. Peluso had visited the school a couple of weeks earlier and presented a slide show about murres, dive-pursuit predators about a foot and a half long. The students then got a practical lesson in seabird adaptations by means of a dress-up game: a coffee filter on the head to represent the bird's salt gland, for example, and swim fins for the webbed feet that help it traverse the open sea.

Today, they are going to do a relay race that will teach them about countershading and seabird feeding grounds. First, Peluso asks: "Who can tell me an adapation that murres have?"

Hands shoot up.

"Down feathers!"

"That's right. And what are down feathers used for?"

"They help the birds stay warm and dry and help them float!"

"Right. What else?"

"Their eggs are pointed on one end!"

"Yes. And why is that a good thing?"

"Because then the egg doesn't roll off the cliff!"

And so they go, picking apart some of the characteristics of birds in general, and of common murres in particular: oil glands, contour feathers, beaks, and of course, guano. The children's recall of what they learned two weeks earlier is phenomenal: they know things about birds that even an accomplished birder might struggle to point out.

Then the fun begins with the relay race, in which the students, divided up into three "murre colonies," vie to see who can get the most fish. When they've finished, Peluso tells them to look closely at their catch and notice that some fish are white and some black. "How come?" she asks. "Think about what the birds would see if they were in the water looking back up at the surface. Would a fish be better or worse off if it were light-colored underneath?" This leads to a discussion of countershading and a refresher on the murres' own coloration.

And then comes the messy-fun part of the morning as the children file into the room and, in pairs, claim birds to paint. In a matter of minutes, the decoys are transformed from sorry-looking almost-penguins into proud brown-and-white *Uria aalge*. "Use long strokes," Peluso instructs. "And do not dip your brush in your neighbor's paint!"

"Do the murres really get fooled?" asks one boy.

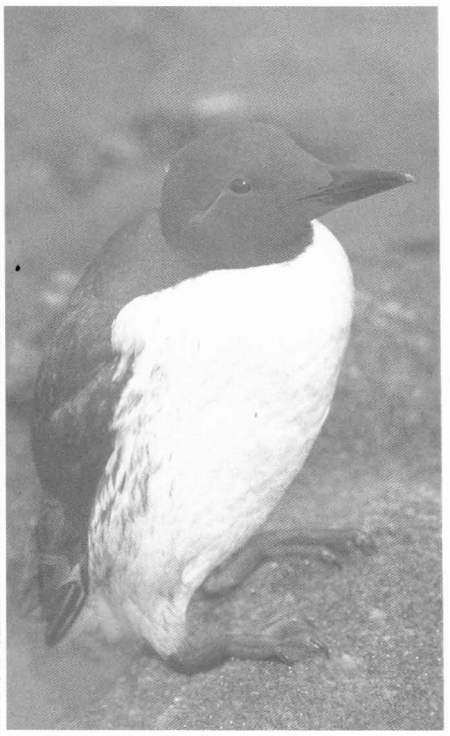
"They sure do," Peluso replies.

Indeed, any murre looking for a colony to cozy up in would be a bit daft to shun these now handsome specimens.

Oiled Birds and Dapper Decoys

THE OVERWHELMING SUCCESS of the Common Murre Project took even its developers by surprise. "We thought we would get a few birds to come in and check out the decoys and hang out the first year, but within 48 hours of putting the decoys up—and mind you, the colony had been empty for ten years—we had birds on the rock, and in that year we got breeding by six pairs, and three fledglings," according to Gerry McChesney, lead biologist on the project. "It blew everybody away." Since that first year of 1996, the goal of establishing 100 nesting pairs by the end of the ten-year project has long been surpassed. Already by 2000 the experiment had lured 98 nesting pairs; in 2001, 115 pairs set up house; and this year the number was up to 123.

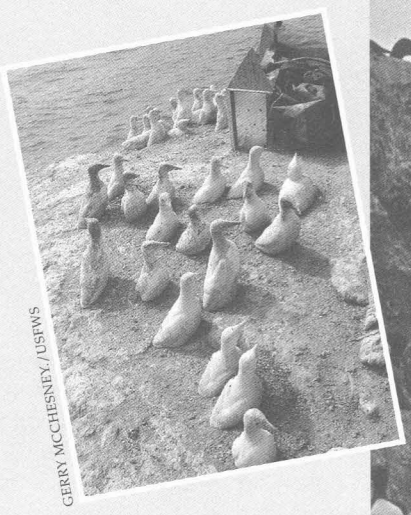
Yet these numbers are but a start to full restoration of the Devil's Slide colony, which in the early 1980s was a raucous, bustling mob of some 3,000 birds (a number that itself represents a significant population decline due to the widespread use of



DR. LLOYD GLENN INGLES © CALIFORNIA ACADEMY OF SCIENCES

ANNE CANRIGHT

Relay race among three "murre colonies." Who will get the most fish?



GERRY MCCHESNEY/USFWS

DR. LLOYD GLENN INGLES © CALIFORNIA ACADEMY OF SCIENCES

Real murres (right) don't fade the way the dapper decoys do out on the rock in the sun and rain.

gill nets for halibut in the 1970s, which drowned tens of thousands of murres). Then in February 1986 the *Apex Houston,* an oil barge en route from San Francisco to Long Beach Harbor, accidentally discharged some 26,000 gallons of San Joaquin Valley crude oil, which coated beaches from Point Reyes to Monterey. Of 9,900 birds killed, 6,300 were murres. The Devil's Slide colony was history.

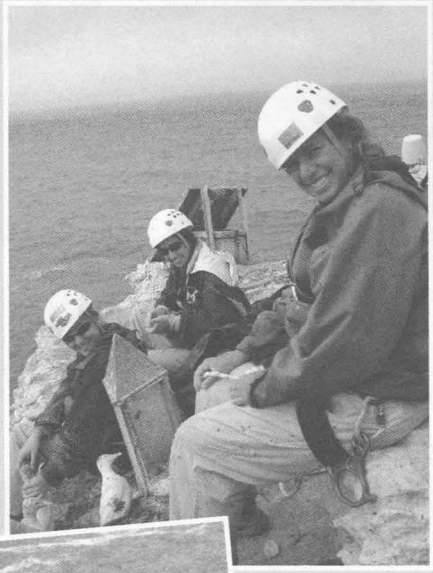
In 1988 federal and state natural resources trustees commenced litigation against Apex Houston Company under the Clean Water Act and the National Marine Sanctuaries Act. The case was settled six years later under a consent decree, for a total of $6.4 million, of which most—$4.9 million—was allocated for natural resource damages. A trustee council, made up of representatives from the National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service (USFWS), and California Department of Fish and Game, was established to review, select, and oversee implementation of restoration actions for natural resources injured by the spill. The San Francisco Bay National Wildlife Refuge Complex, under the jurisdiction of the USFWS, was brought in to lead the project; as overseer of the Farallon Islands, it had already done considerable work documenting declines of murres, and the infrastructure for undertaking the fairly ambitious murre project was already in place.

The decision to implement a "social attraction" plan on Devil's Slide Rock came easily. Since 1977, Project Puffin had been using decoys with great success to lure puffins in to suitable nesting habitat off the coast of Maine. Steve Kress, who works for the National Audubon Society on Project Puffin, was hired as a consultant on the Common Murre Project; he also served as a star witness in developing the Apex Houston settlement plan. Everyone agreed that decoys—lots and lots of them—were the key to luring murres back to their old home. And so Mad River Decoy, then of Waitsfield, Vermont, was enlisted to work magic and create a still-life murre colony.

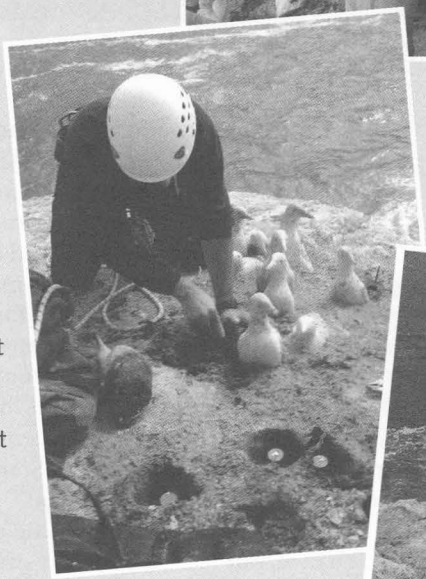
In January 1996, the first decoys were deployed on Devil's Slide Rock, representing 385 adults, 36 chicks, and 48 eggs. It took two days and eight to 10 people—biologists on the project and a few volunteers and interns—to do the work. A solar-powered sound system was set up to play CD recordings of a real murre colony—"important for sucking the birds in," said McChesney—and mirrors helped give the feeling of spacious-

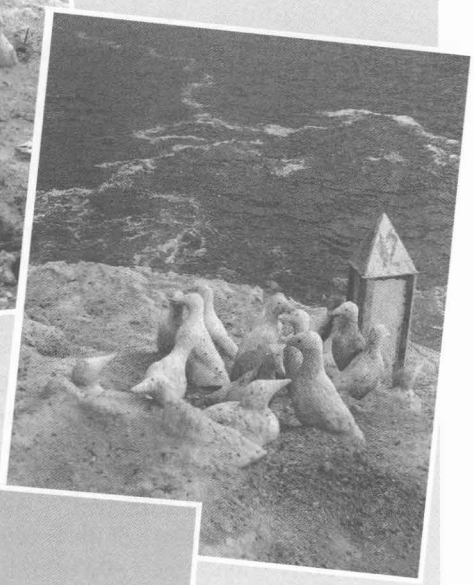
ANOTHER ROCK, ANOTHER STORY

BECAUSE THE DEVIL'S SLIDE project has been so successful, three years ago project managers decided to try putting murre decoys on San Pedro Rock, off San Pedro Point south of Pacifica. Historically, this rock, too, had a common murre colony, but it had suffered a different fate than the Devil's Slide colony, having been wiped out in the early 1900s by the egging industry. In 2002, 260 adult decoys were deployed, yet only four murres came to inspect, and none of them bred. Gerry McChesney offered two theories for the difference in success rates of the two seastacks. One is that Brandt's cormorants were already nesting at Devil's Slide when the decoy plan was implemented, and that may not only have been a stimulus to the murres, which are social creatures, to settle down, but the cormorants may also have kept ravens and gulls, which prey on eggs, at bay. Another idea, quite provocative, is that because Devil's Slide was an active colony up until 10 years before the project got going, "it was likely that there were birds out there who might have been born on the rock." Murres don't breed until four or five or even seven years, and they usually come back to the colony they were hatched in. "That may be what got the Devil's Slide colony jump-started so quickly, although we don't know for sure." Next year some Brandt's decoys will be placed on San Pedro Rock in hopes that, "if we can get cormorants breeding, that will spur the murres."



PHOTOS THIS PAGE: GERRY MCCHESNEY/USFWS





PHOTOS THIS PAGE: ANNE CANRIGHT

ness and movement. Within 24 hours, one murre was seen visiting the rock, and within 48 hours four birds had arrived and settled in. Since that time, the egg and chick decoys have been phased out, and as the number of living, breathing birds has increased, even the adult decoys have become less numerous: in 2002, only 176 were deployed. Meanwhile, a few months later, 102 eggs hatched and 95 chicks fledged—a healthy survival rate for the 123 breeding pairs.

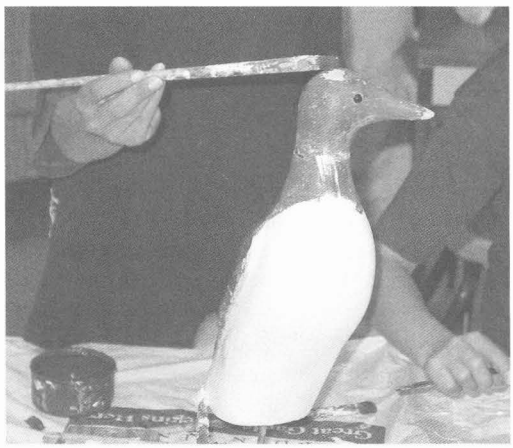
Now that the goal of 100 breeding pairs has been reached, said McChesney, "we don't want to just take everything off. Murres by nature nest in dense clumps: it's an antipredator behavior. One murre against a gull or raven doesn't stand a chance, but several do." The new goal of the project, therefore, is "to start getting the murres to move in closer and closer together, to somehow design the decoy plots toward densification of the birds that are actually there so they'll be self-sufficient." This will take up the last five years of the project (which has been extended by two years). In addition, decoy work on San Pedro Rock, just south of Pacifica—a tougher problem (see sidebar)—began three years ago, so the participating biologists' attention will turn increasingly to that aspect of the project.

Youthful Collaboration

SCHOOLCHILDREN WERE INVOLVED in the Common Murre Project right from the start, in part to ease the job of refurbishing hundreds of guano-encrusted decoys, but even more, to interest the children in the marine environment. "More classes get added every year, and all the teachers seem to want it back every year," McChesney remarked. All but two of the 10 participating schools are in Pacifica, Half Moon Bay, and Montara. "These are kids that ride by the rock and can relate to it. They have their take-home messages, and they really share them with their families."

"It's an amazing opportunity for kids in this age group to be involved with reestablishing wildlife in nature," said science teacher Greathouse. "Some kids get really inspired. Starting early, it's an experience to build on."

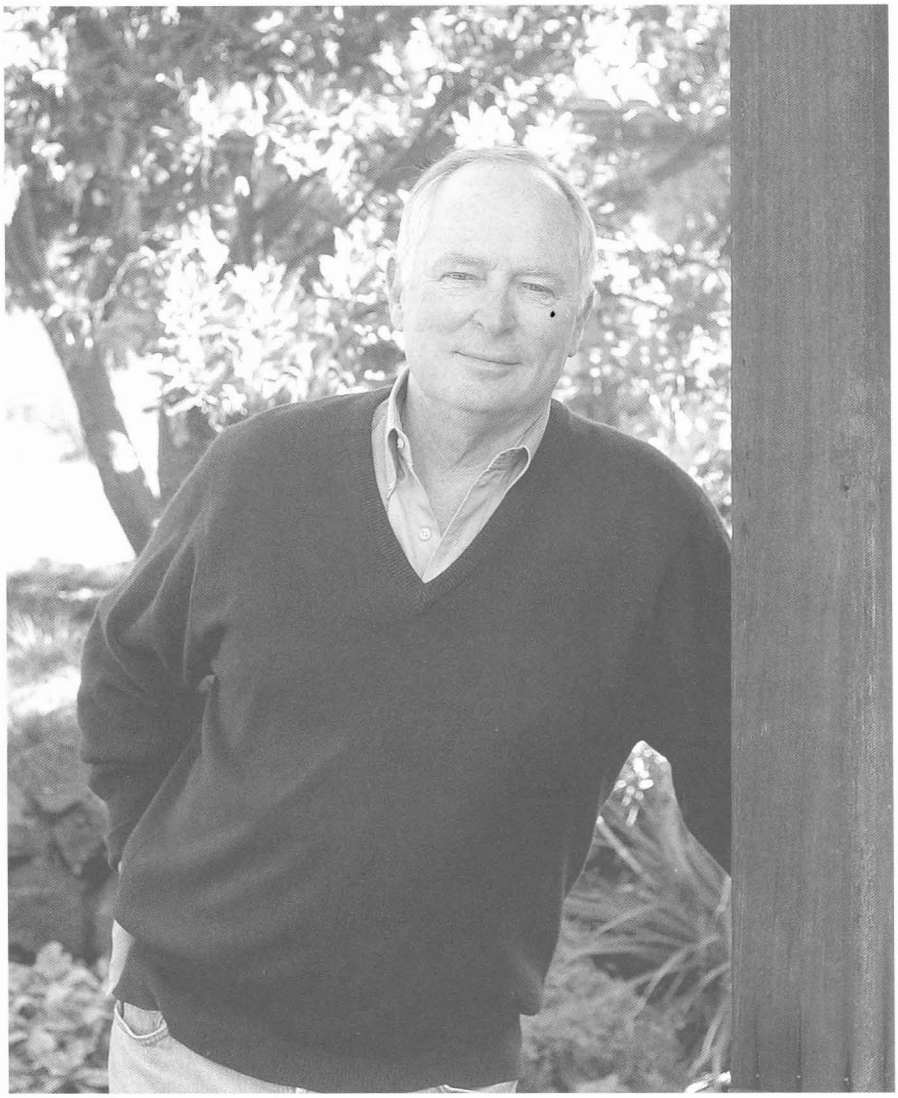
The value of the children's input cannot be underestimated. "Let's face it," said McChesney, "if we're going to clean up the marine environment, it will take education. This isn't just about research. It's about putting something back that we took away." ■



How the Coast Was Won

An Interview with Lew Reid

RASA GUSTAITIS



MARY REID

LEW REID IS A QUIET MAN, *not someone who seeks the limelight, so not many people know of the major role he played 30 years ago, when Californians fought for their coast and won its protection for everyone's use and enjoyment. "Success has many fathers," as the saying goes—and mothers too, one might add—so only those who worked closely with Reid at the time may be aware that he was the principal author of Proposition 20, the 1972 voter initiative that created California's coastal program and the Coastal Commission.* Coast & Ocean *visited Reid at his hilltop home near Sebastopol recently to hear the story of that now legendary campaign. He told an inspiring and exhilarating tale.*

COAST & OCEAN: Proposition 20 became law on January 1, 1973, three decades ago. Many people now know nothing of that history. But is it important to know about it?

LEW REID: I'm not sure that the history is important to anyone other than historians, but there are some lessons. That was an extraordinary grassroots volunteer effort in which just shoe leather and cauliflower ears from the telephone outdid massive amounts of money that were spent to defeat the initiative. And it did cause a sea change in the way we think about land use along the California coast, and perhaps in other areas as well.

C&O: What catalyzed the "Save Our Coast" campaign?

LR: I'm thinking of the things that were happening in the late '60s and early '70s. In 1969 we had a big oil spill in Santa Barbara and there was continuing controversy over whether there should be offshore drilling in California. There was a proposal to make a big desalination plant on the Orange County coast. Then we had the nuclear power plants along the coast; that aroused a lot of opposition. And we had a system by which land use on a thousand miles of coast was regulated by countless counties and cities, without any overarching judgment over that land use. Coastal residential subdivisions were being permitted without consideration of their overall impact. Development interests were much more able to push their agendas with the local

agencies, and the overall environmental point of view was very difficult to present without a regional agency.

C&O: The idea of planning and regulating for the whole coast as a single unit, was that new? And was California the first state to do this?

LR: I know we didn't have models from other states to look at. The model was BCDC, the Bay Conservation and Development Commission, established a couple of years earlier [1969] to regionalize land-use planning around San Francisco Bay.

C&O: Why couldn't the Legislature pass a coastal act?

LR: It could have. We did not really expect to have to rely on the initiative process. In some sense we viewed the initiative we wrote as a companion to the bill we wrote; it was there as an inducement to the Legislature to act. There were two bills in the Assembly in the session that ended in 1970, one by Alan Sieroty and one by Pete Wilson. When the next session started, Alan Sieroty offered the bill we put together for the Coastal Alliance and we fully expected that we would get that bill through the Legislature. It passed overwhelmingly in the Assembly but got bottled up in a Senate committee. So then we had no choice but to campaign for the voter initiative.

I'm not generally enthusiastic about the initiative process. Having come to the coastal movement after three years as committee counsel in a Senate committee in Washington, D.C., I really value the legislative process, the give and take, and the way legislation is tested intellectually during that process. Initiatives tend to be written in a one-sided way, they're not tested by debate and hearings, they're "take it or leave it," and I don't think this is in general a good way to make our laws. So we had crafted our legislative bill, and then to create the initiative we removed a lot of the language that represented compromises that had been made to make the legislative bill more palatable to all sides, and we shortened the bill. We expected that having this initiative waiting in the wings would be an incentive for the Legislature, and the various interests in the Legislature, to come together behind the legislative bill.

C&O: Because the initiative was more pro-conservation?

LR: Exactly. And seeing that, the Senate still didn't pass a bill. Maybe they thought we were bluffing.

C&O: Did Proposition 20, then, have the weaknesses you see as typical of initiatives, was it one-sided and inadequately tested?

LR: It certainly was tilted more toward conservation, more one-sided than the Sieroty bill that passed the Assembly, but we had the benefit of a year of hearings and negotiations on that bill to tease out the problems. Initiatives generally don't have the benefit of hearings. We tried hard to be sure we wrote something that would be constitutional. We thought that if we wrote something that was thrown out in court we would never again have an opportunity to mount the kind of campaign that was mounted to pass it. So we tried to be very careful, to be sure that land-use restraints were reasonable, and that there was a policy purpose, clearly articulated, in the initiative to be a Constitutional foundation for the restrictions. Also, the temporary nature of the Commission at the outset and the need for subsequent legislative reauthorization helped to assure its validity.

[Proposition 20 established a Coastal Commission and gave it permit authority for four years, while a Coastal Plan was drafted and submitted to the Legislature.]

C&O: The Court of Appeal recently upheld a trial court decision that found the Commission to be unconstitutional because the majority of its members is appointed, without fixed terms, by the Legislature, which created the Commission. This was found to be a violation of the doctrine of separation of powers. Did this issue ever come up?

LR: No. Prop 20 gave only one-third of the appointments to the Legislature. Half were from regional commisions. It seemed to me a rather awkward compromise to spread the appointment authority for the other half (the so-called "public members") among the governor, the Assembly speaker, and the Senate Rules Committee. The purpose was to prevent anyone from packing the Commission. [The regional commissions ceased to exist when the 1976 Coastal Act was passed.]

C&O: What would have been an alternative?

LR: I don't recall alternatives ever being considered because it was clear the environmental community wanted the

COURTESY BILL KORTUM

Senate President pro tem Jim Mills led a bike ride to support Proposition 20. It began in San Francisco with great fanfare and ended when the riders reached San Diego.

appointive power to be spread so that the power of any one person was dissipated.

C&O: How do you see it in retrospect?

LR: It seems to have worked, but I still prefer executive appointments with legislative advice and consent.

C&O: The Commission has one great weakness, in that the person who appointed a commissioner can also remove that commissioner at will. Was that anticipated?

LR: I don't think so. The original public members were appointed for a term, namely the initial life of the Commission that ended in 1976. I presume the "at will" appointments are a product of the 1976 Coastal Act. Under the present system the commissioners must be under intense political pressure on some decisions.

C&O: While you were in Washington as minority counsel for the Senate Interior Committee, some major environmental legislation was in the works at the federal level, right?

LR: It was a robust time for expanding the National Park System. In California we created the Redwood National Park and worked on expanding the Point Reyes National Seashore. We also worked on the Wild Rivers Act and implementation of National Wilderness legislation. Probably one of the most significant things that was happening at the time was the incubation of the National Environmental Policy Act [NEPA]. That was introduced for the first time in 1967 or '68 in the Senate. It was the brainchild of consultants and staff for Senator Scoop Jackson of Washington. It was passed in 1970, a year after I left Washington. The NEPA model—requiring a look at the environmental impacts of projects, which on paper seemed pretty benign—caused a profound change in attitudes toward projects. It was an environmental Trojan Horse.

Before NEPA there was an intellectual struggle about how to value conservation and recreational values. For example, where Forest Service lands were managed for multiple use, there were struggles to quantify the economic value of environmental uses. How do you put a dollar value on scenery? In the past 30 years environmental economists have become much more sophisticated, but at that time the efforts were very crude.

C&O: But NEPA did not require that you put a dollar value on it. So that was a value shift.

LR: Exactly. That's what I think was so revolutionary about NEPA: it didn't require that you make an economic quantification of the value of recreation or scenery or ecological systems; it merely said you have to see if there are significant adverse impacts, and if there are, tell of ways to mitigate them. This was a profound shift, and some of that new thinking certainly carried over into the coastal bills because we were asking that a broad range of environmental impacts be taken into account in making land-use decisions.

C&O: You came back to California during this interesting time and returned to your private law practice. What led you to get involved in the Coastal Alliance? And what was that Alliance, exactly?

LR: It was an umbrella association of all the groups that supported the coastline. Janet Adams was the spark plug. She came out of the fight to create BCDC and she really ignited the Coastal Alliance. [State Senator] Peter Behr told Janet I should be drafted as the counsel for the Coastal Alliance. I had worked with him when he was the spokesman for expanding Point Reyes in '66 and '67. At Peter's suggestion, I met with Janet, and no one says no to her.

C&O: Would you describe Janet Adams?

LR: She's just absolutely wonderful—a dynamic, energetic, nonstop, ethical, principled dynamo. She's like a bulldozer with heart.

C&O: Who were some other key people you worked with?

LR: She had a close friend, Alex Donald, since passed away, who raised money. Then there were legislators who were important, the principal one being Alan Sieroty, and his assistant, Peter Douglas; but also Pete Wilson before he became the mayor of San Diego, Paul Priolo, Arlen Gregorio, Don Grunsky, and John Dunlap were influential, and Bob Moretti, speaker of the Assembly. There were volunteers like Bill Kortum, Phyllis Faber, . . . I could go on and on—there were thousands of people and dozens of organizations involved. Two young lawyers in my firm worked very hard on the campaign: Ray McDevitt, who is still practicing in San Francisco, and Ron Gilson, who is now a Stanford law professor. Bill Press, whom you see on cable TV these days as a Washington, D.C. talking head, ran our PR. No one was compensated, every bit of the effort was volunteer. The campaign commanded the passion of legions of people.

Janet and the leaders of the Alliance managed to avoid the infighting you often see in environmental campaigns. I remember the Redwood National Park's creation was slowed down for years because the Sierra Club wanted the park in one place and the Save-the-Redwoods League wanted it in another. There was very little of that kind of thing in the Coastal Alliance. One organization did bolt and gum up progress in the Senate, but we probably would never have gotten a bill through the Senate anyway.

C&O: The conflicts were worked out ahead of time?

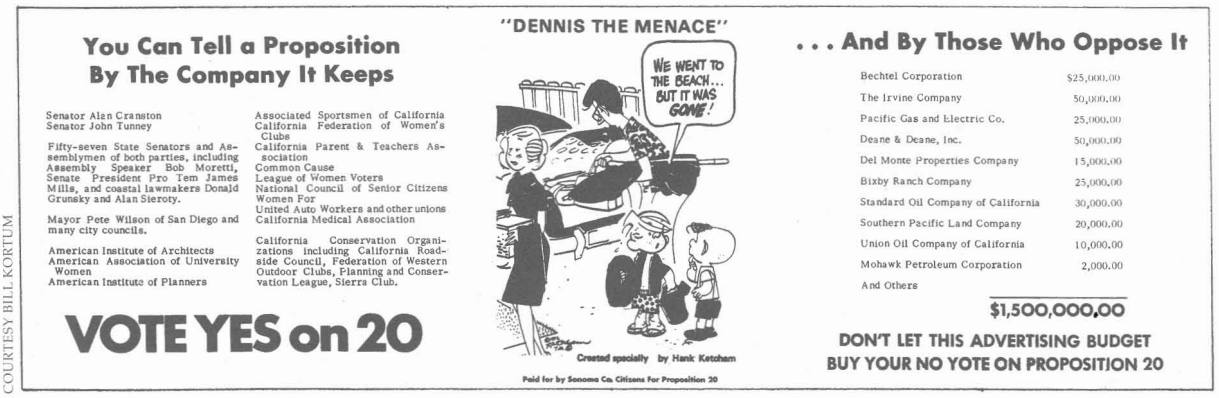
LR: In part by the process by which we created both the bill and consensus around the bill.

C&O: How did that go?

LR: There were many meetings to cement the cooperation. In early 1971 I took the bills Pete Wilson and Alan Sieroty had introduced in the legislative session that ended in 1970, and tried to extract from them all the key issues that needed a decision. We brought leaders of all the environmental and interest groups that were part of the Coastal Alliance together in my office. During weekend sessions we attacked the issue list. For example, "How do you appoint?" was an issue. "How wide is the coastal zone" and "What is to happen within it?" At the end of the day we had come to a consensus on what the environmental point of view would be on all of the

Left to right: Bill Davoren, Lew Reid, Joe Bodovitz, first executive director of the Coastal Commission, Alan Sieroty, and Peter Douglas, celebrated the Coastal Commission at a spring picnic, late 1970s, at Alan Sieroty's place, now part of the Point Reyes National Seashore.

PHOTO COURTESY LEW REID



You Can Tell a Proposition By The Company It Keeps

Senator Alan Cranston
Senator John Tunney

Fifty-seven State Senators and Assemblymen of both parties, including Assembly Speaker Bob Moretti, Senate President Pro Tem James Mills, and coastal lawmakers Donald Grunsky and Alan Sieroty.

Mayor Pete Wilson of San Diego and many city councils.

American Institute of Architects
American Association of University Women
American Institute of Planners

Associated Sportsmen of California
California Federation of Women's Clubs
California Parent & Teachers Association
Common Cause
League of Women Voters
National Council of Senior Citizens
Women For
United Auto Workers and other unions
California Medical Association

California Conservation Organizations including California Roadside Council, Federation of Western Outdoor Clubs, Planning and Conservation League, Sierra Club.

VOTE YES on 20

"DENNIS THE MENACE"

Created specially by Hank Ketcham

Paid for by Sonoma Co. Citizens For Proposition 20

. . . And By Those Who Oppose It

Bechtel Corporation	$25,000.00
The Irvine Company	50,000.00
Pacific Gas and Electric Co.	25,000.00
Deane & Deane, Inc.	50,000.00
Del Monte Properties Company	15,000.00
Bixby Ranch Company	25,000.00
Standard Oil Company of California	30,000.00
Southern Pacific Land Company	20,000.00
Union Oil Company of California	10,000.00
Mohawk Petroleum Corporation	2,000.00
And Others	
	$1,500,000.00

DON'T LET THIS ADVERTISING BUDGET BUY YOUR NO VOTE ON PROPOSITION 20

THE SEBASTOPOL TIMES Thursday, October 26, 1972

CARTOON BY HANK KETCHAM, COURTESY BILL KORTUM

Among those donating their talents to the campaign was cartoonist Hank Ketcham. This ad ran in such newspaper space as the Coastal Alliance could afford.

critical components of the bill. That was the grist for drafting the bill. I chaired that meeting, and I don't recall it as having been a difficult process at all. It was a collaborative process rather than a boisterous one.

Then I used those decisions to prepare a draft of the bill [AB 1471] that was introduced by Mr. Sieroty in the spring of 1971. Throughout that year he and Peter Douglas and I were in constant contact as new issues were raised in the legislative process. Later, we took that bill and the same fundamental decisions and wrote a second, shorter, bill, which was the initiative.

C&O: The key issue was public access, I've been told. That was what everyone cared about the most. What about other things?

LR: I do remember great concern about development, both commercial and residential development at the water's edge. There were lots of impending projects up and down the coast, there were concerns at Monterey, Malibu, Sonoma, and also south of Big Sur.

We entered 1972 not knowing what was going to happen in the Legislature. When it became clear our bill wasn't going to pass the Senate, we had to crank up the initiative process and get the signatures and get qualified for the November ballot.

C&O: What highlights stand out for you from the "Save Our Coast" campaign?

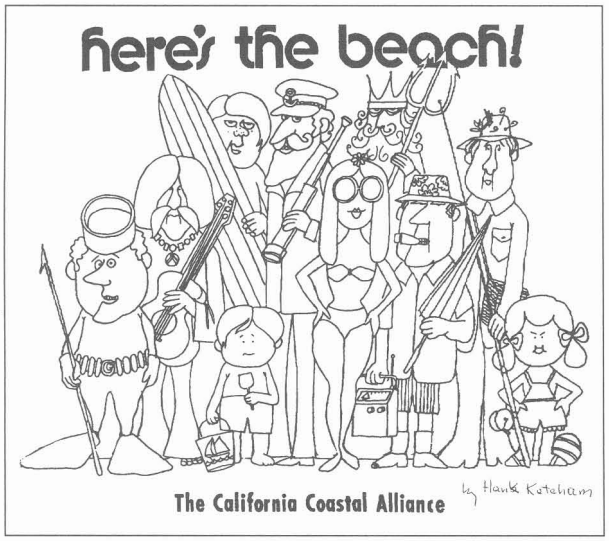
LR: Three come to mind.

The owner of the Firehouse Restaurant in Sacramento, who was also the husband of a prominent San Franciscan, sued the attorney general, the secretary of state, the county clerks of all the big counties, and the Coastal Alliance, claiming that our ballot description was fraudulent and it should have been kicked off the ballot. He claimed that because there were tides at his dock in Sacramento, we were trying to regulate his use of his property. But he didn't read the bill carefully enough. We got into a preliminary injunction hearing in Sacramento with a wonderful judge, Judge Perluss, who quickly saw that the coastal zone stopped at the Golden Gate Bridge [San Francisco Bay is under BCDC jurisdiction] and tossed the case out of court. But it did cause consternation for a few days. And since none of the governmental parties had a real interest, I had the fun of handling the case myself.

C&O: Then there was the billboard incident, right?

LR: The opponents were trying to sound as though their message was the environmental message. Their PR campaign had a slogan: "Don't lock up the beach, vote no on 20." A young man who was running a public interest law firm in Los Angeles called to say he was going to sue the opponents' PR firm, charge them with fraud, and get the "No on 20" campaign enjoined. It was clear to me that he was going to lose that case because the First Amendment protects free speech and you can't have prior restraints on that kind of political speech. So I knew we would have a disaster on our hands if we had a law suit claiming the ads were fraudulent and the suit was thrown out of court on constitutional grounds.

Speaker of the Assembly Bob Moretti was a great friend of the Coastal Alliance. We talked with him and he then held a press conference in front of one of those huge "No on 20" billboards and told the press that the sign was fraudulent and that he was going to hold hearings on fraudulent political advertising. He convened a hearing, brought the head of the PR firm that had created the ad before the hearing, and completely discredited the anti–Prop 20 advertising. Actually, it was a little poignant because the PR man, who had a substantial reputation in California, was humiliated by being denounced by a legislative committee.



CARTOON BY HANK KETCHAM, COURTESY BILL KORTUM

But it did make the point that the advertising was fraudulent, and in a setting in which we did not overstep any constitutional limits.

C&O: Great strategy. And the third episode?

LR: The Federal Communications Commission [FCC] was also involved. This, in some ways, was the most fun of all because it combined legal machinations with the work of volunteers. One of our biggest concerns was that we had virtually no money for any TV advertising. We had some radio spots and some posters we sent people out with, but the opponents had a massive advertising budget—at least massive for that time. It would seem trivial today, I guess.

There were two doctrines in communications law. One is Equal Time, which requires television stations to give equal time to candidates; the other is the Fairness Doctrine, which requires that if there is a controversial issue of public importance, the stations have to be fair in their allocation of time and treatment of the issue. [The Fairness Doctrine was enforced from 1949 to 1987, when the Reagan administration abolished it.]

To my knowledge, the Fairness Doctrine had never been applied to paid advertising before the Prop. 20 campaign. We had produced a wonderful spot in which a San Francisco advertising man named Bud Arnold sat on a stool with a camera on him in a bare studio and said: "I'm Bud Arnold, I'm an advertising man and I think what's being done by the 'Vote no on 20' people is a disgrace to my profession. They want you to believe that you can save the beach by voting no on the proposition to save the beach." A really beautiful commercial—but we didn't have any money to get it on television.

So what I did, with the folks in my law firm, was to prepare a petition to the FCC claiming that one of the San Francisco television stations had violated the Fairness Doctrine. Someone on the other side had sympathies with the coast because we got a copy, in an unmarked envelope, of a list of all the opponents' television buys, station by station. We prepared a petition and attached an exhibit showing all the times that one San Francisco station was running spots, and said we didn't have money to run any spots. We claimed that the television station had an obligation to run our spots free.

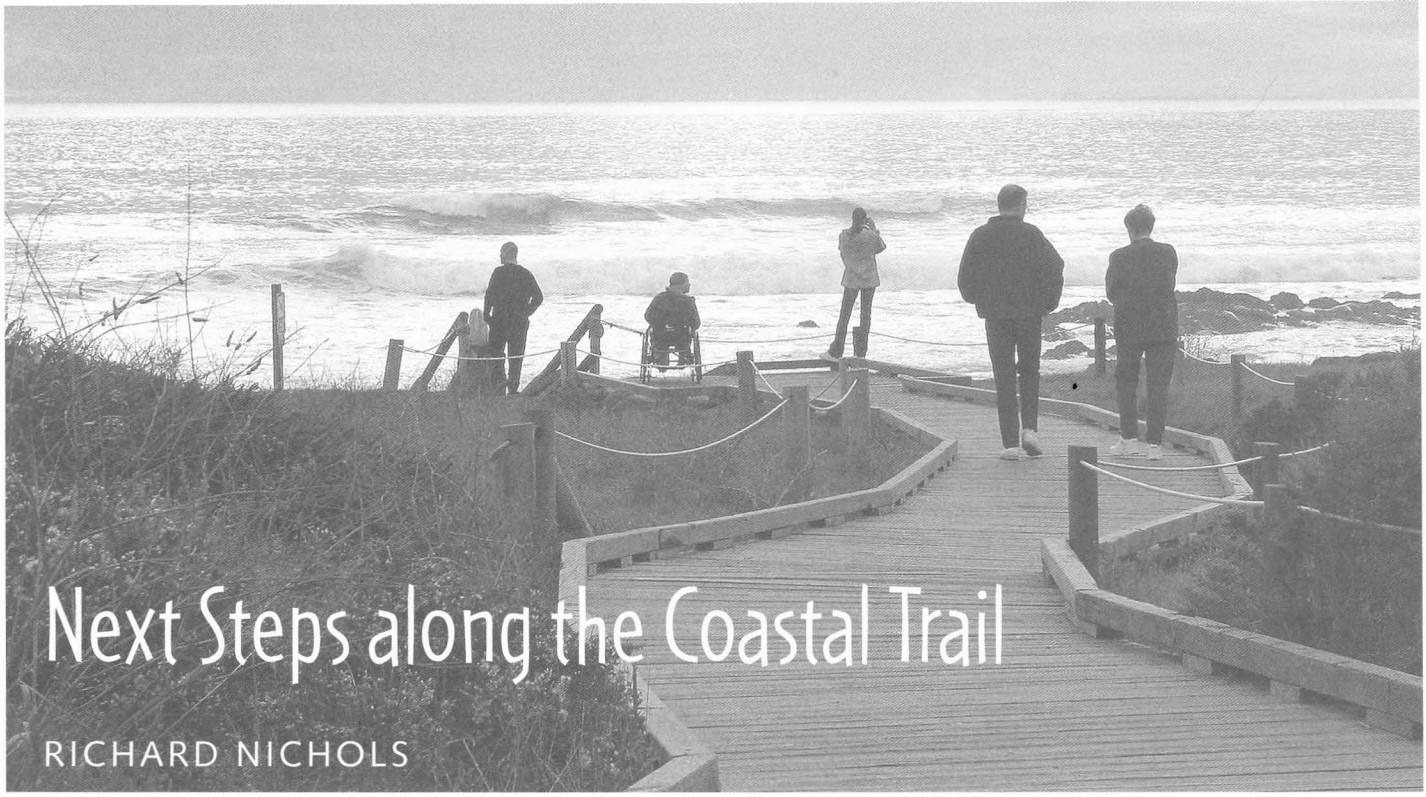
A fellow who had been on the faculty of Boalt Hall [law school] when I was teaching there, Nick Johnson, was head of the FCC. Johnson ruled that there was a violation of the Fairness Doctrine. We got a copy of his order and the next day had volunteers deliver it, together with the Bud Arnold spot, to television stations around the state. Leon Panetta [former White House Chief of Staff] was the volunteer who delivered the copies in Monterey, where he was a lawyer before he ran for Congress. This happened literally a week before the election. During that last week before the election stations throughout California were running our spot *free* or giving us other kinds of coverage. I remember Channel 2 in Oakland gave us a half-hour program, a kind of town hall meeting in which Janet and Peter Behr and I answered questions from a friendly audience of Coastal Alliance volunteers. So we got a vast amount of television coverage in the last week based on a momentous but little-noticed FCC order.

It was quite exciting to use the power and momentum of the opponent to accomplish your own purpose.

C&O: Superb martial arts practice!

LR: So those were some of the incidents that made 1972 a thrilling year. Proposition 20 was an example of what happens when the legislature is not courageous enough to face a critical issue. If the legislature can't deal with it, people are likely to do so.

After the passage of the Coastal Initiative and its embodiment in the 1976 California Coastal Act, Lew Reid continued in private practice for another 25 years in San Francisco, but he declined to handle any legal matters that involved the Coastal Commission. All his work for the Alliance had been pro bono. He is now retired in Sonoma County, having served from 1998 through 2000 as president and CEO of the California Endowment, the largest health-related foundation in California. He is now on its board, on the boards of the Sonoma Land Trust and the American Land Conservancy. He is founder and president of the American Society for the Royal Botanic Gardens, Kew. ■



Next Steps along the Coastal Trail

RICHARD NICHOLS

CARLA CHENAULT

COASTWALK WILL LEAD another coast-long trek this coming summer to build support for the California Coastal Trail, a continuous 1,300-mile pathway that is to run along the Pacific shoreline, linking Oregon and Mexico.

On June 3, up to a dozen people are expected to gather at Pelican State Beach and set forth on Coastal Trail Expedition 2003, with the intention of arriving by September 22 at Border Field State Park, just inside the fence that divides California from Mexico. En route the hikers will spread the word about their vision of the Trail by talking with people they encounter, inviting local officials and citizens to join them for short hikes, and holding press conferences. They will also gather information about the state of the coast, and of public access to it, using digital cameras, GPS, web page uplink, and other research tools. Such data will be useful in efforts to realize the Coastal Trail.

This is the second such walk sponsored by Coastwalk, a nonprofit organization that has been advocating for the Coastal Trail for the past 20 years. In 1996 seven people completed the Whole Coast Hike. By so doing, they moved the idea of the trail forward until it began to seem achievable.

In 2000, voters passed Proposition 40, which includes $5 million to the Coastal Conservancy for the Coastal Trail. In 2001, the Legislature passed SB 908, by Senators Wesley Chesboro and Betty Karnette, and ACR 20, by Assembly Member Fran Pavley, making the California Coastal Trail an official state trail and calling for a report on the concept to be presented to the Legislature. Governor Davis signed the legislation, and, in response, the Coastal Conservancy organized a working group to prepare the report. In 2001 and 2002, representatives of the Coastal Commission, State Parks Department, and Coastwalk met monthly with Conservancy representatives to hammer out a conceptual framework.

The full realization of the Coastal Trail vision will depend on citizen effort. The initial funding was obtained by means of public initiative, support, and approval; hundreds of Coastwalk volunteers have given, and continue to give, their time, talent, and energy to advocacy work. Many more will have to participate to make the border-to-border trail a reality. Although it is projected to be 1,300 miles long, every inch of it is local. "All trails are local trails," points out Nancy Graves of San Luis Obispo, a Coastwalk volunteer.

Whether you live on the coast or inland, it's your coast and your trail. ■

Richard Nichols is the executive director of Coastwalk.

For a schedule of upcoming coastal walks, including the coast-long trek, contact Coastwalk, call (800) 550-6854; write to 7207 Bodega Avenue, Sebastopol, CA 95472; or email rnichols@coastwalk. The Coastwalk web site is at www.coastwalk.org.

Top: Cambria

Below: Monterey Bay Recreational Trail

Bottom: East Beach, Santa Barbara

CITY OF MONTEREY

COASTAL CONSERVANCY NEWS

DURING THE LAST three months of 2002, the Coastal Conservancy approved funding for a wide array of projects along the coast and on San Francisco Bay. These ranged from efforts to eradicate invasive alien plants to construction of trails to preservation of farmlands and emergency repairs to a popular fishing and recreational pier. Much of the funding for these projects was made available through Propositions 12 and 40, the parks and resources bond acts passed by California voters in 2000 and 2002.

Among projects approved October through December, 2002 are these:

BETTER ACCESS TO HUMBOLDT BAY DUNES

AFTER MANY YEARS of planning, the Manila Community Services District has obtained funding to improve trails and park facilities at the 101-acre Manila Dunes Recreation Area. Plans call for three miles of clearly marked trails, recreational and picnic facilities, increased parking, public restrooms, and a wheelchair-accessible boardwalk leading through the dunes to an ocean overlook. The work is expected to be completed by the end of 2003. Total cost is estimated at $473,000.

The Coastal Conservancy approved $246,000 in Proposition 12 funds in October, the District is contributing $100,000, partly with a grant from State Parks. Previously authorized Conservancy funds will pay for the remainder.

The Manila Dunes lie along the ocean side of the North Spit of Humboldt Bay and are a popular destination for hikers, birdwatchers, equestrians, and student groups. These dunes are part of a 13-mile dune system that runs from the Samoa Dunes Recreation Area north to the mouth of the Mad River. They support two federally and state-listed endangered plants, beach layia and Menzies' wallflower, and are potential habitat for the endangered snowy plover.

FORT BRAGG'S GLASS BEACH

GLASS BEACH, the only accessible beach in Fort Bragg, is to be purchased by California State Parks and added to MacKerricher State Park. The Coastal Conservancy approved $2,825,000 for the purchase in October, with $2.5 million coming from federal transportation funds, and $325,000 from Proposition 12 funds.

The Conservancy worked for over four years with the City, the Mendocino Land Trust, and other organizations to assemble funding for the purchase of the 38-acre property and to provide for its future management. The landowner told city officials in 1998 that he was interested in selling to a public agency.

Glass Beach is known for the polished glass pebbles often found there. They are shards of colored glass, worn smooth by waves and tides, legacy of a municipal dump located there from 1949 to 1967. Also left behind by the dump are two small areas contaminated with toxic materials. The California Integrated Waste Management Board will clean these areas before acquisition, which State Parks expects to complete in summer 2003.

A trestle that spans Pudding Creek will be repaired to allow people to walk between Glass Beach and McKerricker Park, and along several miles of beach trails.

BODEGA BAY TRAIL PLANNING

SONOMA COUNTY will begin preparation of a comprehensive plan for hiking and biking trails in the Bodega Bay area, including a Coastal Trail link through the town, with $50,000 approved by the Conser-

CITY OF FORT BRAGG

Glass Beach is on the rocky Mendocino County Coast.

vancy. The plan will include design options, funding and management needs, and construction recommendations. The public will be invited to take part in the plan's development.

ANOTHER WORKING RANCH NEAR TOMALES BAY PROTECTED

MARIN AGRICULTURAL Land Trust (MALT) will protect another 308 acres of west Marin County's farmland by purchasing a conservation easement on the Zimmerman Ranch, on the east side of Tomales Bay, for $684,000. The Conservancy committed $350,000 in Proposition 40 funds toward the acquisition. MALT has applied to the Department of Conservation for the remainder, $334,000.

By purchasing the easement, MALT will permanently prevent the subdivision and development of a productive cattle ranch, and will enable the younger generation of the Zimmerman family to continue farming. In this area, agriculture is greatly threatened by the purchase of farmlands for use as estates. The easement will restrict the size of the farm's two primary residences to 3,000 square feet, and will prevent uses of the land that would degrade water quality or cause soil erosion into Tomales Bay.

In the past 20 years MALT has permanently protected 47 family ranches, a total of 32,000 acres.

PETALUMA RIVER AND MARSH

THE CITY OF PETALUMA is moving forward with its plan to create a marsh and trail system modeled after the pioneering Arcata Marsh. The $8 million project on the Petaluma River is centered around around 30 to 40 acres of "polishing wetlands," which will improve the quality of treated wastewater draining to the river while also creating habitat, trails, and wildlife-watching opportunities.

The Conservancy approved $2 million in Proposition 12 funds, and the Sonoma County Agricultural Preservation and Open Space District is contributing another $2 million for the purchase of land on the east side of the river at the city's southern boundary. A trail system will be built on the perimeter of the polishing wetlands, connecting with more than two miles of trails at neighboring Shollenberger Park.

The City's purchase will also allow protection and improvement of over 200 acres of riverside marshlands that provide habitat for the endangered California clapper rail, black rail, salt marsh harvest mouse, and other wildlife. The purchase is expected to be complete by summer. The polishing wetlands and other improvements are to be completed within five years. The Conservancy has worked for many years with the City and other parties on recreational and environmental improvements to land along the river.

PHOTOS THIS PAGE: SCOTT HESS

Above and below: Looking south and southwest from Petaluma's Shollenberger Park

PROGRESS ON SAN FRANCISCO BAY AND RIDGE TRAILS

OVER $1.1 MILLION approved by the Coastal Conservancy in October will support the design and construction of new sections of the Bay Area Ridge Trail and the San Francisco Bay Trail. This funding will be matched by over $3 million from many other organizations.

Rector Ridge Trail, Napa County: To the Bay Area Ridge Trail Council, $600,000 to build a six-mile trail near Yountville on property owned by the California Department of Veterans' Affairs. The trail will start near Silverado Trail and end near the Stags Leap rock formation, providing sweeping views of Napa Valley and San Francisco Bay. The council will raise the remainder of funds needed, estimated

at $115,000, and coordinate volunteer efforts for the construction.

Inkwells Bridge, Marin County:
To the Marin County Department of Parks, Open Space, and Cultural Services and the Marin Municipal Water District, $100,000 to build a 170-foot bridge across San Geronimo Creek, connecting a Ridge Trail segment in Samuel Taylor State Park to one on district property, and to a bicycle path along Sir Francis Drake Boulevard. The pedestrians, bicyclists, and equestrians who now use the trail must ford the creek, damaging creekside vegetation and causing erosion. The county, the district, and others will contribute over $1.2 million.

White Hill Underpass, Marin County:
To the Marin County Open Space District, $40,000 to build a 2,000-foot pedestrian, bicycle, and equestrian trail under a new road bridge on Sir Francis Drake Boulevard in Marin County, providing trail users with a safe route across this major roadway. The new trail will connect a Ridge Trail segment at Loma Alta Open Space Preserve with White Hill Open Space Preserve. Caltrans will provide $80,000 of the project's $130,000 cost. The Open Space District and Ridge Trail Council will each contribute $5,000.

Aoki Acquisition, Santa Clara County:
To the Santa Clara County Open Space Authority, $250,000 toward the purchase of the 62-acre Aoki property on a prominent ridge in the foothills east of San Jose. The Authority will provide $1.5 million for the acquisition, which will help secure a four-mile Bay Area Ridge Trail alignment connecting San Jose's Alum Rock Park to the county's Grant Park while protecting habitat for black-tailed deer, coyote, badger, mountain lion, and other wildlife.

Coyote Point Park, San Mateo County:
To San Mateo County, $71,500, administered by the Bay Trail Project, toward preparation of final plans for a new one-mile Bay Trail alignment parallel to Coyote Point Drive. The county will contribute an additional $20,000. The realignment will greatly improve the current trail route, which is narrow, underused, and disconnected.

Middle Harbor Park, Oakland:
To the Port of Oakland, $100,000, administered by the Bay Trail Project, to construct a 2,500-foot trail segment on Seventh Street between Wood and Maritime Streets, filling a Bay Trail gap between the new Middle Harbor Shoreline Park and Jack London Square. The port will contribute $95,000 toward the total project cost of $195,000.

DELTA SLOUGH TO BECOME MARSH

MORE THAN **1,160** acres along Dutch Slough, in the city of Oakley, will be purchased for restoration to tidal marsh. Because this acreage has not subsided as deeply as other parts of the Sacramento–San Joaquin Delta, a variety of habitat types can be restored. Beneficiaries will include chinook salmon, delta smelt, sandhill crane, and other threatened or endangered species. The rapidly growing human population in eastern Contra Costa County will gain badly needed public access, open space, and recreational opportunities.

The purchase will require up to $5 million of the Conservancy's funding, made available through Propositions 12 and 40. An expected $23 million grant from the CALFED Bay-Delta Ecosystem Restoration Program will cover the balance of the purchase price.

The Conservation Fund, a key partner in the project, will purchase the property from three private owners, who are willing to sell for $10 million below the appraised fair market value. The property is zoned for mixed-use development, and the owners have an approved agreement to develop between 4,100 and 6,000 residences here, which they will forego by the sale. The Fund will then sell the property to the Department of Water Resources.

The CALFED Bay-Delta Ecosystem Restoration Program will provide an additional $2 million for environmental restoration plans. In addition, the Conservancy will provide $50,000 to the City of Oakley to plan for public access on the restoration site and adjacent city property. Proposed projects include the construction of fishing piers, wildlife viewing areas, and a trail network. These will require future funding.

ECO VILLAGE FOR YOUTH IN RICHMOND

TO HELP LAUNCH an innovative environmental education program in the city of Richmond, the Conservancy approved a $350,000 grant and a $350,000 no-interest loan to the Trust for Public Land (TPL) in October. The funds will help TPL to buy 5.6 acres with a house and a small orchard on Laurel Lane, along San Pablo and Wilkie creeks, where the youth-oriented program will be undertaken by the Earth Island Institute.

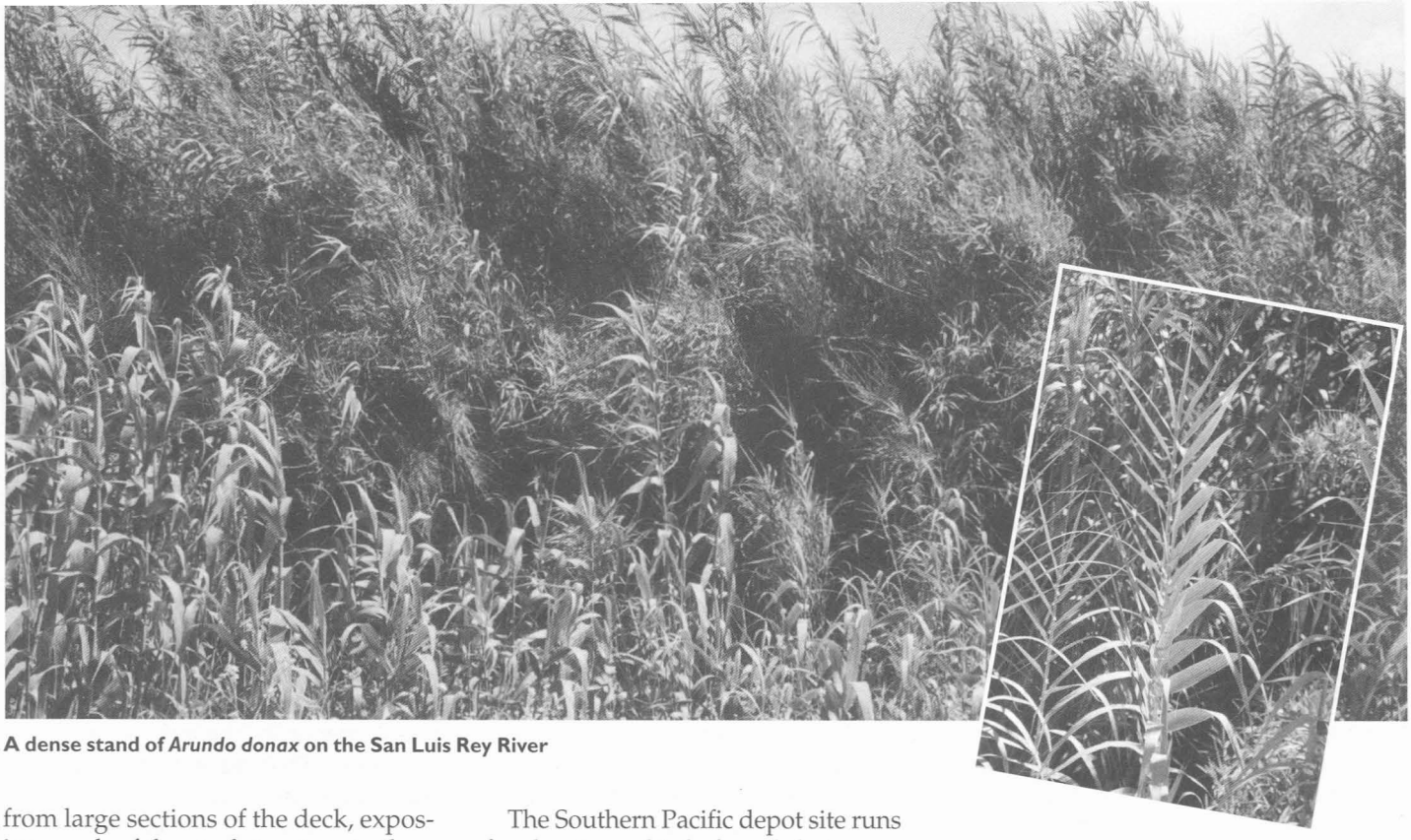
The goal is to promote sustainable living through the teaching of "permaculture," a strategy for land use and community building. Workshops will teach youth how to restore, value, and protect ecological systems while growing crops. At least 20 area schools are expected to be involved.

Water and energy conservation, composting, natural pest management, organic gardening, and creek restoration are among topics to be covered. TPL is launching a fundraising campaign for the purchase. It will reimburse the Conservancy $350,000 within 18 months, then transfer ownership to Earth Island Institute.

PACIFICA PIER REPAIRS

THE PACIFICA MUNICIPAL PIER is the only open-ocean, deep-water fishing pier in northern California. Built in 1972, it is widely appreciated for both its near quarter-mile length and the opportunities it affords for deep-water fishing. The City has maintained it for the past 30 years, doing the year-to-year repairs to keep it safe and open to the public. However, the constant pounding of the ocean surf has taken its toll, and major structural repairs, beyond this small city's means, became essential.

Such repairs were begun last spring after $500,000 for the project were included in the state budget. In anticipation of these funds, the City began the work, using its own money. But then the state funding was stripped from the state budget and the City interrupted its work. This left the pier even more vulnerable to storm damage, for concrete had been removed



A dense stand of *Arundo donax* on the San Luis Rey River

PHOTOS THIS PAGE: JESSE GIESSOW

from large sections of the deck, exposing much of the steel structure to the elements.

The Coastal Conservancy has stepped into the breach by approving $500,000 in Proposition 40 money to enable the City to continue essential work, preventing further deterioration.

SANTA CRUZ DEPOT SITE RENOVATION

THE LONG-HOPED-FOR restoration of an 8.5-acre area surrounding the site of the old Southern Pacific passenger and freight depots near downtown Santa Cruz has moved closer to reality.

The City's plans include renovation of the historic freight depot, a new natural history museum, and beach parking for 200 cars. A transportation center for rail, bus, pedicab, and horse-drawn carriage, together with an extensive system of pedestrian and bicycle paths, will enable visitors to move easily to downtown, the nearby Neary Lagoon, and the city's boardwalk, municipal wharf, and beach.

The City has invested or committed $5.4 million of its own funds for the project, and received a $2.4 million grant from the Regional Transportation Commission. The $10.8-million project budget still had a $3 million gap, which will be covered by the Conservancy's grant, made available though Proposition 12.

The Southern Pacific depot site runs for about one-third of a mile between downtown Santa Cruz and the waterfront. West of the site is the 44-acre Neary Lagoon, a natural habitat preserve. The passenger depot was abandoned in 1940, when passenger service was discontinued. It later housed restaurants and nightclubs for about 20 years, then was demolished after a fire in 1998.

The Railway Express Office, known as the freight depot, operated from 1918 until the 1960s, when freight service was discontinued. The tracks at the depot site are currently used by branch lines of the Union Pacific Railroad and by the Roaring Camp and Big Trees Railroad, which transports passengers between Felton and the Santa Cruz Boardwalk.

WAR ON GIANT REED ALONG SAN LUIS REY RIVER

GIANT REED, *Arundo donax*, is a tall bamboo-like grass that forms dense stands and crowds out native vegetation along streams and rivers. It is the primary cause of habitat destruction in the 359,000-acre San Luis Rey River watershed, which extends from the Palomar Mountains to Oceanside in San Diego County. The reed is extremely flammable and also poses a flood hazard by holding back sediment and constricting water flows. If allowed to spread, *Arundo donax* can significantly reduce streamside habitats for many animals and plants.

The Mission Resource Conservation District (RCD) has apparently succeeded in eradicating giant reed along the Margarita River in San Diego County and has been overseeing eradication efforts in the upper watershed of the San Luis Rey River. The projected cost of removing the reed from the entire watershed is $5.05 million. Federal, local, and other state agencies have committed $2.01 million. The Conservancy approved $642,000 in Proposition 40 funds in December to enable the RCD to expand its attack to a 4.75-mile reach of the river's central watershed. Within this reach, about 41 acres have 80 percent or greater reed cover. These sites will be treated with the herbicide Rodeo during the next five years and will be monitored so that any new infestations can be removed.

The U.S. Fish and Wildlife Service has designated the San Luis Rey River as critical habitat for three endangered species—the least Bell's vireo, the southwestern willow flycatcher, and the arroyo southwestern toad. The river supports the state's largest population of southwestern willow flycatchers and San Diego County's second-largest population of least Bell's vireos.

ROADS—A THORNY DEBATE

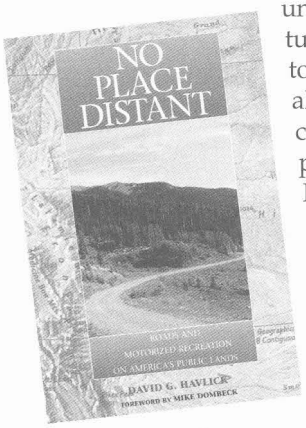
No Place Distant: Roads and Motorized Recreation on America's Public Lands, *by David G. Havlick. Island Press, Washington, DC, 2002. 300 pp., $18.95 (paper).*

TO SOME, ROADS ARE the commercial arteries of our nation. To others, "roads are daggers thrust into the heart of nature." In many cases, they are both, although finding people on either end of the political spectrum to agree to this might be difficult. David Havlick's *No Place Distant* is a welcome and insightful overview of the promise and perils of road construction through lands managed by the National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and U.S. Forest Service.

The author, a land management expert, examines history and policy since the early days of the republic, when some presidents and congressmen "considered federal funding for internal improvements—including roads—illegal and unconstitutional," to the present, when the Forest Service is offering incentives to private interests to build roads through wilderness.

This work's usefulness to land managers is somewhat undermined, unfortunately, by a failure to suggest practical alternatives to a continuation of the polarized debate. Havlick's conclusion, that "we should learn to manage our public lands not for vehicles, but for people, other animals and plants, clean water, beauty, and intact functioning ecosystems," is a nice thought, but it will not translate to positive action without taking account of the Blue Ribbon Coalition, a potent trade group representing an estimated 650,000 off-road vehicle (ORV) users, not to mention the timber industry. Further, by discounting the notion that the complaint preservationists have with ORV use is at least partly a concern with pace of use, rather than style of use, Havlick sidesteps a thorny philosophical debate over land management that reaches back much further than ORV manufacturers' "extreme" marketing strategies, which actively promote conversion of pristine areas to demolition derby sites. Nevertheless, Havlick provides sufficient knowledge and perspective to enable land managers and the concerned public to begin addressing the ecologically vital issue of road construction and public access rationally and constructively. It is a timely work, coming at a moment when local authorities are spending millions to undo damage caused by inappropriately constructed roads of the past, even as the federal administration is doing everything in its power to return to the practices of a bygone era—by which road-building on federal property is both encouraged and subsidized. Use of those roads, and surrounding areas, by mechanical means is permitted without thought of either the ecological integrity or the contemplative value of nature, and other long-standing environmental protections are stripped from federal projects and from lands all citizens own in common.

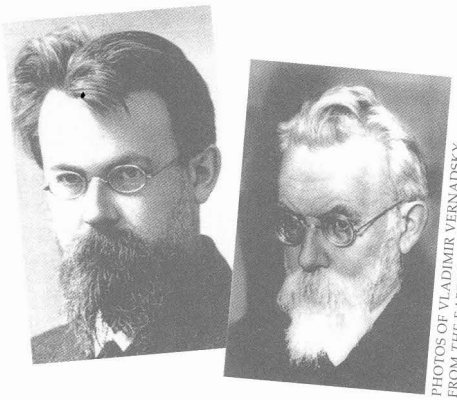
—Michael Bowen



THE WHOLE ORGANIC WORLD

The Earth's Biosphere: Evolution, Dynamics, and Change, *by Vaclav Smil. MIT Press, Cambridge, MA, 2002. 346 pp., $32.95, (hard cover).*

IN THIS EXCITING BOOK, a response to scientific reductionism (a practice likened to "the drilling of ever deeper holes"), Vaclav Smil outlines a synthetic approach to understanding our Earth, employing the latest findings in disciplines ranging from organic chemistry to solar physics, microbiology to geology. His exegesis is broad-based and idiosyncratic (for example, he admits a special interest in "the intricacies of microbial life"). Despite its mere 271 pages of text (the remainder of the book comprises eight appendixes, an extensive reference list, and three indexes, of scientific names, people, and subjects), this volume provides a breathtaking look at the glorious planet we live on, an amazingly complex, efficient, and resilient array of life forms, systems, and processes. The author provides copious tables, graphs, maps, photos, and drawings to illustrate his descriptions and arguments.



PHOTOS OF VLADIMIR VERNADSKY FROM *THE EARTH'S BIOSPHERE* COURTESY MIT PRESS

He begins with an exploration of the concept of the "biosphere," a term coined in 1875 but only developed 50 years later by the brilliant Russian mineralogist Vladimir Ivanovich Vernadsky (1863–1945). In the early 1910s Vernadsky posed this question: "What importance has the whole organic world in the general scheme of chemical reactions on the Earth?" In 1926 he published his answer, in the form of a book entitled *Biosfera.* According to Vernadsky, the biosphere is "a region of transformation of cosmic energy, specifically of the solar radiation . . . 'a thick layer of new molecular systems.'" He likened the biosphere to a continuous, life-saturated envelope that spreads uninterruptedly "in a manner analogous to gas." In the 1930s he expanded on this idea, describing how living matter interacts with an array of inert matter through a variety of bio-geochemical processes. Finally, during the last years of his life Vernadsky paid increasing attention to the idea of the noosphere,

or "the envelope of the mind"—that is, the idea of "humanity as a new geological, perhaps even cosmic, force resulting from human intelligence."

In the United States, Vernadsky's ideas were adopted and promoted by one of the twentieth century's most influential ecologists, Evelyn Hutchinson (1903–1991) of Yale University. As early as 1948, Hutchinson decried the wastefulness and destructiveness of modern society—a concern that two decades later became vividly real as air pollution, the threat of nuclear weapons, and pesticide poisoning were recognized as real, if potentially preventable, threats. The International Geophysical Year (1957–58), investigation of the greenhouse gas phenomenon, the first detailed maps of the ocean floor, ecosystemic acidification, population growth, and the U.S. space program, as well as other strands of scientific investigation and governmental action in the 1960s and 1970s, all contributed to a growing environmental consciousness.

Hutchinson, however, remained pessimistic about the prospect of extended human life on Earth. And Smil acknowledges that "even adjectives like 'awesome' and 'immense' are completely inadequate for describing [the] complexity and duration" of the task of planetary management that is necessary if we as a species—not to mention much of the rest of life as we know it—are to survive. Nevertheless, he is hesitant to proclaim doom as a certainty. Over the past three decades, he points out, satellite monitoring ("global and virtually instant coverage of just about every essential biospheric variable"), truly interdisciplinary and international attempts at assessing and solving global environmental problems, and expanding computer-modeling capabilities in fact give some cause for hope.

Smil seems to tap into this hope as he explores the global characteristics of the biosphere, including the biochemical unity and diversity of carbon-based life; solar and terrestrial energy systems; and water and material flows. From here he proceeds to a "synthetic" analysis, looking at the extent of the biosphere, its mass and productivity, and the "fundamental rules and grand patterns" of life on Earth. Here he lays out the awesome concordances and capabilities of this infinitesimal speck in the universe.

In his final chapter, however, devoted to "Civilization and the Biosphere: The Earth Transformed by Human Action," the feeling of hope becomes tempered. Even though the biosphere itself "is a product of constant change," Smil points out, the impact of *Homo sapiens* has been profound—and he goes on to explain, rationally and scientifically, just how. He ends by delving briefly into the question of planetary management, of which he observes, "My feeling is that although we may already (or soon) have some requisite technical capacities, effective planetary management is far beyond our intellectual and social capabilities—but that we are doing it anyway. And . . . we are doing much worse compared not just to what we should be doing, but to what we could have already done." In the end, he explains, it is not a matter of technical and scientific know-how that keeps us from effectively managing our planet, but a question of values—in particular, the values of the governments and citizens of affluent countries, whose level of consumption far exceeds what the biosphere can support. "Only the ethos of moderation derived from the sense of sharing and intergenerational responsibility (both being applicable to other life forms as well as to future populations) can guarantee the long-term integrity of the biosphere."

In an epilogue, Smil looks speculatively to the future—in particular, to a future dominated by machines. Not machines as we know them today but, more accurately, a machine-based consciousness: one, perhaps, so imbued with human values that it seeks to recreate replicas of the Earth's biosphere on suitable celestial bodies.

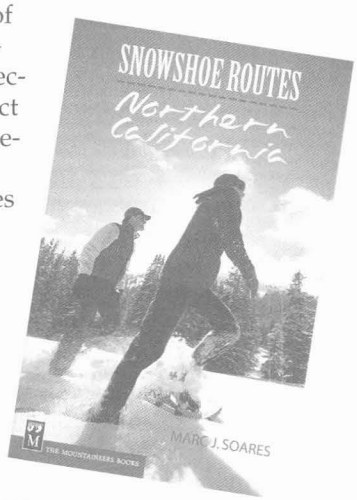
For Smil, yes, anything may be possible. But in this book he outlines what is real—and suggests that we would do well to take heed of these realities. General readers and specialists alike will benefit from Smil's balanced, clear, yet passionate synthetic approach. This book makes us appreciate how very complex our world is, even as it drives home our responsibility in maintaining that complexity and viability.

—Anne Canright

ADDICTED TO SNOWSHOEING

Snowshoe Routes: Northern California, *by Marc J. Soares. Mountaineers Books, Seattle, WA, 2002. 222 pp., $16.95 (paper).*

"TRUDGING IN A SLOW DANCE rhythm over pure white heaven can be delightfully addictive, especially in the mighty mountains of Northern California," warns Marc J. Soares. His warning should not be taken lightly: I was addicted after my first snowshoe excursion—Castle Valley to Round Valley, with an overnight stay in the picturesque Peter Grubb Hut. That's one of the 66 routes featured in this collection. This compact and handy sourcebook provides a selection of routes from easy to strenuous, day hikes to backpack trips, grouped by geographic area. It will inspire novices and experienced trekkers alike to more fully enjoy the breathtaking winter landscape of Northern California. I particularly enjoyed the overview of trees and shrubs contained in the helpful and informative introduction.



—Moira McEnespy

AQUACULTURE

Editor:

I am surprised that Wesley Marx ("In Search of Eco-Friendly Aquaculture," *Coast & Ocean*, Autumn 2002) suggested that tilapia, catfish, and shrimp farming are environmentally friendly endeavors and that consumers should help create markets for the industries by consuming their products. Through flooding and other containment breaches, exotic fish stocked in aquaculture ponds inevitably reach the wild. Introduced fish spread disease and drive out native fish and shellfish by devastating food supplies.

Moreover, creating a market for farmed shrimp will only increase the destruction of mangrove forests when exporting countries attempt to cash in on the culinary demands of affluent Americans who are not likely to distinguish between the different types of farmed shrimp, such as those raised in destroyed mangroves and those raised in ostensibly less destructive land ponds in the U.S.

Your article also mentioned that "catfish growers in Mississippi and other southern states have been hit hard by cheaper imports of frozen basa fillets from Vietnam," but failed to mention that Mississippi has been hit hard by catfish farmers who have introduced Asian carp, an invasive and destructive species used by catfish farmers to eat snails that carry parasites, which can taint catfish stocks. I imagine that California farmers also use Asian carp. Even if they don't, once again, it is unlikely that consumers can be expected to know which catfish farms have imported invasive Asian carp species and which have not.

Searching for "eco-friendly aquaculture" may merely serve as a distraction from facing the limits of our Earth's aquatic resources. In the United States, where the average person consumes twice the recommended level of protein, citizens could eliminate their consumption of fish and seafood without significantly affecting their nutrition, but the benefit to the environment would be great.

Monica Engebretson
Animal Protection Institute, Sacramento

Wes Marx replies:
The Audubon Society, Environmental Defense Fund, and Monterey Bay Aquarium, which are concerned with the spread of exotic species, include farmed catfish in the "best choice" fish category. The suggested approach of not eating fish overlooks the fact that the American Heart Association and medical researchers urge us to eat fish regularly to help reduce the risk of heart attack. All forms of food cultivation impact the environment. Edible plant cultivation also causes habitat loss, soil erosion, contaminated runoff, and the spread of non-native species. We can choose organic produce grown in a way that reduces such impacts. Consumers of seafood should have similar options.

DOING OUR SHARE

Editor:

California, the world's seventh largest economy, is immediately to the north of one of the world's last frontiers, the Baja California peninsula and its surrounding waters; a frontier full of adventure, with almost pristine landscapes that fill the horizon and the spirit, allowing residents and visitors the rare experience of silence and isolation. Rural Baja California is a subsistence economy; in few places in the world are such economic extremes in such proximity.

The persistence of Baja California's landscapes is not the exclusive responsibility of its inhabitants and governments—visitors play an essential role in shaping its future. Much of Baja California's income depends on the California visitor; many visitors praise the isolation and rustic conditions as the most important reasons for their long travels; they come here to avoid the "Cancún Experience."

How can Californians and Baja Californians keep landscapes and experiences alive? Developments like the Escalera Náutica, and the unmitigated development that would surely follow the presence of liquefied natural gas receiving and power-generating plants are obvious threats to Baja California's marine and terrestrial environments. Not so obvious threats are our whale-watching, snorkeling, scuba diving, fishing, kayaking, boating, and camping trips. All these activities demand the use of the area's most scarce resource: fresh water. Mexico's national water board (CONAGUA) has established that the peninsula is in a permanent water crisis. Care must be taken by all to insure these low-impact activities remain sustainable.

Sustainable use and conservation are simple, direct, and effective ways that will allow both the native Baja Californians and the California visitors to maintain the landscape and the experiences that Baja California offers. We share landscapes and experiences, we should share their protection.

Among local organizations working to protect the landscapes and the coast, and to support the indigenous peoples, are pro esteros (www.cicese.mx/~proester), CUNA (www.cicese.mx/~cunabc), and Terra Peninsular (www.terrapeninsular.org). They can give you an idea of the conservation work on the peninsula.

Horacio de la Cueva
Acting Executive Director, Terra Peninsular A.C.
horacio@terrapeninsular.org

Coming in the Spring issue of *Coast and Ocean:*

The State of the Coast

Coastal Conservancy

CALIFORNIA COASTAL CONSERVANCY
1330 BROADWAY, 11TH FLOOR
OAKLAND, CA 94612

PRSRT STD
U.S. POSTAGE
PAID
BERKELEY, CA
PERMIT NO. 1

Also in this issue:

Beach Water Questions

Murres Come Home