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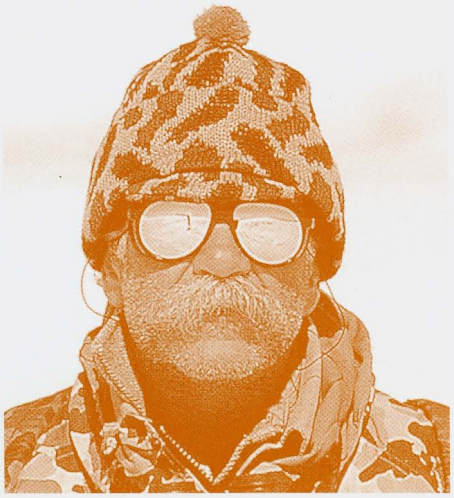
Cover photograph of dowitchers on Willapa Bay, Washington, courtesy of Tupper Ansel Blake.

ROBERT ANDREW FISHER



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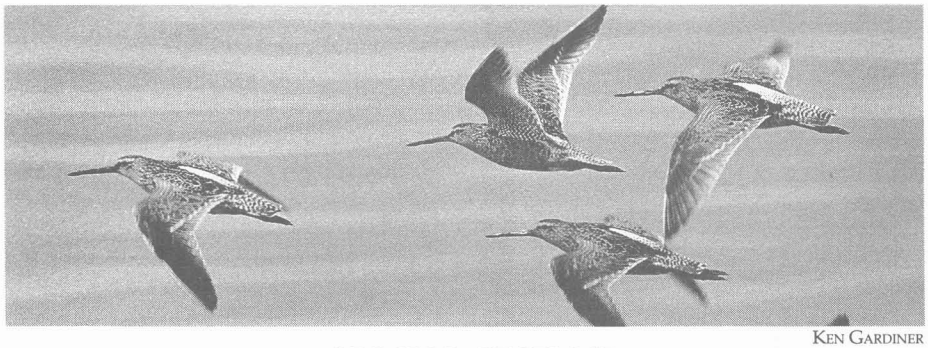

KEN GARDINER

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by Peter Grenell

This issue of *Coast & Ocean* features the Pacific Flyway, the great avian highway traveled by many millions of migratory waterfowl and shorebirds that visit the California Coast. It stretches from Wrangel Island in the former Soviet Union through Alaska, British Columbia, along the coast of Washington, Oregon, and California to Mexico and South America. The coastal wetlands that comprise much of this habitat include breeding, stopover, and wintering habitat for numerous species, including many that are endangered or threatened, such as the Caspian tern, Aleutian Canada goose, California brown pelican, western snowy plover, and the bald eagle.

These wetlands have declined drastically. Under pressures of human settlement and natural resource exploitation, more than three-fourths of these wetlands have disappeared. In California the loss has been as much as 90 percent. In an effort to keep the vast flocks that rely on the wetlands from vanishing as well, the United States and Canada in 1988 organized the North American Waterfowl Management Plan. Mexico joined in later. The plan's objective is to restore waterfowl populations to levels recorded in the 1970s, when comprehensive counts first began. Toward that end, the plan identified coastal wetlands, rivers, and adjacent uplands on the flyway among areas requiring top priority protective action.

As a way to implement the Pacific Coast segment of the management plan, the Pacific Coast Joint Venture was established in 1991. A companion to the Central Valley Habitat Joint Venture, created in 1988, the Pacific Coast effort seeks to secure 290,000 acres of existing wetlands and associated uplands in the three states; to enhance 60,000 acres of habitat on existing public and private wetlands and agricultural lands; and to restore 15,000 acres of former wetlands.

The Pacific Coast Joint Venture will seek to modify land management and development policies, promote public education and demonstration projects, and develop landowner incentives and extension services. It will seek to protect and restore wetlands by purchasing land outright or by buying easements. (See p. 18.)

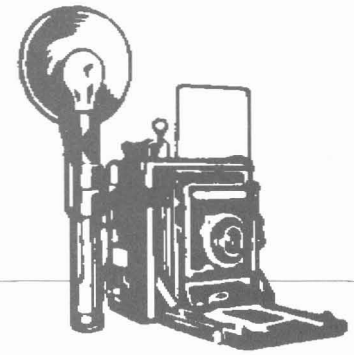
Much remains unknown about the Pacific Flyway. Though some records have been kept of waterfowl populations for decades, comprehensive counts of shorebirds began only in 1991, as Dave Shuford of the Point Reyes Bird Observatory points out (p. 12). If we do not act now on what we do know, however, we will lose our only opportunity to protect the great migrations, and along with them the many benefits that coastal wetlands provide to our own species as well as many others. Wetlands protect not only waterfowl but also migratory shorebirds, resident species, as well as numerous fish and invertebrates on which commercial and recreational fisheries depend. The overall values of the wetlands and the flyway are incalculable, although efforts have begun recently to quantify them in dollars. (See p. 17.)

Something much more profound than economic benefit underlies our concern for these areas, however. As part of the natural environment, our survival—not just our use, however enlightened, of these resources—depends on not destroying the flyway's creatures and their living places. A major priority of the State Coastal Conservancy is to achieve goals held in common with the Pacific Coast Joint Venture. Since 1978, the Coastal Conservancy has completed 147 projects to protect and/or restore over 24,000 wetland acres. With the Joint Venture, it can continue to do so within some new partnerships.

Because migratory birds do not recognize political boundaries—be they local, state, or international—some of the work to secure the Pacific Flyway will require international cooperation as well, as can be seen from the article by Emily Young and Serge Dedina on Magdalena Bay (p. 24). The trend toward new and broader conservation alliances is worldwide. But for most of those who live or have interests on the coast, the work is best begun close to home. Landowners and others who have an interest in the Joint Venture are invited to call the State Department of Fish and Game at (707) 445-6493.

Worth a Thousand Words

The Conservancy is seeking high-quality photos, slides, and drawings of San Francisco Bay and environs for an upcoming *San Francisco Bay Shoreline Guide*. If you would like to donate any of your work, please send it to *Coast & Ocean*, State Coastal Conservancy, 1330 Broadway, Suite 1100, Oakland, CA 94612. We will return work accompanied by a self-addressed stamped envelope.



Recent Conservancy Actions

These and other State Coastal Conservancy projects were approved between November 1992 and February 1993:

Noyo Harbor Waterfront Restoration

The State Coastal Conservancy approved the Noyo Harbor Urban Waterfront Restoration Plan prepared with $50,000 of Conservancy funds authorized in November 1988. The January approval of the plan will allow the Noyo Harbor District to proceed with preparation of conceptual site plans. The document is also expected to serve as an effective tool for obtaining funds to implement the project. The public and government agencies participated extensively in the plan's preparation.

Noyo Harbor is a major North Coast commercial fishing harbor and a popular destination point for visitors. The plan seeks to address the needs of these diverse user groups by identifying key facilities needed to maintain viable commercial fishing activities, offering specific proposals for safe pedestrian access to and through the harbor, improving traffic circulation and parking, and resolving conflicts between city and county land use designations.

Houda Point Trail Improvements

Also in January, the State Coastal Conservancy approved up to $54,000 to the Humboldt North Coast Land Trust for improvements at Houda Point, south of the city of Trinidad. The funds will enable the land trust, which owns and manages Houda Point, to restore and expand access by correcting hazardous conditions. The land trust will repair and expand public access trails, construct erosion control structures, create bluff top access for wheelchair users, and install benches and interpretive signs at the Houda Point property, south of the city of Trinidad in Humboldt County.

Houda Point is a rock formation that juts out into the ocean, providing views of rugged wind-swept beaches to the north and south. It is popular with beachcombers, fishermen, bird watchers, surfers, and tourists driving along Scenic Drive. A trail system leads from the vicinity of the parking area to the point, as well as to beaches. This is the only access for a mile of coast between Luffenholtz Fishing Access and Moonstone County Park.

CAROL ARNOLD

Treated wastewater is being used to restore 120 acres of habitat in the Conservancy-funded Hudeman Slough Wetland Enhancement Project in southern Sonoma County. Dedicated last July, the project is part of the Sonoma County Sanitation District's multimillion-dollar effort to upgrade its wastewater conveyance and disposal system while also increasing habitat for the Salt marsh harvest mouse, many birds, and other wildlife; to improve agricultural land, and provide recreational opportunities.

NOAA Lends A Hand

Conservancy staff's efforts in applying for grants have increased significantly over the past several years in response to the agency's dwindling funds. A major contributor has been the National Oceanic and Atmospheric Administration (NOAA), which has funded acquisitions, enhancement plans, and technical assistance, including publications, on a variety of projects. A summary of NOAA grants to the Conservancy from 1984 through fiscal 1992 follows: $1,829,500 for nine acquisitions, $280,000 for six enhancement plans, and $746,500 for technical assistance. Given the continuing fiscal difficulties at both the state and federal levels, the amount of future funding from NOAA's Office of Coastal Resource Management is uncertain. The Conservancy has received no NOAA funding for the past two years. Regardless, the Conservancy will continue its responsible participation in the federal/state partnership under the Coastal Zone Management Act of 1972.

Ocean Governance

by Marc Beyeler

Since President Reagan proclaimed a 200-mile Exclusive Economic Zone (1983) and a 12-mile Territorial Sea (1988), little, if anything, has been done administratively or legislatively to establish a coordinated national ocean policy.

In the past decade, funding for coastal and ocean programs has been neglected and adequate legislative and policy attention has been lacking at the federal level. Although the United States was a pioneer among nations in enacting ocean legislation in the 1970s, most laws dealing with the ocean are largely single purpose in nature and do not offer an overall strategy or vision for sustainable ocean development under U.S. control. To preserve and sustain our ocean resources, a new vision of comprehensive ocean governance must be developed. (For more, see *C&O*, Winter/Spring 1991, p. 8.)

This was the consensus of the Ocean Governance Study Group, a body of ocean and coastal policy experts from throughout the United States, who met at the University of California, Berkeley, January 10-13. The study group was created in 1991 to reexamine the status of coastal and ocean governance in the United States and to develop management options for achieving responsible and "sustainable" stewardship of the global ocean. It is composed of 36 U.S. ocean policy experts, mainly from academic institutions, and of six international advisors. The study group is assisted by another two dozen advisors representing legislative, agency, and nonprofit organizations.

The aim of the meeting, the study group's second, was to explore in detail some major coastal and ocean policy issues and to discuss research and policy initiatives either already being undertaken or proposed by members of this group or other interested parties. The conference discussions and presentations followed from a series of policy research papers prepared by members of the study group and published in December 1992 as *Ocean Governance: A New Vision*.

Ocean policy issues are broadly defined to include coastal concerns. Indeed, a good portion of the study group's discussions in Berkeley addressed coastal management issues, and the important connections between the coastal and ocean environments. Of particular interest to readers of *Coast & Ocean* were the presentations and discussions on the recent creation of the Monterey Bay National Marine Sanctuary, the largest such sanctuary in the nation, and dredging in San Francisco Bay to deepen the Port of Oakland.

These two case studies highlighted critical issues that constrain the development and implementation of effective ocean policy. These issues include interactions of policy and politics, fragmentation in governance and management, and conflicts between different economic interests and different users.

Jim Rote, principal consultant, California Assembly Office of Research, described the effort that lay behind President Bush's designation of Monterey Bay as a marine sanctuary in June 1992. First nominated in 1977, the sanctuary concept had broad public, scientific, and political support, thanks to much deft and patient coalition-building. The sanctuary encompasses 4,000 square miles and 300 nautical miles of shoreline along six central California counties. Oil and gas exploration and drilling are banned within its boundaries, while existing commercial and recreational use is allowed. The cooperative effort required to manage the sanctuary successfully will be even greater than that needed to win the designation, Rote predicted.

In discussing the controversial issue of dredging for the Port of Oakland, Robert Kagan, professor of political science, University of California, Berkeley, demonstrated that resolution was impossible as long as environmentalists and proponents of port development were pitted against each other. A fragile coalition is now growing, opening the way for solutions that would be acceptable to both sides. Some of the uncontaminated dredged materials, for instance, will be used in a State Coastal Conservancy project to restore wetlands in Sonoma County, thus serving to increase habitat while also partly solving the thorny problem of dredge materials disposal.

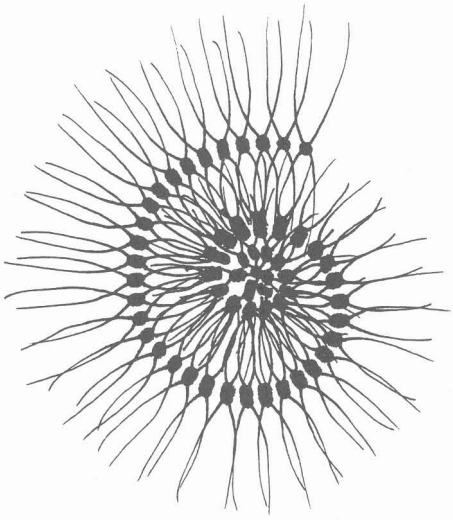
The environment/development issue also emerged in discussions on the changing international context of ocean governance. Biliana Cicin-Sain and Bob Knecht of the University of Delaware examined the development and conservation goals and policies of the United Nations Conference on Environment and Development (UNCED), the "Rio Earth Summit." They focused specifically on the UNCED Report, *Agenda 21*, Chapter 17, "Protection of the Oceans, All Kinds of Seas, Including Semi-Enclosed Seas, and Coastal Areas and The Protection, Rational Use and Development of Their Living Resources." Chapter 17 calls for new initiatives and new strategies for in-

tegrating conservation and development, addressing greater integration of development and conservation objectives, increased scientific and data collection efforts, greater technology exchange, and broader citizen participation in development planning and project and policy implementation.

While *Agenda 21* offers a commendable integrated approach, its general goal-setting and vague implementation and financial targets indicate that serious decisions have yet to be made. Recommendations in Chapter 17 include several suggestions for immediate follow-up actions, including: 1) a global conference in the next year to exchange information regarding integrated coastal zone management and development; and 2) a meeting proposed to be organized by the United Nations Environment Program focused on the protection of the marine environment from land-based activities. Groups such as the study group and participants in the biannual Coastal Zone meetings can make essential contributions in following up the Rio Earth Summit.

The difficulty of coordinating global, or large-scale regional policy, and major related problems was illustrated by David Caron of the University of California Boalt School of Law in the context of the Arctic. Despite several bilateral and multilateral efforts over the past decade to control adverse environmental conditions in the Arctic, serious problems persist: acidification, concentration of persistent organics such as chlorine, radioactivity, heavy metals, and oil pollution.

In the wake of the Exxon *Valdez* and Shetland oil spills, global concern has emerged about the need to regulate oil



DARRELL DEVORE

transport and oil production in remote, but very sensitive areas. Yet given the economics involved, this remains a particularly difficult issue to address on such a scale. In spite of the relatively large number of multilateral agreements relating to oil pollution in the Arctic, Caron identified several new large oil production projects that could compromise existing efforts.

As in many other highly sensitive environments, the Arctic's problems are caused by pollution or demands for development that originate outside the region. This circumstance presents opportunities for increased international action and also means that concerns about remote, yet highly sensitive areas such as this may not burn brightly in the distant places where crucial development decisions are made.

On another global issue, Richard McLaughlin of the University of Mississippi pointed to the growing importance of international disputes involving trade and environment. He analyzed the controversial ruling by a panel of the General Agreement on Tariffs and Trade (GATT) that the United States violated GATT rules by banning imports of Mexican tuna because Mexico had refused to comply fully with the dolphin protection provisions of the Marine Mammal Protection Act. This ruling may well be only the opening salvo in what may become an increasingly important component of the ocean and coastal decision-making process, where international trade and economics and environmental protection efforts are the center of important disputes. (See Fall 1992 p. 26.)

The Berkeley conference provided an important opportunity for an informal exchange about coastal and ocean issues. The continuing work of the Ocean Governance Study Group may prove crucial to the development of more effective, integrated coast and ocean management efforts.

Papers and abstracts from the Berkeley conference can be obtained from Harry Scheiber, Center for the Study of Law & Society, 2240 Piedmont Ave., Berkeley, CA 94720. Copies of *Ocean Governance: A New Vision* (publication DEL-SG-17-92) can be obtained from the Ocean Governance Study Group, Center for the Study of Marine Policy, Graduate College of Marine Studies, University of Delaware, Newark, DE 19716; phone: (302) 831-8086 or FAX (302) 831-3668.

Marc Beyeler is manager of the Conservancy's Urban Waterfronts Program.

Western sandpipers and dunlin, Copper River Delta, Alaska.

TUPPER ANSEL BLAKE

THE PACIFIC FLYWAY

Where Wetlands Meet the Sky

"The fact is, the great migrations are reflections in the sky of the waters of the globe. The Pacific Flyway is but a corridor connecting the wetlands of the West."

— *Peter Steinhart*

Each spring and autumn, great flocks of waterfowl and shorebirds pass through our skies and descend on marshes and estuaries along the coast, in San Francisco Bay, and in the Central Valley. They are en route between breeding grounds in the far North and wintering areas in this state, Mexico, and as far south as Costa Rica. Because many of them fly by night, and because most of us are urban people, few of us are aware of their comings and goings. By their passage, however, they weave a web around the planet. They connect earth and sky, land and water. They mark the seasons. Seeing them—even thinking of them—can awaken a longing that is perhaps an ancestral memory of times when humans followed vast herds and flocks.

The migrating birds that stop in California are travelers along the Pacific Flyway, one of four major sets of avian migration routes through North America. The Pacific Flyway is not a single pathway but rather a network that connects Arctic regions in the former Soviet Union, Canada, and Alaska to Washington, Oregon, Alta and Baja California, and links the Rocky Mountains and the Great Basin to the Pacific shore.

Birds that breed in the far North must travel to warmer climates for the winter before their food is locked in ice. They need to find similar habitat and that means long-distance journeys that require unimaginable stamina. Among the most amazing migrations is that of the black brant, smallest and fastest of the geese. It flies up to 3,400 miles nonstop from Alaska to Baja California, averaging 60 miles per hour and arriving in less than two-and-a-half days. Each bird loses about a third of its weight during that flight.

Many migrant species familiar in California nest in the Arctic. All the brant, long-billed dowitchers, sanderlings, and most western sandpipers come from the tundra, the watery treeless expanse of land and water that is permanently frozen beneath a thin layer of exuberant summer growth. After the spring sun has released surface water from its confinement, and during the white nights of the short summer, the sloughs, rivers, and ponds of the tundra are dense with vegetation, insects, and other invertebrates. Mosquitoes and black flies thicken the air, salmon return to spawn, and vast flocks of birds appear. They breed, raise their young, and prepare to leave. Almost all Arctic birds migrate.

In Alaska's Yukon-Kuskokwim Delta, and scattered other breeding grounds in the tundra, black brant lay eggs in nests they make of their down in moss or low-growing grasses. If the parents have to leave the nest for any reason, they pull the down over the eggs. The goslings emerge in 24 days and are on the water with their parents 24 hours later. In late August, when they can fly, brant families from all the breeding grounds move to Izembek Lagoon, on the Alaskan peninsula, where the adults shed their primary wing feathers and are flightless for about a month, building up fat in the thick beds of eelgrass. In November, they all stage (gather) together and, when the winds are favorable, nearly the entire population of Pacific black brant—up to 120,000 dusky brownish-black birds—takes off together.

The flock rises from the water, fills the skies, and most of it heads south at an altitude of about 4,000 feet, sweeping in a huge arc over the ocean toward the Pacific Northwest coast. Some of the brant, however, do not take the ocean skyway but follow the coast most of the way, and perhaps 6,000 winter in Alaska, said James Bartonek, Pacific Flyway representative at the Office of Migratory Bird Management of the U.S. Fish and Wildlife Service. The reasons for this are not known.

Until the late 1950s, most black brant wintered in Washington, Oregon, or California, but now only about 20,000 do so while the vast majority continues to Baja California. Both human disturbance and habitat degradation may have caused the shift. Studies on Humboldt Bay have shown that when hunters pursued brant aggressively in boats, the birds stopped using the bay during the day, wildlife biologist Paul Springer said.

Kevin Foerster, manager of the Humboldt Bay National Wildlife Refuge, gets word from of the brants' departure from Izembek Lagoon. He knows that some will veer off to rest or winter on

Puget Sound, Willapa Bay, the Nisqually Delta, Tillamook Bay, and Humboldt Bay. But if the winds are right, most do not stop until they reach Baja. Few people have ever seen the flock in flight, and it remains mysterious.

Foerster starts looking for brant again in January when many stop, for varied lengths of time, on their way north. This time it's not a mass migration. Some are leaving Humboldt Bay while others are still arriving, in family groups. "Brant have tight family bonds," Foerster said. "The same groups seen in Alaska have been seen in Baja, and again in Humboldt Bay in the spring." The population on the bay grows until the end of April and in 1992 reached 25,000. In June all the brant are gone.

KEN GARDINER

Dunlin.

Like the brant, some birds travel primarily above the ocean and coast. Others go inland. Many snow geese from Wrangel Island come down the coast as far as the Queen Charlotte Islands, veer inland to Alberta, and cross Montana and Idaho en route to California's Central Valley. Most ducks come overland from the prairie potholes (marshy ponds) of Canada and the north-central United States, flying 1,500 miles to the Central Valley. Some waterfowl and shorebirds also go to Imperial Valley and Salton Sea.

Whatever their route, most of these long-distance fliers follow water and most of them depend on wetlands. "The heart of the flyway is the seam where water and earth meet to form mud," wrote Peter Steinhart, coauthor with photographer Tupper Ansel Blake of *Tracks in the Sky*, a magnificent portrait of the Pacific Flyway. (Chronicle Books, 1987, out of print). Because only 30 percent of the West's historic wetlands remain, and only 10 percent of California's, the Pacific Flyway's future is precarious. The great flocks are known to stop at only a few shoreline sites, and the loss of some of that habitat could have devastating consequences. Wetland losses continue despite growing efforts to protect and restore what remains.

Will there be room for migrating birds on a coast increasingly claimed for human uses? "We have lost so much already," observed Richard Coleman, manager of the San Francisco Bay National Wildlife Refuge. "One-half of one percent of the land mass of California is wetlands. It used to be 10 percent. Now 99.5 percent of the state is not wetlands. That's a lot of room for development. Why can't they leave that half of one percent alone?"

But the human population of the Pacific coast states is increasing, and most people want to live near the ocean. To safeguard the flyway will require will and persistence to match that of the black brant. It will also require more knowledge than scientists and wildlife managers now possess. The needs of migrating birds, particularly shorebirds, are only partly understood. We do not even know how many travel the flyway. Comprehensive waterfowl counts, by the U.S. Fish and Wildlife Service, date back to 1955, but the first comprehensive shorebird census, by the Point Reyes Bird Observatory, was begun only in 1988. What is clear, however, is that both breeding and wintering grounds need effective and continuing protection.

In Alaska, the tidal flats of the Copper River Delta, southeast of Anchorage, are the only known breeding ground for the dusky Canada goose. They also appear to be a stop-

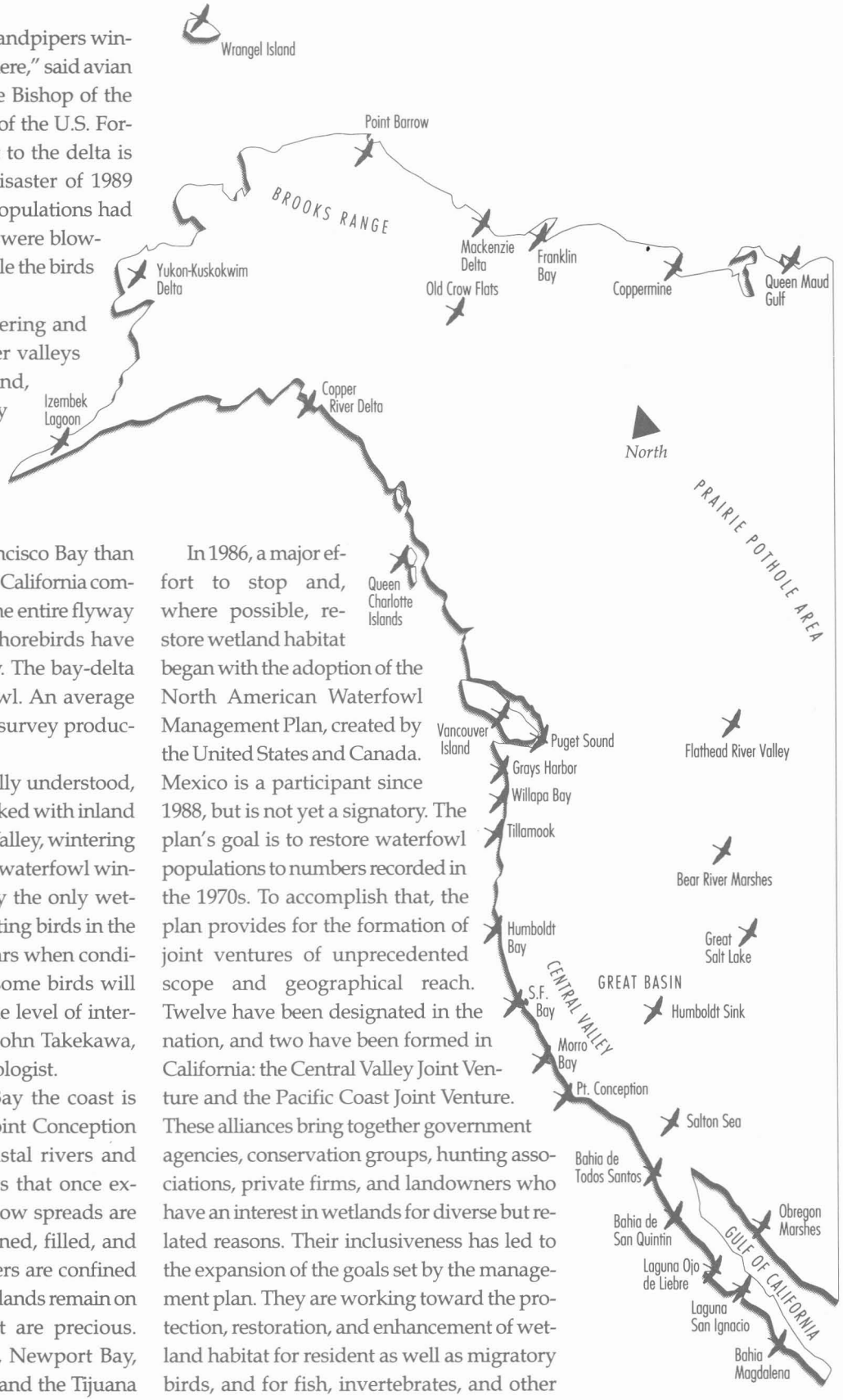
over for "almost all western sandpipers wintering in the Western Hemisphere," said avian research biologist Mary Anne Bishop of the Copper River Delta Institute of the U.S. Forest Service. The major threat to the delta is from oil spills. The *Exxon* disaster of 1989 could have decimated bird populations had it happened when the winds were blowing in the delta's direction while the birds were there.

Farther south, major wintering and resting areas include the river valleys and tidelands of Puget Sound, Grays Harbor, and Willapa Bay in Washington, the Columbia River mouth, Humboldt Bay, Tomales Bay, Bolinas Lagoon, and San Francisco Bay-Delta. More shorebirds use San Francisco Bay than all the wetlands on the coast of California combined. It is the only place on the entire flyway where more than a million shorebirds have been counted on a single day. The bay-delta is also important to waterfowl. An average Fish and Wildlife midwinter survey produces a count of 693,000.

In ways that are not yet fully understood, the Pacific Coast Flyway is linked with inland areas, especially the Central Valley, wintering grounds for 60 percent of the waterfowl wintering in California. Virtually the only wetlands now available to migrating birds in the valley are man-made. "In years when conditions are bad in the valley, some birds will come to the bay-delta. but the level of interchange is not known," said John Takekawa, Fish and Wildlife research biologist.

South of San Francisco Bay the coast is steep much of the way to Point Conception and there are few large coastal rivers and marshes. The wide wetlands that once extended where Los Angeles now spreads are long gone, having been drained, filled, and paved. The south coast's rivers are confined in asphalt channels. What wetlands remain on the central and south coast are precious. Elkhorn Slough, Morro Bay, Newport Bay, Mission Bay, San Diego Bay, and the Tijuana River Estuary are all used by flyway travelers. Smaller remnant marshes also play a role. "All are used by shorebirds," said Dave Shuford of the Point Reyes Bird Observatory.

In 1986, a major effort to stop and, where possible, restore wetland habitat began with the adoption of the North American Waterfowl Management Plan, created by the United States and Canada. Mexico is a participant since 1988, but is not yet a signatory. The plan's goal is to restore waterfowl populations to numbers recorded in the 1970s. To accomplish that, the plan provides for the formation of joint ventures of unprecedented scope and geographical reach. Twelve have been designated in the nation, and two have been formed in California: the Central Valley Joint Venture and the Pacific Coast Joint Venture. These alliances bring together government agencies, conservation groups, hunting associations, private firms, and landowners who have an interest in wetlands for diverse but related reasons. Their inclusiveness has led to the expansion of the goals set by the management plan. They are working toward the protection, restoration, and enhancement of wetland habitat for resident as well as migratory birds, and for fish, invertebrates, and other wildlife that depend on wetlands. (See p. 18.) Two-thirds of all fish caught in California commercially or by sportsmen find shelter in shallow coastal waters in their juvenile stages.



MAP BY POISSON HOMME

Some major stops on the Pacific Flyway.

Conservancy Provides Travelers' Aid

Since 1978, the State Coastal Conservancy has completed 147 projects to protect, restore, or enhance more than 24,000 wetland acres. Working with other agencies, local governments, and nonprofit organizations, the Conservancy has protected some of the state's most significant wetlands critical to the survival of migratory birds and other species. These include wetlands along San Francisco Bay, Humboldt Bay, Elkhorn Slough, the Tijuana River Estuary, Upper Newport Bay, Tomales Bay, and Morro Bay. About one-third of the agency's funds have gone to wetland acquisition, enhancement, and restoration efforts, always in cooperation with others. The Conservancy's funds, about $46 million, have leveraged about $147 million from other sources toward these vital efforts.

Scott Nielsen, Courtesy of Ducks Unlimited

In its projects, the Conservancy has sought to do much more than set aside coastal wetlands and riparian watersheds that might otherwise be developed or lost in other ways. It has worked to patch together fragments of lost wetlands into larger integrated habitat areas, while also providing other benefits: flood control, groundwater storage, water purification, recreation, and, in at least one case, a possible site for the storage of materials dredged from a shipping channel. In these and other ways, the Conservancy has found it possible to make habitat protection cost-effective for local governments, and nonprofit groups.

Throughout the state, 32 endangered species and nine threatened species depend on wetlands for their survival, according to the National Wildlife Federation. Protection and restoration of these wetlands is vital to the state's environmental and economic health. Only about nine percent of the wetlands California had before European settlement are left, and failure to protect these remnants would not only do irreparable harm to migrating species, it would diminish the state's ability to control floods, clean water, provide outdoor recreation, produce commercial fisheries, and provide for endangered and threatened species.

Other economic values of wetlands are only beginning to be recognized. (See p. 17.)

Waterfowl have been the first to command attention. Because they were hunted, they had a constituency and were seen as economically valuable. Only recently have the separate needs of shorebirds and other waterbirds, such as herons and egrets, begun to attract the attention of researchers and management agencies. (See p. 12.)

"The world populations of many shorebirds that breed along the Arctic coasts are . . . relatively small and concentrated, and hence vulnerable to localized environmental degradation that might have only a slight effect on a more widespread species," according to John Terborgh, in *Where Have All the Birds Gone?* (Princeton University Press, 1989). Support for that observation comes from a recent study of western sandpipers on San Francisco Bay. Sarah Warnock of the University of California, Hayward, found that these small birds have very local habits. She radio-tagged and banded 110 sandpipers caught in mist nests erected in the salt flats in south San Francisco Bay, followed 97 of them for up to five weeks, and discovered that they stay within a range that was as small as 1 square km (0.4 square mile.) They do not move to the north bay. The western sandpiper is the most common shorebird species on the bay. The second most common is the dunlin, which tends to move among different mud flats in its winter habitat. (See p. 16.)

During wetland restoration efforts, choices often have to be made in consideration of the needs of different species. How much upland, freshwater marsh, saltwater marsh should be included? How shall this shrinking habitat be apportioned? Each new study of coastal marsh users adds new information, revealing new unknowns.

"The gaps in the research on long-distance shorebirds are just beginning to attract international attention," commented Robin Doughty, professor of geography at the University of Texas in Austin, who has studied the management of international flyways. "Part of the problem is that researchers are compartmentalized by region and nation."

Scientists know very little about birds wintering in Mexico, South America, and the Car-

ibbean, Terborgh has written. This holds true for waterfowl and shorebirds, but even more so for songbirds, the Neotropical migrants. Habitat areas are still unmapped, comprehensive counts are yet to come, and birds unidentified by ornithologists continue to be discovered. Sanford R. Wilbur, research biologist with Fish and Wildlife in Portland, said some information in his book, *Birds of Baja California* (University of California Press, 1987), has already been rendered obsolete by new discoveries.

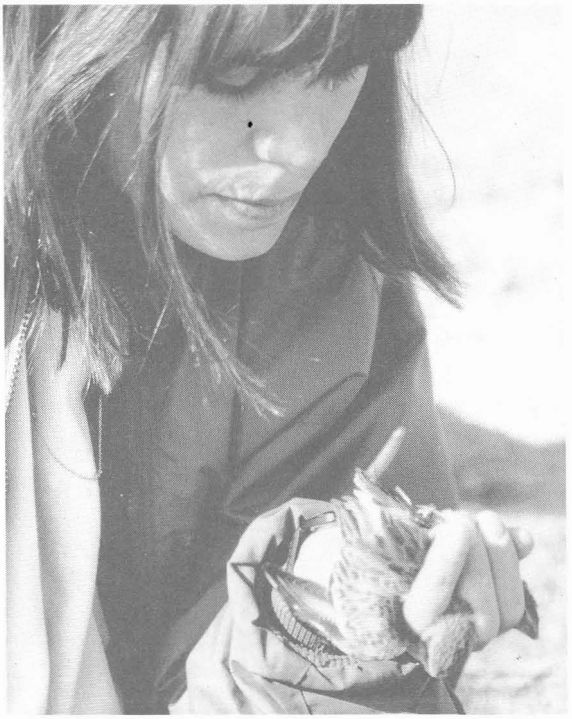
Until recently, Terborgh wrote, "ornithological surveys [in tropical forests] were made down the barrel of a shotgun," by professors from cold northern campuses seeking a bit of sun during midwinter breaks. "It is hardly an exaggeration to say that until the 1970s nearly all we knew about Neotropical migrants in the winter was contained on the labels of hundreds of shot specimens in the nation's museums." This is changing, though slowly.

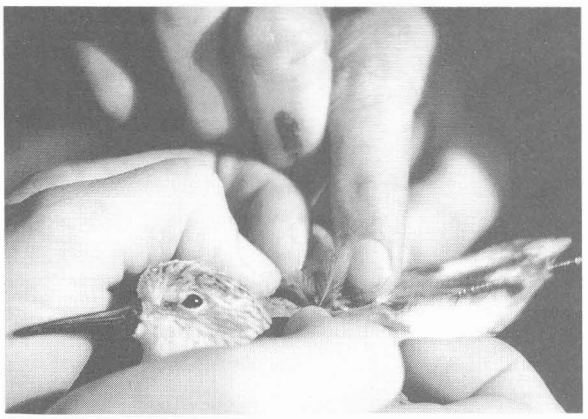
The proposed North American Free Trade Agreement will have profound implications on wetlands in Mexico. What these will be will depend largely on whether comprehensive investment in conservation is included.

Some notable cross-boundary efforts to protect migrating birds on the Pacific coast include Pro Esteros, a binational organization dedicated to conservation of the estuaries in Baja California, based in Imperial Beach, San Diego County, and Ensenada, Mexico. The Point Reyes Bird Observatory's Pacific Flyway Project is working in cooperation with Canadian and Mexican researchers. The program to restore the threatened Aleutian Canada goose is a team effort by United States, Russian, and Japanese wildlife researchers and conservationists.

Under the Wetland Conservation Act of 1989, which provides for projects in Canada and Mexico as well as the United States, the Fish and Wildlife Service is offering training and technical assistance in wetland management to Mexico and aiding Mexico in habitat inventories. Ducks Unlimited is also mapping habitat areas. Working on behalf of Neotropical songbirds, as well as shorebirds, is Partners In Flight, a two-year-old program in which state and federal agencies, and nongovernmental organizations cooperate. The Western Hemisphere Shorebird Reserve Network, of Manomet, Massachusetts, formed in 1985 to protect migratory shorebirds, has identified wetlands of major significance to shorebirds, including Copper River Delta and San Francisco Bay. It has recently joined the Audubon Society, World Wildlife Fund, U.S. Fish and Wildlife Service, the International Association of Fish and Wildlife Agencies, and the University of Cordova, Argentina, to form Wetlands for the Americas. The mission of this new group is to promote the conservation of wetland ecosystems in the Americas, and it is working primarily in South America. Also important is the Ramsar Convention on Wetlands of International Importance, which has designated Izembek Lagoon, Alaska, and Ash Meadows, Nevada, and is expected to designate Mono Lake as wetlands of vital importance on the Pacific Flyway. (The Fish and Wildlife Service is a signatory of this convention.) The Nature Conservancy is helping communities in Mexico with natural resource conservation.

NILS WARNOCK





Sarah Warnock places a radio tag on a western sandpiper.

A catalyst for all activity is the awareness that habitat protection is in a race with habitat destruction while, as Mary Anne Bishop at the Copper River Delta Institute observed: "We are just beginning to unravel some of the mysteries of migration." ❐

—*Rasa Gustaitis*

Rasa Gustaitis is the editor of California Coast & Ocean.

Shorebirds o

American avocet.

KEN GARDINER

the Pacific Flyway:

Where do they go? What do they need?

by Dave Shuford

Bicycling to work along the shores of near-pristine Bolinas Lagoon on Marin County's outer coast, I have the pleasure and privilege of marveling at the seasonal ebb and flow of a host of migratory waterbirds. Among these, the shorebirds—sandpipers, dowitchers, plovers, avocets and their allies—hold a special attraction. Restless bands twist and turn, alighting on mud flats in chattering conversation, energetically probing the substrate in search of invertebrates to fuel their long-distance migrations. In spring, populations can swell by the thousands overnight or plummet in the twitter of a wing as flocks rise skyward, following ancestral pathways to breeding grounds in the far North. Shorebirds are highly migratory, averaging greater distances in their seasonal travels than any other group of birds on Earth, inspiring awe, admiration, and a special concern for their safe passage. Large numbers of western sandpipers winter in Panama, and some birds migrating north to Alaska via the Pacific coast travel over 1,200 miles in a 24-hour period.

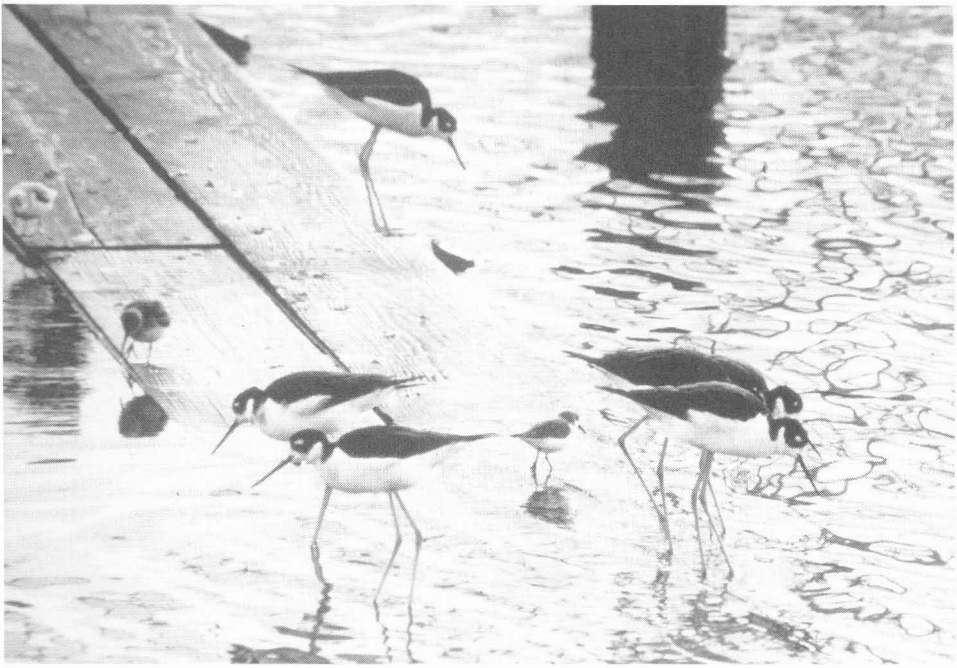
For a wildlife biologist, a leisurely ride along the water allows time for contemplation of the fate of shorebird populations, which add so much to the life breath of our vanishing wetlands. Are their numbers dwindling or growing? Do trends differ among various species? To what degree are declines caused by human-induced changes, and are the effects caused by habitat alteration in breeding areas, on the wintering grounds, or at migratory staging areas? Point Reyes Bird Observatory staff have conducted frequent censuses at Bolinas Lagoon for over 20 years and can chart the rising or falling fortunes of shorebirds there. But even this rare commodity of long-term scientific data at a single site sheds only a very narrow shaft of light on the health of populations that span continents in their yearly travels. Shorebird trend analysis stands in murky waters. Some facts, however, are evident.

From colonial times, North American shorebirds ran a gauntlet through the blazing guns of tenacious market hunters. Commercial exploitation of wildlife traveled westward with human expansion, and it was not uncommon in Gold Rush California to find such items as "stuffed curlew" and "boiled plover with jelly sauce" on the menus of fine San Francisco restaurants. Grinnell, Bryant, and Storer wrote in their classic *Game Birds of California*

(1916) that although it was easy to make statements as to population trends of game, to substantiate such claims with reliable figures was "well-nigh impossible."

Despite a lack of rigorous scientific data, however, it was crystal clear to any seasoned observer at the turn of the century that wildlife populations were declining precipitously from overhunting. Public outcry led to protective legislation, and by the early 1930s all shorebirds but snipe and woodcock were removed from the lists of game birds. Recovery of many species soon followed but, ironically, interest in documenting population trends faded after the birds' legal protection was won. Meanwhile, as the human population expanded and technology advanced, the insidious destruction, alteration, and contamination of our nation's wetlands continued and increased in magnitude.

SARAH WARNOCK



Black-necked stilts.

Some birds migrating north to Alaska via the Pacific coast travel over 1,200 miles in a 24-hour period.

In contrast to the lack of scientific data on shorebird population trends, there is plenty of documentation on the extent of North American wetlands loss. About half the wetlands in the United States have been drained or developed, and in California the figures are even more staggering: The state has lost 90 percent of its total wetlands and 95 percent of its interior wetlands.

How have these tremendous rates of habitat loss affected shorebird populations? We do not know precisely, for no comprehensive census of shorebirds was conducted until 1988, when the Point Reyes Bird Observatory launched its Pacific Flyway Project. The conclusion seems inescapable, though, that shorebirds depending on these vastly diminished wetlands must have suffered major population declines similar to those documented for waterfowl.

For decades wildlife agencies collected population trend data on waterfowl because of their value for sport hunting. These data show great continentwide population declines, particularly since the 1970s. Armed with census facts, a coalition of government wildlife agencies and private conservation organizations has rallied to form the North American Waterfowl Management Plan, to restore critical wetland habitat and to increase waterfowl populations. The plan should benefit other species sharing the habitat, but their perceived lesser value, and a lack of basic population data, have hampered efforts to manage for shorebirds and other species.

Point Reyes Bird Observatory initiated the Pacific Flyway Project to fill glaring gaps in our knowledge of shorebirds. Its goal: a flyway-wide overview of shorebird abundance, population trends, key concentration areas, and habitat needs. The project is working to: (1) identify wetlands of regional, national, and international significance for supporting shorebird populations; (2) identify threats to wetlands; (3) synthesize the threat and bird use data into a comprehensive picture of the future prospects of the flyway's shorebirds; (4) use the project data to increase public awareness and understanding of the need to protect shorebirds and their wetland habitats; (5) develop sound conservation and management strategies for shorebirds and their habitats; and (6) provide a baseline of data for monitoring population change in the flyway to protect shorebirds for future generations.

With the Pacific Flyway stretching from Alaska to Baja California and from the Pacific Coast to the Rockies, our project has had to rely on a host of cooperators, particularly volunteers and wildlife agency personnel. Successful volunteer involvement has the added benefits of demystifying the scientific process and increasing public commitment to saving wetlands.

Via a gradual expansion, by 1992 the project had gathered shorebird census data from most of the important wetlands in the Pacific Flyway. On the Pacific coast, we identified 60 wetlands that held over 1,000 shorebirds, 26 that held over 10,000, and 10 that held more than 100,000. Falling in the latter category were the Copper River and Stikine River deltas in Alaska; the Fraser River delta in British Columbia; Puget Sound, Grays Harbor, and Willapa Bay in Washington; the Columbia River estuary on the Washington-Oregon border; San Francisco Bay in California; and the Colorado River mouth and Laguna Ojo de Liebre in Baja California. So far, San Francisco Bay is the only site that flyway project censuses have shown to hold close to 1,000,000 shorebirds on a single day. San Francisco Bay's critical importance is further emphasized by the fact that it holds more shorebirds than all other coastal California estuaries combined in all seasons.

The PRBO results confirm that Pacific Flyway shorebirds concentrate at a relatively few wetlands. Dependence on a few key links in the chain of wetlands leaves large numbers of shorebirds at risk to threats at these bottlenecks through which they must pass. An environmental disaster, such as a major oil spill, at a key estuary during the peak of migration could doom a large part of a species' population that depends on that site for the invertebrate food desperately needed to fuel energy-intensive migratory flights. Flyway project data also illuminate which species concentrate at particular wetlands at which season and the

Shorebirds depending on these vastly diminished wetlands must have suffered major population declines...

KEN GARDINER

Dowitchers.

So far, San Francisco Bay is the only site that flyway project censuses have shown to hold close to 1,000,000 shorebirds on a single day.

Shorebirds: Ultimate Commuters

Studies of the dunlin, a hardy little sandpiper, suggest that some shorebirds use both coastal and inland marshes during the winter, moving among different feeding sites when conditions change.

This small sandpiper winters relatively far north for a shorebird, and it is usually abundant on Bolinas Lagoon, in Marin County. Over the years, however, researchers at the neighboring Point Reyes Bird Observatory noticed that sometimes dunlin numbers drop dramatically on the lagoon during extended periods of heavy rain. Biologists speculated that the birds flew to interior sites and wondered why. Was it because conditions forced them out or because something better was available? So in winter 1991-92, the Pacific Flyway Project, with research associate Nils Warnock, began a study. From December to January, we color-marked or radio-tagged 75 dunlins at Bolinas Lagoon and Bodega Harbor.

After heavy rains in mid-December, numbers of dunlin at Bolinas Lagoon dropped from about 3,500 to 1,300 and color-marked dunlin began to be seen nearby in San Francisco Bay. Some were found to commute daily between the bay and the lagoon. By late January and early February, only 250 dunlin were counted at Bolinas. Simultaneously, up to eight color-marked or radio-tagged dunlin were detected in the Sacramento-San Joaquin River Delta or the lower Sacramento Valley, demonstrating that large numbers had moved inland, presumably in response to heavy rains.

These findings show not only that important shorebird movements do occur in winter, but also that in the same season some species rely on both coastal and interior wetlands for survival. Hence, efforts at wise stewardship of wetlands must be based on a broad perspective of shorebird habitat needs. —*DS*

Sanderling.

KEN GARDINER

broad flyway-wide patterns of shorebird use by species and season.

In the coming years, the Pacific Flyway Project will strive to collect three to five years of data on shorebird use at all flyway wetlands as a baseline for monitoring and conservation efforts. If you would like to obtain our progress reports or join us in our census or conservation efforts, please contact us at: Pacific Flyway Project, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970. ❐

Dave Shuford is a biologist at Point Reyes Bird Observatory working on the Pacific Flyway Project. His Marin County Breeding Bird Atlas, *to be published this spring, is available from PRBO.*

wetlands

WISE INVESTMENT

In the debate over wetlands protection, environmentalists are learning to speak the language of economics to convince policy makers to pursue conservation instead of development. The Campaign to Save California Wetlands has published *The Value of California Wetlands: An Analysis of Their Economic Benefits,* to assist in this endeavor.

The 15-page report was written by Jeff Allen, Mike Cunningham, Alex Greenwood and Larry Rosenthal, graduate students at the School of Public Policy, University of California, Berkeley. They reviewed economic studies conducted during the past 20 years in many states to produce conservative estimates of the benefits provided by California's 454,000 acres of wetlands. The permanent value of protecting wetlands in the state was estimated conservatively at $124.5 billion.

A variety of methods can be used to assess economic value of wetlands. For example, replacement cost estimates are based on the least costly alternative for replacing a wetland function, such as removal of pollutants by a water filtration plant instead of a coastal marsh. Damage cost estimates look at the extent of damage avoided by a wetland, such as the cost of flooding after loss of streamside wetlands. Other approaches include evaluating wetlands' contributions to an industry, such as fisheries, and asking people how much they would hypothetically pay to protect wetlands. These and other methods were used in the studies cited by the authors.

Because these studies were from many states, the authors reported a range of values in addition to a median, or best, estimate. They converted estimates into 1990 dollars and reported them as both annual per acre values and permanent statewide values. The greatest annual value was attributed to hydrological functions of wetlands, such as regulation of water supply ($6,800/acre), water quality ($6,600/acre), and flood control ($4,650/acre). Other values estimated were habitat ($3,337/acre), recreation ($347/acre) and fisheries ($199/acre).

Although it is tempting to use these figures to calculate an individual wetland's value, they are only valid as statewide estimates averaged across all wetlands. A salt marsh's functions, and thus value, differ from those of a vernal pool. More studies are needed, especially in California, to develop better estimates. In attempting to put a dollar figure on wetlands, however, we should not lose sight of other, incalculable values. What price do we place on an endangered species or on scientific knowledge gained from wetlands?

This report is especially timely because the wetlands debate is often cast in terms of economics versus wildlife habitat. The analysis, however, demonstrates that wetlands themselves have tremendous economic value to society. Despite some uncertainties in the estimates, this study should prove valuable to policy makers.

To order, write to the Campaign to Save California Wetlands, P.O. Box 20651, Oakland, CA 94620-0651. Enclose $5.00.

—*Ramona Swenson*

Ramona Swenson is a doctoral student in integrative biology at the University of California, Berkeley.

The permanent value of protecting wetlands in the state was estimated conservatively at $124.5 billion.

Pacific Flyway Joint Ventures

A continental ecosystem-wide effort to secure the survival of wetlands on the great American bird migration routes began in 1986 when the United States and Canada adopted the North American Waterfowl Management Plan, calling for the restoration of migratory waterfowl populations to levels recorded in the 1970s. Mexico is not yet a signatory but has participated since 1988.

The plan calls for agencies and organizations with separate but related interests in wetlands to join in bioregional joint ventures that leverage their separate strengths. These partnerships are to focus on 34 critically important waterfowl habitat areas, of which nine are to be given high priority attention. Among the nine are California's Central Valley, and the western Pacific coast from the mouth of the Skeena River in British Columbia to just north of San Francisco Bay. The Central Valley Joint Venture was formed in 1988, the Pacific Coast Joint Venture in 1991.

Partners include flood control agencies, farm bureaus, sports and commercial fishery organizations, and others whose cooperation is important and whose interests would be served by a more creative view of wetland functions. "As more diverse partnerships began to take shape, they have evolved into biodiversity joint ventures," noted Carey Smith, coordinator for the Pacific Coast Joint Venture, Pacific Region of the U.S. Fish and Wildlife Service, Portland, Oregon. Joint venture goals go beyond those specified in the plan. They include securing habitat for shorebirds, waterbirds, fish that depend on wetlands, and other wildlife.

A variety of strategies was devised, in keeping with perceived opportunities, needs, and funding options. Public agencies and nongovernmental organizations pooled resources to acquire important habitat or put it under protective easements. Land management policies were reviewed in light of habitat needs. Landowner incentives and extension services were employed to maintain, enhance, or restore habitat.

A sense of urgency drives this international initiative. "This is one last continent-wide coordinated effort to get federal, state, and private interests all working together," observed Paul Springer, adjunct professor at Humboldt State University and a participant in the plan.

Pacific Coast Joint Venture

The Pacific Coast Joint Venture is the only one of the 12 to cross an international boundary. It aims to protect "islands" of habitat that include coastal wetlands and estuaries, freshwater wetlands, riparian areas along the floodplains of creeks and major rivers flowing from the coastal mountain ranges, and also uplands, some of them farms or ranches, to which waterfowl have become adapted. The aim is to secure 290,000 acres of wetlands and associated uplands in the bioregion, to enhance 60,000 acres of habitat on public and private wetlands and agricultural lands, and to restore 15,000 acres of former wetlands.

So far, this joint venture has affected 28,000 acres of habitat in the United States and Canada at a cost of $48 million in federal and state, nonprofit organization, and corporate funds, Smith said. Most of these funds would have gone, in whole or part, to different groups for separate projects. As part of the joint venture, they can be used to buy more for less as cooperation replaces needless competition. Most projects proposed and initiated so far are in Canada, Washington, and Oregon. The Pacific Coast Joint Venture is organized into 13 focus areas. The two in California have only recently completed strategic planning.

Some projects will benefit farmers as well as birds and other wildlife, and may also encourage the development of pest control methods that minimize chemical dependency.

PETER VILMS

Cinnamon teal on farm pond in the Laguna de Santa Rosa flood plain.

Farmers and dairy ranchers in the Pacific Northwest have been plagued annually by the descent of vast ravenous flocks of swans, geese, and widgeon on pastures and crops. As marshes were diked and drained for farming, intertidal habitat shrank, and many of these birds turned to alternatives, such as corn, winter wheat, clover, potatoes. "Now they will often forego pristine natural habitats for more easily foraged agricultural lands," Smith said. The Fish and Wildlife Service tries to haze the birds away from the fields and onto refuges, in some cases employing full-time help to make noise and flash tinsel at them. However, said Smith, "It's hard to force nature upon them when nature is pretty much gone. To maximize the nutritional yield on what little habitat remains, our only logical alternative was to almost be farmers ourselves."

The U.S. Fish and Wildlife Service and the Canadian Wildlife Service now contract with farmers to grow crops on wildlife refuges specifically for birds. In return, farmers take part of the crop for themselves, or put in a summer crop during the birds' absence. In the Willamette Valley, farmers grow annual and perennial rye grass, market the seed, and leave the plants for wildlife.

Where agriculture is struggling to survive, cooperative farming for wildlife provides a boost for dairy ranchers and farmers. They do not need to worry about yield per acre, nor about market price for corn or wheat. "They can plant a crop and leave," said Smith. They do, however, have to agree to abide by certain conditions. "We have had to walk away from potatoes because of the heavy use of chemicals in normal cultivation," Smith said, "although some species select potatoes over other agricultural and natural foods."

"We specify methods, type of crop, cultivation techniques, pesticide, herbicide, and rodenticide use," said Scott Stenquist, coordinator of integrated pest management (IPM) for the Pacific Region of Fish and Wildlife. "We are looking for the least toxic methods of pest control that do the job, yet protect soil, water, and nontarget organisms." Many farmers are interested in IPM, for economic and health reasons, and because of consumer concern about pesticide residues. "We're seeking a common ground, a zone where interests overlap," explained Chad Roberts, Audubon Society representative on the Pacific Coast Joint Venture and chairman of its California steering committee. "It would not suit us to see agriculture disappear."

Projects undertaken by the Pacific Coast Joint Venture range from huge to small but significant, and they often reinforce goals set by local citizens, governments, or agencies. In the first California project, water control structures were purchased to improve wetland habitat on 800 acres at the Humboldt Bay National Wildlife Refuge. The $14,000 required was provided in an even match by Fish and Wildlife and Ducks Unlimited.

In Sonoma County, local citizens hope to see a wildlife refuge on the Laguna de Santa Rosa, a 7,000-acre seasonal wetland that provides for bountiful waterfowl and other birds and wildlife in winter, when pastures flood. In summer, the laguna is a shallow stream bordered by wetlands. In winter, it is a shallow lake. It is south of Windsor, north of Cotati, between Santa Rosa, Sebastopol, and the Mayacamas Mountains. Most of the land is in privately owned pasture. The city of Santa

Joint Ventures *continues on page 29.*

"This is one last continent-wide coordinated effort to get federal, state, and private interests all working together."

Paul Springer

RAISING Rice & Birds

An increasing number of rice farmers in the Sacramento Valley are playing host to thousands of birds migrating along the Pacific Flyway. By flooding their fields in the fall and letting the water stand until March before draining and replanting, the rice farmers provide a feast for migrating waterfowl and avoid having to burn the rice straw that remains after harvest, a practice that will be outlawed by the year 2000.

Ricelands Habitat Partnership, a three-year pilot project undertaken by The Nature Conservancy, Ducks Unlimited, California Waterfowl Association, and the California Rice Industry Association, is studying the effects of flooding 13,000 acres of rice fields in the valley with 4,400 acre feet of water, dragging a heavy cage roller through it, and letting it stand at a depth of four to eight inches for about six months, until the rice straw disintegrates. (The partnership is one component of the Central Valley Habitat Joint Venture, which seeks to increase the number of migrating waterfowl on the Pacific Flyway in keeping with the goals of the North American Waterfowl Management Plan.) Traditionally, most rice farmers have burned the straw left after harvest, but the Rice Straw Burning Reduction Act, effective last year, requires them to phase out this practice because of the air pollution it generates.

This leaves the options of plowing the straw under, baling it and hauling it to a cogeneration plant, or flooding the fields. The method each farmer chooses depends on which he decides would be least expensive and least disruptive for the farm. Flooding has the advantage of attracting a large number of waterfowl migrating along the Pacific Flyway. For some farmers, the birds bring in a second income in the form of hunting fees. "A farmer can sell hunting rights for $40 an acre," noted Dan Chapin vice president for government affairs of the California Waterfowl Association. For others, it is a way to help rebuild the waterfowl population, said Robert Herkert, field service manager for the California Rice Industry Association. "A large sector of the rice farming community is opposed to hunting," he said. "Besides, the more ducks a farmer has out on the fields stamping the rice straw into the ground, the faster the straw disintegrates." About two dozen rice farmers are participating in the Ricelands Habitat Partnership, but many more have been flooding fields on their own—at least 20,000 acres.

Except for the small minority of birds that wind up on the hunter's dinner table, flooded rice fields are a bonanza for waterfowl. "The Central Valley is definitely one of the hot spots on the flyway," said Chris Unkel, director for wetlands at The Nature Conservancy and chairman of the Central Valley Habitat Joint

Venture. "We have very good data from previous studies that show that holding water on rice fields will attract waterfowl because initially the flooded fields provide a lot of waste grain, and later they provide a lot of invertebrates [insects, snails, worms, midges, and crustaceans]—both of which are good food sources for birds," he said. "The make or break issue for this will be the agronomics—whether this will benefit the farmers and not impact the fertility of the fields."

When farmers drain their fields in March or April, they will discover how much of the rice straw has disintegrated. "Anecdotal evidence so far indicates that if a farmer floods early and attracts lots of waterfowl, the straw will just disappear," said Herkert. The partnership is also studying how well ducks and geese are attracted to flooded fields under varying conditions, the quality of the water being drained, and the effects of flooding on nontarget species, such as snow geese or the sand hill crane. "We want to be sure we're not trading one problem for another," explained Unkel. "We're very confident that we'll have very high quality water released from the fields because of the care and control in the rice industry's use of herbicides."

One question remains troubling. How will flooding affect anadromous fish? Diverting water from the Sacramento River could further endanger the habitat of salmon and steelhead using the river to spawn. The Ricelands Habitat Partnership is examining ways to avoid this, including flooding with groundwater or with irrigation water that has already been used. Alternately, water used for flooding could be stored and used again in the spring for irrigation.

Farmers have harvested rice in the Sacramento Valley for about 80 years. Last year, they planted about 375,000 acres. Marc Reisner, general consultant to The Nature Conservancy, estimates that in a wet year, it is "conceivable" that 250,000 acres of rice farms could be flooded in the winter. By the end of the decade, "it is likely that 100,000 to 150,000 acres will be flooded," he said. In his best-selling 1986 book on California water, *Cadillac Desert*, Reisner characterized rice farming—which he recently estimated as using about 5 percent of all the state's water—as one of the most wasteful uses of imported water. "Providing habitat and food for the birds on the Pacific Flyway is pretty good compensation for diverting a couple million acre feet or more of water," he said recently. "The benefits of flooding are clearly extraordinary—and we have to have the rice industry making money in the summer in order for there to be fields to flood in the winter."

—*Regina McGrath*

U.S. Fish and Wildlife Service

To famished migrating waterfowl flocking to the Central Valley each October and November, harvested rice fields provide millions of pounds of readily available food.

Homing with Map

Consider the puzzle a homing pigeon faces: it is taken from its loft in a covered basket and released at some totally unfamiliar place.

Perhaps the greatest mystery in long-distance bird migration is the birds' extraordinary navigational ability. How do these famous travelers find their way so precisely across oceans and thousands of miles? The answer seems to involve two distinct yet interrelated systems. One is the birds' "compass" and the other is their "map." Together, these two processes may be the means birds use to find home. We who explore bird migration have taken divergent paths ourselves in search of the solution to this mystery. Mine has followed homing pigeons. Many of my ornithological friends look down their noses at pigeons, but we would be lost without them.

Consider the puzzle a homing pigeon faces: it is taken from its loft in a covered basket and released at some totally unfamiliar place. It doesn't know where it is. It doesn't know where home is. What is it to do? First it must answer the question—which direction is home? Once it has determined that home lies to the north, for example, then it seems to use a compass to find that direction. Pigeons may have not one but two compass systems. They seem to prefer the sun when it is visible and the earth's magnetic field when the sun is not shining.

How do we know this? Researchers have performed experiments in which pigeons were confined to a box where the lights were out of phase with the real day by six hours. When it was really noon, the pigeons thought it was 6 A.M. When these "clock-shifted" birds were released, they flew off at 90 degrees away from the direction of home. Why? Because they were using the sun as a compass.

However, this mistake occurred only when the sun was shining. Under cloudy skies, the clock-shifted birds flew straight home. Clearly they were no longer using the sun as their compass. What were they using? We have long suspected that birds use the earth's magnetic field.

Now that we are fairly certain of the compass, we are trying to figure out the birds' mysterious map. Before a homing pigeon can effectively use its compass, it must decide which direction is home. But how do pigeons know where they are in relation to their loft?

Pigeons fitted with opaque contact lenses had no trouble becoming oriented and finding home. Pigeons released over the ocean, out of sight of land, also found their way without difficulty. Both of these experiments indicate visual landmarks are not very important. And the good orientation often seen under overcast rules out the sun or stars. What is left?

There are currently two major theories. A group in Italy, led by Floriano Papi of the University of Pisa, and Hans Wallraff in Germany, have proposed that pigeons use familiar odors to find the loft. J. Gould at Princeton, Bruce Moore at Dalhousie University in Nova Scotia, W. Wiltschko in Germany, and A. Lednor and I at Cornell think that the earth's magnetic field plays the key role.

Papi and his colleagues have performed many ingenious experiments that support the idea that pigeons use odors as the basis of their map. Papi's idea is that pigeons learn to correlate the odors around their loft with the directions of the wind. Sitting in the loft, the bird learns, for example, that a chocolate factory lies to the north, the sea to the south, an olive grove to the east, and a Fiat plant to the west. In this way, the pigeons develop an olfactory map of their surroundings. When released at a new location, they sample the local odors, remember what wind direction brought it to

and Compass

them at the loft and then fly in the appropriate direction.

If pigeons are not employing odors, could they be constructing their map using the earth's magnetic field? As mentioned before, there is some evidence that they use it for a compass. To understand how birds could use the earth's magnetic field for orientation, consider the earth to be a grapefruit with a bar magnet poked through the middle. If you remember from playing with a bar magnet, thumbtacks and paper clips are attracted to either end of the bar, but not to the middle, an indication that the magnetic field is strongest at the poles of the magnet.

The same is true of the earth. The magnetic field is strongest at the north and south poles and weakest at the equator. Thus, information about one's position north and south could be derived from the strength of the earth's magnetic field if one were sensitive enough to detect it. However, it is hundreds of times weaker than what your finger feels when placed between the tips of a common horseshoe magnet. It is hard to imagine that a pigeon could sense infinitesimal changes in the strength of the magnetic field as it travels to its home. Yet, evidence is mounting that shows that this may be what is happening.

Three recent experiments indicate that pigeons use more than one cue, and that pigeons growing up in different places may use different cues to find their way home. The human analogy would be that growing up in New York City, a person might learn to use the streets, skyscrapers and even the subway system to find his way. Someone growing up in Ithaca might find the lakes, hills, and roads more useful.

In the first of the experiments, Rosie and Wolf Wiltschko made pigeons anosmic (unable to smell) by anesthetizing their noses. Using precisely the same experimental techniques in three countries, they found that in Italy, anosmic pigeons neither oriented nor homed. In Germany, they both oriented and homed normally, and in Ithaca, New York, anosmic pigeons were more scattered in their orientation and slower in homing than normal pigeons. In the second experiment, we raised siblings—pigeons typically have two young at a time—in two lofts in Lincoln, Massachusetts, separated by only 1.5 miles. Birds from one loft were disoriented at magnetic anomalies; birds from the other loft were well oriented. In the third experiment, pigeons from our loft at Cornell released at a Jersey Hill fire tower 70 miles west of Ithaca are totally disoriented and few of them ever get home. Pigeons raised in other lofts, even Cornell pigeons, home normally from Jersey Hill. We have no idea why our Cornell pigeons become completely disoriented at Jersey Hill, which is not a magnetic anomaly.

The more we learn about how pigeons home, the more impressed we become with the flexibility of their navigational system. And perhaps knowing more about pigeons will help us to understand how a Manx shearwater, released in Boston, found its way across the Atlantic Ocean to its home on the coast of England in only 12 days. ❐

—*Charles Walcott*

Charles Walcott is the executive director of the Cornell University Laboratory of Ornithology. This is an updated excerpt from an article originally published in 1982 in The Living Bird, *a quarterly magazine of the Cornell Laboratory of Ornithology.*

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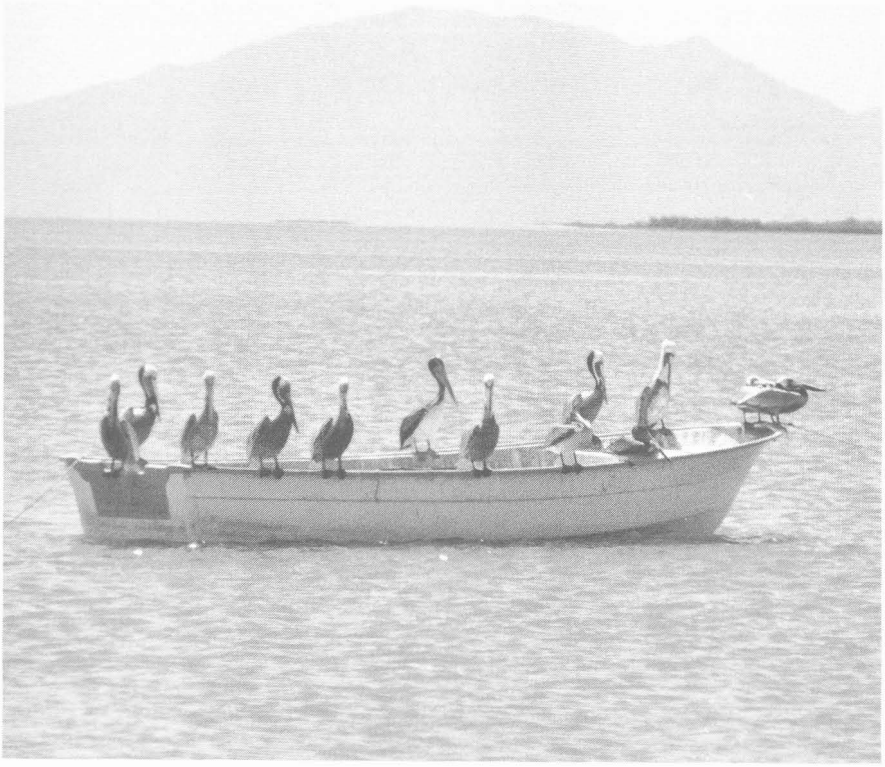


Last Stop in Baja

MAGDALENA BAY

by

EMILY YOUNG

and

SERGE DEDINA

"Anyone worrying about migrating birds in California needs to worry about Mexico."

Barbara Massey, ornithologist

California is often thought of as divided into North and South. If you continue moving past the international boundary, however, you find another perspective. From San Ysidro, Baja California extends some 800 miles to the south, while Alta California reaches 1,100 miles north. To birds traveling along the Pacific Flyway, such man-made boundaries are meaningless. The birds' survival depends on the continuity of coastal marshes along the entire stretch of shore.

In sharp contrast to most Alta California coastal wetlands, which have been drastically altered by dredging and development, or eliminated entirely, many in Baja California Sur remain largely undeveloped. But here, too, major changes are underway. Urbanization, tourism, large-scale commercial fishing, and agriculture threaten the ecological integrity of coastal habitats of enormous significance. Officials at the Baja California Sur Ministry of Development estimate that within the next five years, $200 million to $300 million will be invested in large development projects

throughout the state of Baja California. Much of that investment will be focused on the coast.

Nowhere is the interplay of development forces and natural resource issues more evident than on Magdalena Bay, the largest embayment on the peninsula, some 500 miles south of the U.S. border. This most southerly of the major coastal wetlands on the Californian part of the Pacific Flyway is a primary wintering habitat for Black brant, which flies from Alaska's Yukon-Kuskokwin Delta on the Bering Sea to breed in these lagoons. The largest colonies of magnificent frigate birds in Baja nest among the mangroves. The only bald eagle nests known in Baja are on this bay, according to Sanford R. Wilbur, research biologist with the U.S. Fish and Wildlife Service in Portland and author of *Birds of Baja California* (University of California Press 1987).

The warm waters of the bay provide calving grounds to the highest density of gray whales on the California coast. The chain of five barrier islands that form the bay protects an extensive series of mangrove lagoons from the Pacific Ocean. The islands also shelter what is probably the most important breeding ground for brown and white pelicans in California. Other birds seen here include clapper rails, great blue herons, white ibises, Brandt's cormorants, mallards, and ruddy ducks. The largest colonies of sea lions on the peninsula are here. Bay wetlands are important nurseries for commercially valuable fish and shellfish species that sustain thousands of fishermen and their families.

How important is Magdalena Bay to migrating birds? "We don't have a clue," said ornithologist Barbara Massey, co-chair of Pro Esteros, a U.S.-Mexican citizens group collaborating on transboundary environmental studies. "We can't know unless we do science. And it's hard even to get counts." Comprehensive shorebird counts began in Baja only two years ago and are sketchy. They are based primarily on aerial surveys, which estimate numbers according to bird size, not by species. Such counts, done in January, have shown that Ojo de Liebre (Scammon's) Lagoon has the largest shorebird concentration—over 1 million. But does that mean Magdalena Bay is not important? "The information is only beginning to be gathered," Massey said. For instance, "Every species of West Coast heron has been seen here but, as far as I know, no ornithologist has been here to count during heron breeding season."

Critical Choices

The extraordinary wildlife values of the bay are under growing pressure. Conflicts have emerged between local people seeking

to maintain these values as community assets that assure them and their families a livelihood, and large-scale tourist enterprises, from abroad, that provide few economic benefits locally and threaten to upset the ecosystem. Development plans include a $1-billion resort proposed by a Japanese developer, extending over 250 square miles and including hotels, marinas, golf courses, an international airport, an extensive network of roads, and a botanical garden. Other conflicts pit local fishermen against large boats from elsewhere, and a local whale-watching tour cooperative against foreign tour operators who have less of a stake in assuring the whales' continuing presence here. The outcome of this struggle will affect the future not only of the local population, but also of the bald eagles, green turtles, whales, and migrating birds from the northern coast.

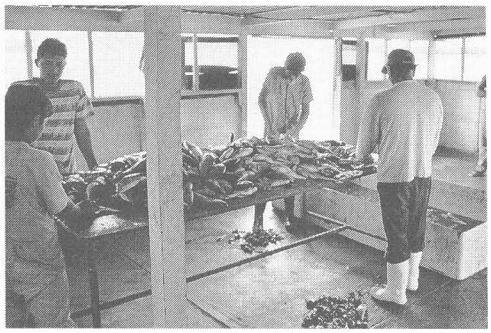
Maps by Poisson Homme

Because Magdalena Bay is so rich in natu-

ral values now, it could become a model for the type of economic development that assures both human and other species' well-being. By the same token, its destruction would mean irretrievable loss.

The lagoons of Magdalena Bay now offer a contrast in ecologies, cultures, and economies. In the waters north of Puerto Lopez Mateos, the gray whales calve and thousands of white pelicans congregate on the sand bars amidst stands of mangroves. The people of Puerto Lopez Mateos, a town of 3,500, subsist on fishing, farming, ecotourism, and cannery work.

PHOTOS BY SERGE DEDINA AND EMILY YOUNG.



Above: **Manuel Mendoza, fixing a manta ray net at El Cayuco, has fished off Magdalena Bay for 30 years.**
Upper right: **Puerto Chale's fish processing plant.**
Lower right: **José Martinez Torres of Puerto Chale filleting manta ray, to be dried and sold.**

The biggest town on the bay shoreline, San Carlos (pop. 6,000) is on a small peninsula at the center of the bay. Oil tankers and large fishing boats dock here. As you approach from the desert interior, a thin band of smog signals the town's presence. Where the highway from Ciudad Constitución enters San Carlos, you note a discotheque and a modern, Mitsubishi-designed electrical generating plant, powered by heavy fuel oil and diesel. The plant provides energy for pumping water from more than 700 deep wells that dot the fertile SantoDomingo Valley, 30 miles to the east. More than 75 percent of that ancient fossil water goes to irrigate wheat, garbanzo, cotton, green chiles, maize, and varied other fruits and vegetables. According to Alvaro Gomez Reynoso of the Mexican Ministry of Rural Development, the value of the crops produced in the valley was over $53 million in 1991. The rate of ground water consumption, however, far surpasses the natural capacity for recharge, he said.

The area south of San Carlos is wide open and sparsely populated, with scattered ranches and fishing settlements. The rugged peaks of Santa Margarita Island loom dramatically above the water. Here sea lions and frigate birds coexist with a small Mexican naval base. South of Santa Margarita Island, sea turtles lay eggs on other barrier islands. Local people survive on a dwindling supply of fish. They must compete with seasonal migrants from the mainland who come to harvest shrimp and other fish, and with larger commercial boats with large nets that sweep the waters outside the bay. Many fishermen from Puerto Chale, a small village at the extreme southern end of the bay, seek better fishing grounds farther along the peninsula, and some raise a few head of cattle, goats or chickens, and cultivate crops to make ends meet.

History of Exploitation

Though much of this land and seascape may look pristine, Magdalena Bay has been a center for resource extraction—almost exclusively by foreigners—since the 1800s, when Boston-based whalers slaughtered some 2,000 gray whales within 30 years. It was only because the whale population here had been decimated that Charles Melville Scammon and other whalers sought out other whale calving grounds, such as San Ignacio and Ojo de Liebre lagoons.

U.S. colonists also slaughtered vast numbers of ducks and geese, drastically reducing their presence on the bay, according to an 1874 visitor's report. U.S. hunters killed so many pronghorn antelope to feed workers in the growing mining industry on Baja that by 1920 the species was nearly extinct. Before the arrival of the colonists, the pronghorns ranged for some 500 miles along the coast and in the plains to the east. Now they can only be found in the remote Vizcaino Desert north of San

Ignacio Lagoon. (Mining of gold, silver, copper, iron, lead, and tin took place throughout the Baja peninsula during the last century.)

Green turtles, once abundant throughout the bay, were canned on Santa Margarita Island and the meat shipped to San Francisco by Pacific mail steamers. They also were a staple food for local people during much of this century. The Mexican government recently prohibited the capture and sale of sea turtles. They are scarce on the bay, though local fishermen say hopefully that they are making a comeback.

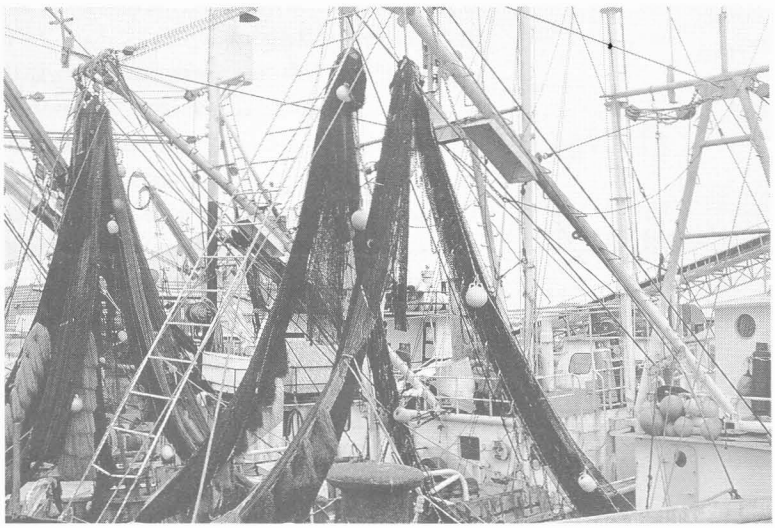
Before the turn of the century, a U.S. syndicate owned 4 million acres here, including the entire bay. It granted concessions to others. The commercial fishing industry that is now firmly established on the bay was launched in 1912 by Kondo M. K. Fisheries, a Japanese firm.

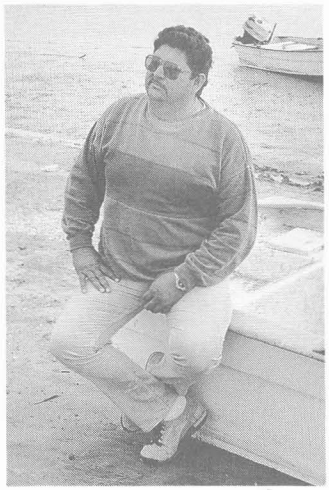
But it was the U.S. Navy that practiced the most destructive activities on the bay by using it as a bombing range. The Mexican Revolution stopped that and ended all foreign concessions on the bay. Since then, marine wildlife has staged a dramatic recovery. Visitors enjoying the scenic beauty and tranquillity here would be surprised to learn that at one time the bay echoed with the sound of rifles and cannon.

Livelihoods and Resorts

The most serious threat now may be a proposal by Fukuzo Iwasaki, who has developed resorts throughout Japan and in Australia, to build a complex in the southern portion of Magdalena Bay. A preliminary master plan shows eight separate resort clusters in an area of about 250 square miles extending from just south of San Carlos to the northern end of Bahia Almejas and to Santa Margarita Island. Mexican officials emphasize that the proposal is no more than an "idea" and have stated that Iwasaki owns no land in the region. Last April, however, Iwasaki announced in Japan that his company, Iwasaki Sangyo, had purchased 5,000 acres of private land around the bay for $500,000 and hoped to buy 25,000 acres of federal property in the vicinity. Iwasaki's grandson was naturalized as a Mexican citizen. Formerly, Mexican law prohibited foreigners from owning land, but that prohibition was lifted in February 1992 by constitutional amendment.

Small farmers and fishermen around the bay told these researchers that they had heard only rumors of the Japanese resort plan. Their reactions varied from enthusiastic support to worry about potential threats to their livelihoods. One fisherman remarked that work in a resort would be a welcome alternative to leaving his family behind to fish for sharks in a remote area of the Sea of Cortez. Clearly, without a better alternative, many will feel the same way.





Top: **Mexican tuna boats docked at Puerto San Carlos.**
Bottom: **Domingo Romero, president of the whale-watching club in Puerto Lopez Mateos.**

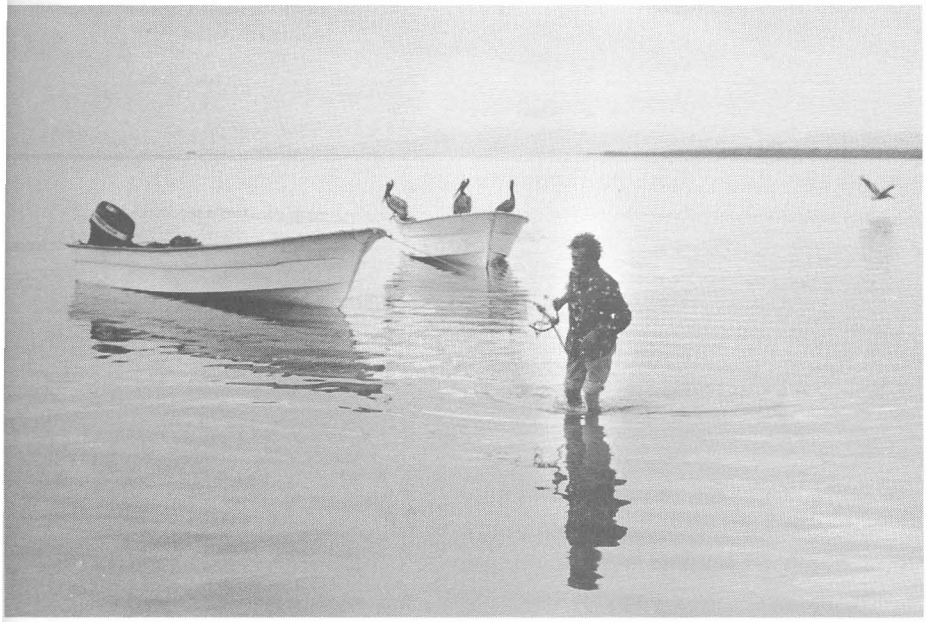
Local people and the Mexican government have shown a concern for protecting the ecological integrity of Magdalena Bay. In 1990, 12 fisherman in Puerto Lopez Mateos formed a whale-watching club, the first of its kind in Baja. It was a response to a growing problem: Competition for tourists eager to see gray whales had intensified to a point where local people felt it was destructive to their community and to the whales, who seemed to be avoiding the bay. The club's intent was to regulate and reduce the amount of whale watching and boating in the area and to provide a more constructive and equitable way of distributing profits from whale tours.

The club membership has since almost tripled. Members take turns with the tours and share revenues, allotting a portion to a fund to pay for government fees and to support public works projects such as road improvements. They limit the number of whale-watching boats in the water at a time.

Researchers have not concluded that inter-

actions with whale-watching boats necessarily disturb gray whales in the short term, but they are unsure of the long-term effects. Therefore, it is to the benefit of whales and other sea life that fishermen restrict boating activity and engage in a public education campaign to tourists and community members about the need to protect the gray whale.

However, club members complain that whale-watching tours organized by U.S. tour operators undermine their efforts. The U.S. operators who bring their own boats bypass the club and provide little or no benefit to local communities. According to club president Domingo Romero and club secretary Juan Rodriguez, large whale-watching and fishing boats discharge their waste into the bay. "We maintain 60 families with the money we make [from whale tours]," said Rodriguez. "The other guides are not from here. None of their money helps the town. The only thing they leave us is their trash." Biologist Ignacio Peña with the Mexican Agency for Urban Development and Ecol-ogy (SEDUE), recently reorganized as the Agency for Social Development, echoed the concern about garbage dumping.



Marcial Canchola, longtime fisherman and sole resident of El Cayuco, preparing to work.

The whale-watching club has also undertaken restoration work for shellfish stocks. In March 1992, just as the gray whale season was ending, it reseeded local clam beds, working closely with fisheries experts from the federal department of fisheries, PESCA.

The idea has recently been advanced by environmentalists in La Paz that the local resource-friendly economy might be sustained by the creation of a wildlife preserve in and around the gray whale calving grounds. A precedent exists in the 6-million-acre Vizcaino Biosphere Reserve, which extends from San Ignacio Lagoon to Ojo de Liebre Lagoon and includes part of the Sea of Cortez. The reserve regulates boating and other human activities to ensure habitat protection but allows fishing and shellfish harvesting in specified areas. According to Peña, local residents were initially opposed to the Vizcaino Reserve. But now those who live within its boundaries like the presence of government regulation because it has decreased competition with outside exploiters of local resources. Members of fishing cooperatives inside the reserve receive permits to give tours while those outside it do not.

Future Vista

Magdalena Bay remains superficially unspoiled, although it is heavily used by local people. The construction of the new power plant in San Carlos indicates the potential for development and change, but a shortage of water and financial resources could impede projects.

Unlike almost all the remaining coastal wetlands in Alta California, Magdalena Bay has not been compartmentalized into "islands" of habitat that offer insufficent refuge for local and migratory wildlife. Currently, the bay provides local inhabitants and visitors the opportunity to interact with an ecosystem that is rapidly disappearing worldwide. With some protection against outside forces they cannot control, the people on Magdalena Bay can demonstrate that humans need not be enemies of natural habitats but, rather, can become agents necessary for their protection. ❐

Emily Young and Serge Dedina are doctoral students at the Department of Geography, University of Texas at Austin. Dedina is a member of the Sierra Club National Coastal Committee.
Partial funding for field research was provided by Pro Esteros, a citizens group working on environmental issues in the Californias, and the Southwest Wetlands Interpretive Association (SWIA).

Joint Ventures *continued from page 19.*

Rosa owns 1,000 acres, which is mostly in pasture and hayland irrigated by treated wastewater. In a joint venture project, the California Department of Fish and Game, which has acquired about 300 acres, plans to restore meanders and braiding to a low-flow channel as a step toward a larger enhancement project. Fish and Game fisheries biologist Bill Cox expects that this will be one of a number of "small things that will happen and have a snowball effect that will slowly gain momentum."

Central Valley Habitat Joint Venture

"Unless you have water and can pump it where you want it, you can't protect wetlands in the Central Valley: the wetlands are virtually 100 percent man-made," said Chris Unkel, director for wetlands at The Nature Conservancy, chairman of the Central Valley Habitat Joint Venure.

The great valley used to be mostly grassland in summer and a vast waterscape, dense with birds, in late winter and spring. Some 4 million acres of wetland were fed by snowmelt and rain runoff that swelled the streams coming down from the Sierra. Now only some 5 percent of those wetlands remain, mostly in state and federal reserves. The water is channelized and captured, primarily for agriculture. Yet 60 percent of the birds on the Pacific Flyway winter in the valley.

Last year, passage of the Central Valley Project Improvement Act (Miller-Bradley bill), brought a policy change long sought by conservationists. It designated wildlife as a primary user. "Now one of the major purposes of the Central Valley Project is for wildlife," Unkel explained. "Because of that the Bureau of Reclamation operations will be different."

The Central Valley joint venture aims to protect and/or restore 200,000 acres, either through fee purchase by public agencies and nonprofits, or through restrictive easements. "My guess is we're half-way there," Unkel said. A major early achievement is the protection and restoration of 14,000 acres of wetland and riparian habitat on the 18,000-acre Parrott Ranch, on the Sacramento River near Chico. With $12 million in state and federal funds and private donations, 4,000 acres were purchased in 1991 and another 10,000 acres were placed under a restrictive easement that guarantees the land will remain as wetlands. The Fish and Wildlife Service, California Department of Fish and Game, Ducks Unlimited, and The Nature Conservancy will share management responsibility. Some areas will be a sanctuary for resting and feeding waterfowl, some will be managed for hunting, and some for riparian habitat. The remaining 4,000 acres will continue to be operated as a ranch.

Another big achievement is the Cosumnes River Preserve, 5,500 acres of seasonal wetland and riparian habitat near Sacramento, protected and being restored in a joint effort by Ducks Unlimited, California Fish and Game, the Bureau of Reclamation, The Nature Conservancy and others. Some 900 acres of seasonal wetland have been restored, primarily by flooding in winter months, according to Alan Wentz, director of Pacific Flyway operations for Ducks Unlimited, Sacramento.

Farmers are essential participants in this joint venture. Some provide winter habitat by flooding rice fields. One grows alfalfa as a winter crop at the Merced National Wildlife Refuge, taking it for hay but leaving the regrowth for waterfowl. The birds clip off the tops.

"The joint venture has brought additional emphasis to existing programs. It has brought in new people," commented Wentz. "People are recognizing that partnerships are the way to get things done," said Unkel. "The severity of the drought and the state of the economy have made people more willing to do things together, recognizing that each of us does some things better than others and taking that into account. The unifying feature is wetlands. People are interested from different viewpoints, but we're all interested in protecting wetlands, and we know that if we don't do it now, it's all over."

—*Mark Wheetley and Rasa Gustaitis*

Mark Wheetley is a project manager in the Coastal Conservancy's enhancement program.

As part of the joint venture, funds can be used to buy more for less as cooperation replaces needless competition.

THE MONARCH

by Regina McGrath

California's coast offers winter shelter to one of the wonders of the world: the migrating monarch butterfly. This orange and black butterfly *(Danaus plexippus)*, while introduced widely around the world, is native only to North America where it is famous for its annual long-distance migration. Each year it stages a journey that extends over several generations and along thousands of miles, returning to the same groves of trees each winter.

For people who live near Pacific Grove, Santa Cruz, and numerous other coastal towns the return of the monarchs marks the onset of autumn. The butterflies arrive at groves as far north as Mendocino County and as far south as Ensenada, Mexico. They are not the same butterflies as left the previous spring. Up to four generations are required to com-

PHOTOS COURTESY OF GINNY MONTEEN/ *CAL POLY TODAY*

Marathon Flier on Gossamer Wings

Of all the long-distance migrants that visit the California coast, the monarch has the most discriminating taste in real estate.

plete the great migration cycle. Yet they always settle in the same groves, in colonies that may have as many as 250,000 butterflies each, hanging from branches like enormous clusters of bright-hued grapes.

How these butterflies manage their amazing journey remains a mystery. It is known that they ride thermal air currents to gain altitude and then coast along on tail winds, traveling as much as 80 miles a day. They alight occasionally to congregate around nectar sources, fuel up, and continue. Glider pilots have reported seeing monarchs at altitudes close to 4,000 feet.

"We know monarchs have a sun compass, [can navigate using the sun] and they probably respond to the Earth's magnetic field since they have magnetite [a magnetic black iron oxide] in their bodies," said John Lane, butterfly biologist and education director of Santa Cruz City Museum of Natural History. "It's possible they may orient to prominent peaks on the horizon to navigate across bodies of water. Moisture gradients or areas of still air may aid them in short-range navigation to their chosen locations," he speculated.

If some monarchs are already there, they will stage a bright orange display, opening and closing their wings as others come close. Whether the purpose is to prevent others from landing on them, or to welcome them in is unknown. But how do the first ones to arrive find the trees? One theory holds that, before leaving, the butterflies mark the spot for succeeding generations with some kind of scent, but Lane said scientists have taken air and leaf samples and never managed to isolate any butterfly-produced marking scent.

By November the monarchs have congregated in their winter colonies where they primarily live off their fat reserve and try to stay out of the wind. Between January and March, they mate. Shortly after, females fly off to lay eggs on milkweed plants, the monarch caterpillar's only food. (Milkweed contains cardiac glycosides, which make the caterpillar and butterfly distasteful and poisonous to many birds and other insectivores.) After laying the eggs, the adult monarch dies. After a few days, a caterpillar hatches from the egg. Three to five weeks later, the caterpillar becomes a chrysalis. After ten more days, the butterfly emerges and begins to fly north. It lives only about a month, as do its offspring, flying ever northward in search of milkweed.

Monarchs born in late summer, however, will live six to nine months and will make the entire trek south to wintering grounds either along the coast of California or in Mexico. They depart from the northernmost sites when the weather begins to turn colder, in August and September, feeding on nectar to build up fat for the long migration and winter wait.

The largest North American population of monarchs, about 100 million, lives east of the Rocky Mountains and migrates from the entire eastern United States and Canada down to the mountains of central Mexico. The Pacific population, estimated at no more than 3 million by Lane, travels each fall to the coast from throughout the western United States and Canada, from as far east as the western slope of the Rockies.

Protecting the Monarch

In recent decades, the need to protect monarch butterflies has come to the attention of scientists, conservation groups, and public agencies. Many wintering sites

along the California coast have been destroyed by development. Although some new sites have become available in eucalyptus trees planted on former grasslands, "California loses at least one overwintering site a year," noted Mia Monroe, a ranger at Muir Woods National Park. "This could be a result of development on the coast or the cumulative effects of habitat destruction." The use of pesticides and nematodes (which kill caterpillars and butterflies) and herbicides (which kill milkweed) may also have affected the monarch butterflies.

In response to these and other threats, the Xerces Society, an international nonprofit group dedicated to the conservation of rare invertebrates, started the Monarch Project in 1986. In 1990, the Monarch Project encouraged local butterfly activists to coordinate efforts in this state. An attempt is underway to organize in response, according to Ranger Monroe.

In 1987, California took its first step to protect wintering sites when the state legislature passed a bill by Assemblyman Byron Sher (D-Palo Alto) that officially recognized the environmental significance of monarch overwintering colonies and directed the Department of Fish and Game to prepare management plans for roosts on land it controls. The 1988 Wildlife, Coast, and Parks Initiative included $2 million for the purchase of land with monarch overwintering colonies. Monarch researchers assembled by Fish and Game selected ten major sites, in order of priority, for the state to purchase.

As of February 1993, the Wildlife Conservation Board, which acts as the real estate arm of Fish and Game, had purchased or helped to protect four of the five top sites. It bought South Branciforte Creek in Santa Cruz ($245,000) and contributed $200,000 to the $1.4-million purchase of another site by the city of Pacific Grove. The board also purchased a major grove of trees in Santa Cruz, known as Escalona Gulch Ecological Reserve,

To Track a Butterfly

To learn more about the life and travels of the monarch butterfly, scientists have been tagging them with messages that ask the finder to write the tagger, describing where it was found and giving the number of the tag. The tag is made of gum tape that is folded over the edge of the upper part of one wing, taking up about 1 percent of the wing, according to Kingston Leong of California Polytechnic State University.

The information is important for the protection of the species, but it is not necessarily harmless to the butterfly tagged. Leong said that research he completed last year showed that if the monarch damages 10 percent of its wing during mating, or because of wind or bird predation, it may not return to roost. Tagged butterflies, therefore, may be at greater risk."So far my studies imply that butterfly wings are more fragile than we thought," he said.

Butterfly tagging was started by F.A. Urquhart, an entomologist at the University of Toronto, who spent 40 years looking for the wintering colonies of the monarch. In the 1930s, he suspected that the monarchs were migrating south instead of lying dormant over the winter. He began to mark butterflies with various dyes and paints in order to track them. After these false starts, he developed adhesive paper tags with numbers and a return address. During the next 30 years, he and his colleagues tagged 400,000 monarchs. Finally, in 1974, Kenneth Brugger, an assistant of Urquhart, discovered some of the wintering colonies located northwest of Mexico City.

Every fall, the children of Pacific Grove welcome the monarchs with a parade.

RICHARD BUCICH

for $431,000. And it recently closed escrow on a $375,000 site in Stinson Beach, Marin County. "The remaining $700,000 will be used to pursue other sites on the list," said Jim Sarro, land agent with the board.

Population Crash?

This winter fewer monarchs have been observed in their wintering sites than anyone has seen since 1976, when Lane first began efforts to count them. "Usually the colony here has between 100,000 and 200,000 butterflies. This year we doubt we have 10,000," said Ro Vaccaro, president of the Friends of the Monarch in Pacific Grove, the city that calls itself "Butterfly Town, U.S.A." Lane noted that large fluctuations in the population are not unusual. The drought could in part explain the drop. It contributed to the decline of milkweed and also possibly to an upsurge in parasites and bacteria that feed on the caterpillar. The freeze in Mexico last winter killed off a good portion of monarchs east of the Rockies, so populations on the whole continent are down, Lane said. Monroe called the monarch situation across the United States "grim. This year we're seeing only 10 percent of the monarchs return to California, and in some places on the East Coast they are noticeable by their complete absence."

A monarch has very specific microclimate requirements. It needs to protect its wings against sharp winds, and to be within a particular temperature range in winter. "If we know enough about this, we may be able to create butterfly colonies by planting trees in just the right places," Lane said.

Kingston Leong, professor of biology, California Polytechnic State University, has spent the last year gathering data on the monarch's microclimate requirements, and is ready to put this idea to the test at Pacific Grove's Monarch Grove Sanctuary—a 2.7-acre property that local citizens purchased for $1.4 million, by approving a special tax, to prevent its development. "At Pacific Grove, we're starting with a site that was once a major cluster and trying to restore the habitat by planting native trees [Monterey pine]," said Leong. He will monitor the microclimate at the site before and after the trees are planted and then monitor how the butterflies use the new trees. "This study will probably take about 15 years to complete and is the only study of its kind that I know of in the state," Leong said.

Preserving the sites of monarch colonies is not only crucial to the butterflies, but it also provides coastal towns with a tourist attraction during the slow winter months. Pacific Grove realizes that—its streets even bear signs that say "Caution—Butterfly Zone." ❐

Regina McGrath is associate editor of Coast & Ocean.

Saving Carmelita Cottages

BY RICK HYMAN

A new hostel for coastal travelers will open soon in Santa Cruz in a restored Victorian cottage. Behind that event lies a tale of remarkable perseverance.

California's newest coastal hostel opens soon in Santa Cruz, in a Victorian cottage nestled under mature trees in a garden setting. Travelers of all ages and nations will be welcome. Few will hear of the obstacles—bureaucratic, political, financial—that the hostel's sponsors overcame to provide low-cost lodgings while preserving a piece of Santa Cruz history. The cottage, built in 1872 by Timothy Dame, a steamer captain, is one of six in the Carmelita Cottages complex.

This is not the first time that the twin causes of historic preservation and low-cost coastal access have been furthered by creation of a hostel. Partly due to financial assistance from the State Coastal Conservancy, Californians can visit four other coastal hostels in historic buildings: a Civil War era building at Fort Mason in San Francisco, a lighthouse on Pigeon Point in San Mateo County, a lighthouse in Montara, farther north, and in a restored farmhouse (DeMartin House) in Redwood National Park in Del Norte County. Each is unique. All bring closer the dream of a 1,100-mile chain of coastal hostels, each no more than a day's bike ride from the next. But none was so plagued with controversy, nor required such perseverance from local sponsors and Conservancy staff, as this charming new one, on Main Street, Beach Hill, two blocks from the Santa Cruz beach and municipal wharf.

The Gift

The hostel project was made possible by a generous gift. Lottie Thompson Sly, who inherited Carmelita Cottages and lived in them most of her life, bequeathed them to the city of Santa Cruz. In a 1953 handwritten will, two years before she died at age 83, she stipulated that the property was to become a park, "cleared and properly landscaped, making it a restful place for the public to enjoy." Should the city fail to establish the park, the property was to go to Stanford University. Mrs. Sly's will gave life tenancy to her friend Abra Budworth, who survived her for 21 years. After Mrs. Budworth died, also at age 83, the city took possession.

The bequest consisted of close to one-half acre, with six board and bat cottages, with gables and stained glass windows. Two face Main Street, four are behind them, close together in a courtyard, surrounded by trees and flowers. Just three blocks from the noisy, bustling boardwalk, Carmelita Cottages are an island of tranquillity from a more leisurely time. "A towering deodora cedar with a trunk larger than a person could reach around stands guard at the entrance to the garden," wrote Ida Hills in the *Santa Cruz Sentinel* in 1976. "A liquid amber and tulip tree only slightly smaller than the cedar complete the . . . canopy." Camellia, pink dogwood, variegated azalea, rhododendron, and a variety of roses are among the "handsome old plants that have outlasted the generation which planted them," she observed.

The will was unambiguous about the grounds. They were to be a public park. But what of the cottages? Did they have to be "cleared?" If not, what could be done with them?

The city considered its options under the watchful and covetous eyes of Stanford University attorneys. Under Stanford's pressure, it agreed in 1979 to demolish five dwelling units by July 1, 1984—two immediately. Two structures fronting the street would be allowed to remain for historical museum purposes.

When tenants and preservationists heard of this plan, they were furious. Vocal among them was Matilda Bachelder, 92. "I've lived in my home for 25 years and I'm against them wrecking my house to make room for a park," she told the city council in 1979. When a reporter called, she met him at the door and pointed at the elaborately landscaped garden, "I planted everything you see around here."

Others argued that the cottages should be protected for their historic value. "Preservation must apply not only to prominent civic buildings or impressive major houses, if we are to have any understanding and appreciation of our past," argued Sara Holmes Boutelle, of the Santa Cruz County Society for Historical Preservation, in a letter to the *Santa Cruz Sentinel.*

The city backed off and, almost a year later, in 1980, reached a revised agreement with Stanford. As the tenants moved out, the units would not be rerented, but they would be

Courtesy Santa Cruz City Natural History Museum

Circa 1890s photo of the mail being delivered at Carmelita Cottages.

renovated. The July 1, 1984 deadline was retained for all units to be vacated and the property made into a park.

Attention turned to the cottages' potential use. A committee established for the purpose of considering alternatives persuaded the City Parks and Recreation Commission to support a privately operated bed and breakfast. But the city council was uncomfortable with the idea of evicting low-income tenants for a project that would serve people of greater means.

It was at this point that the Santa Cruz Youth Hostel Society stepped in. This nonprofit volunteer organization was looking for a permanent home for a successful summer hostel it operated in rented school space. In canvassing city-owned land, the society became aware of the cottages, decided they would do perfectly, and applied for their use as a 45-bed, European-style hostel. But, at a special city council meeting held just after Christmas 1982, the idea was abruptly nixed. The council majority supported continuing the affordable housing use by renegotiating the agreement with Stanford. The council did endorse locating a hostel somewhere in town, enabling the society to proceed with an application to the Coastal Conservancy for funding.

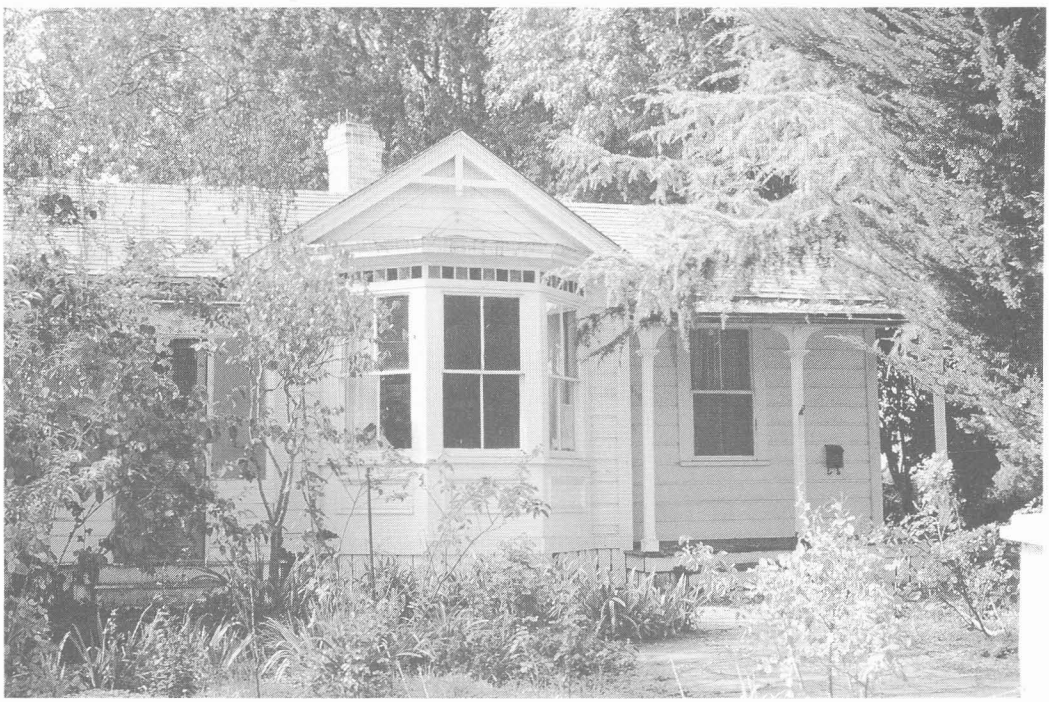
With encouragement from Coastal Conservancy staff and from Jim Lang, director of Santa Cruz Parks and Recreation Department, and armed with favorable petitions, the Hostel Society returned to the city council for support of its application seven months later. This time the council told the society that Carmelita Cottages could be added to the list of possible hostel sites.

The Battle

Thus began—yes, just began—a lengthy battle to actually secure city permission to renovate the cottages as a hostel. The society set about negotiating a lease, securing plans, and applying for permits. On January 24, 1984, the city designated the cottages a historic landmark. (Listing in the *National Register of Historic Places* followed on March 20, 1986.) Ironically, because the cottages—the same cottages that the city had planned to raze—now had "city landmark" status, the society was required to obtain a special historical alteration permit. The Historical Preservation Commission was supportive. But when the society came before the Zoning Board for a use permit, neighbors, concerned about more traffic and transients, testified against it, bolstered by opposition petitions. The board voted three to two for denial, on the ground that the hostel would be incompatible with the neighborhood's residential character. The Hostel Society appealed to the city council.

In preparation for the meeting, former hostel board member Laurel Wilson recalled "walking door-to-door to counteract misrepresentations that the hostel would attract dis-

This restored cottage will open to hostelers this spring.



RICK HYMAN

Hosteling in Santa Cruz

Carmelita Cottages is to be operated as an annex to the Santa Cruz Hostel at 511 Broadway. To make reservations ($12 a night for adults, $6 for children) call (408) 423-8304 or write to P.O. Box 1241, Santa Cruz, CA 95061.

To get there by car from San Francisco, go south on Highway 1, turn right on Laurel St., which becomes Broadway.

From San Jose and Monterey, follow signs for Ocean St. and beaches. Go south on Ocean, turn left on Broadway.

By bus: walk south on Front St. or Pacific Ave. and turn left on Laurel. Take Laurel across the bridge, continue until you cross Ocean St. The hostel is on the left.

COURTESY SANTACRUZ HOSTEL SOCIETY

ruptive people. It was fun meeting our future neighbors, discovering a wide variety of ages and lifestyles." The Hostel Society won the petition battle with hundreds of signatures, as well as many supportive letters. Opponents testified that they represented the majority of area property owners concerned about the perceived disruption that the hostel would bring, but the council, in a pivotal four to three decision in October 1984, overturned the Zoning Board and conditionally granted the use permit. Neighbors then sued the city over its decision.

Superior Court Judge Rollie Hall concluded that use of the site for a hostel (by night, with the grounds open to the public during the day) did not violate the terms of Lottie Sly's will. Hostel opponents appealed. Over one year later, the Court of Appeals also ruled for the city.

In April 1985, the city leased the cottages and surrounding grounds to the Hostel Society for ten years at a dollar a year. That same month, the Coastal Conservancy approved a $75,000 long-term loan for the renovation project. The Hostel Society set about the arduous task of securing the remaining necessary design, landmark alteration, coastal, and, finally, building permits. Suffice it to say that these were not routinely and expeditiously approved. As the Hostel Society's plans had to adhere to rigid city earthquake, handicapped access, and energy-efficiency requirements, costs escalated. The estimate for the project skyrocketed from under $200,000 to over $500,000. That meant "a lot of bake sales," observed Ken Sievers, then-president of the society. A legal dispute with the first designer, who failed to secure his architectural license, further delayed efforts. Frustrated, the society rented a year-round, 18-bed hostel elsewhere in the city.

Still, it continued to press on with Carmelita Cottages. "This is just such a natural," said Sievers. "This is a great place for travelers going up or down the coast. Somehow there has to be a way to make it happen."

Efforts to find funding under two state bond acts, Propositions 18 in 1984 and 70 in 1988, were unsuccessful. The society did manage to secure the services of a contractor and youth workers under the county-sponsored Job Training Partnership Program to spruce up the grounds and deteriorating buildings. But efforts to parlay cottage rehabilitation into a job training exercise failed to materialize.

By 1990, cost estimates for the project had risen to $800,000. Discouraged, the Hostel Society voted to terminate the Carmelita Cottages project, reasoning that it could buy a suitable building that was already up to code for less money. The city again began to explore other options for the property, including a mix of housing and park use.

As the society still had a lease on the Carmelita Cottages, however, the organization continued to maintain the grounds and employ a caretaker. Coastal Conservancy staff approached the Hostel Society about restructuring the restoration by phasing the project over a longer time period. Conservancy staff pledged to seek out additional funding. After more than a year of extensive efforts by the Conservancy and the Hostel Society, the funding was secured, and a new plan was developed.

Artist's rendering, by Phil Plouchart, of the renovated Carmelita Cottages fronting on Beach Hill.

The Victory

By this time, the Hostel Society's permits had expired and its lease had only five more years to run. The approval process had to be revisited, but this time around, there was comparatively smooth sailing. The Hostel Society again successfully canvassed the neighborhood to ensure that the project had support. In May 1991, the city council agreed

to a new 30-year lease. The next month the Conservancy replaced its original loan with a $375,000 grant to the Hostel Society. Failing to find off-street parking on Beach Hill, the Hostel Society planned that Carmelita Cottages would be operated as an annex to the current hostel. In March 1992 the Zoning Board unanimously approved new permits, stipulating that automobile parking not be available at Carmelita Cottages.

Even with this guarantee, some lingering neighborhood opposition remained. But having previously expended considerable money only to lose in court, the leaders did not mount another aggressive campaign and did not appeal the Zoning Board approval.

So in October 1992, a decade after the society first envisioned a hostel at Carmelita Cottages, reconstruction commenced on what will be the first dormitory at 315 Main Street. Shortly afterward, the adjacent two-story home, built circa 1872 by saloon keeper Thomas V. Johnson, was raised to add a new foundation. It will be the second dormitory, and will open later this summer.

While the political battles may now be over, much work remains to complete the project. As visitors enjoy the remodeled 19th century accommodations, they will initially find the rear building off-limits. The society has nine years remaining to raise the funds to renovate these into a manager's unit, a kitchen/dining/laundry, and two more dormitories.

If history is any guide, the Hostel Society will succeed, as perseverance has been the organization's trademark. In highlighting historic milestones, this account does injustice to the untold hours that individuals expended on grant applications, lawsuits, and other peripheral matters in addition to designing the new hostel. "We lost a lot of good volunteer people; they got burned out," commented Peter Pethoe, a veteran board member. But new volunteers have stepped in with equal commitment and determination. Although board member Peter Kambas bemoans their lack of political acumen, Laurel Wilson recalls hearing praise from other state hostel leaders about the locals' political sophistication. Kambas believes the society was encouraged to persist with Carmelita Cottages by a sense of broad support from the community and government officials, even in the face of the specific negative decisions mentioned. The society's unselfish mission to provide a needed and rewarding service to world travelers will be apparent to all who will now be able to stay at Carmelita Cottages. ❐

Rick Hyman, a planner with the California Coastal Commission in Santa Cruz, recognized the Carmelita Cottages' potential as a hostel over ten years ago. He chronicled their early history in a chapter of Every Structure Tells a Story, *by the Santa Cruz Historical Trust (1990, $10.95).*

RICK HYMAN

Original circa 1872 home of saloon keeper Thomas V. Johnson, this building will be refurbished as the second hostel dormitory in the Carmelita Cottages complex this summer.

Fishing for Roe, not Fish

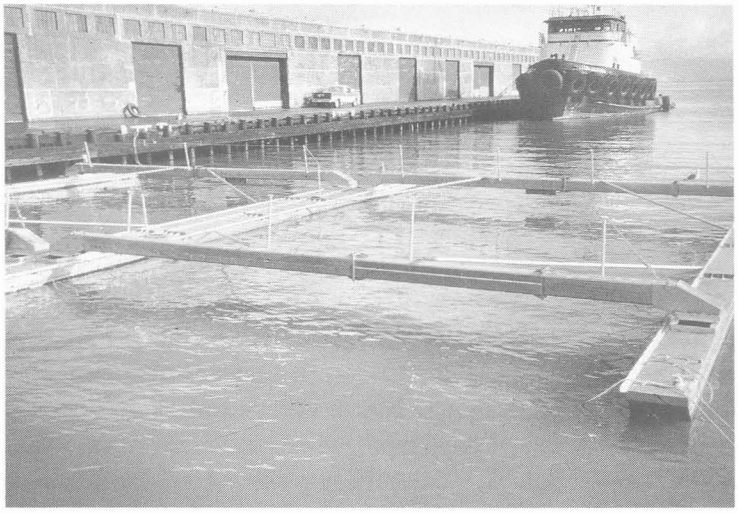
In Japan, herring roe on kelp (*kazunoko kombu)* is a delicacy served as a side dish or appetizer during holidays, especially New Year's celebrations. California fishermen conventionally harvest roe for the Japanese market by catching female herring in purse seines or gill nets and excising the eggs. Since the mid-1980s, however, a few fishermen on San Francisco Bay have been using an alternative method, which allows them to collect the eggs while sparing the fish. They attract the herring to spawn on giant blades of kelp, suspended from strategically placed aluminum rafts.

In the 1992-93 season, December 1 to March 31, ten fishermen harvested 47.4 tons of herring roe, worth at least $806,000, through the open pound roe on kelp method, known in the trade as ROK. Roe sells for $8.50 to $9 per pound to Japanese wholesalers, said Jim Williams of San Francisco, who has been fishing the bay for 30 years, the last five for roe on kelp. ROK fishing is not easy, but Williams says he would never go back to purse seining because it kills the fish. "The fishery here is in very sad shape," he said. "I'd like to see it shut down until the fish recover."

ROK fishing is well established in Washington State, Alaska, and British Columbia. The prospects for its expansion in San Francisco Bay are slim according to Connie Ryan, associate marine biologist with the California Department of Fish and Game, because sites for placing the rafts are scarce. Some 400 herring fishermen cast their nets in San Francisco Bay. The ROK fishermen have to maneuver around them and avoid navigation routes.

"It's a very labor-intensive way to fish, and about half the product price goes to cover costs," said Williams. At the start of the spawning season, 60 x 45-foot rafts (which can cost $25,000 each) are placed off shore, ready to be towed to places where spawning is expected. These locations vary from spawn to spawn. Before the raft is moved into position, the kelp must be hung. The kelp is hand-harvested in the Channel Islands, off Santa Barbara, and trucked to San Francisco. Herring spawn on eel grass, rocks, piers, and marine algae, and on kelp if it is available.

Department of Fish and Game



Hung with kelp, this raft attracts spawning herring in San Francisco Bay.

Cut kelp only lasts eight to ten days, so the ROK fisherman must be alert to herring school movements into the bay, position the rafts, and have fresh kelp fronds at the right time. "Each time we bring up a load of hand-picked kelp, it costs us about $3,000 said Williams. "Timing could make or break you for a season."

When spawning is over, workers pull up the lines on which the kelp blades are suspended and break the blades from the stipe (stem). Kelp is eaten with the roe and damaged blades mean lower prices, so great care is taken. The roe on kelp is placed in plastic containers, in layers, and transported to a processing facility to be washed and trimmed. Silt and mud from dredging in the bay means that the roe harvested here needs more cleaning than that from Prince William Sound or British Columbia. For the last two seasons, Williams has washed his ROK in a machine he has invented.

Cleaned and trimmed, the ROK is placed in plastic trays, drained, weighed, and then put in containers, layered with rock salt. The containers are filled with brine, covered, put in cold storage, and then usually shipped to Washington State, Japan, or Korea where the ROK industry is bigger and more processing facilities exist. In time, the ROK will be served on Japanese tables.

The Department of Fish and Game plans to hold public hearings later this spring on management of the 1993-94 fishery. "In the past two years we haven't seen the two-year-old fish [first-time spawners] come in to spawn," said Ryan. "The fact that there is a very low survival rate for young herring could be due to the drought, water diversions, El Niño, or a whole slew of factors."

In light of the sorry state of this resource, ROK could help. Any kelp not kept for sale is returned to the water to allow attached eggs to hatch. The 47.4 tons of ROK harvested this year is equivalent to about 211 tons of whole fish, which instead are free to spawn again, if they can avoid other predators.

—R. McGrath

Gardening for Butterflies

by Nancy Ferris

Butterflies—along with moths—belong to the scientific order *Lepidoptera*, the second-largest order in the animal kingdom. Here in California, over 200 species have been recorded. They range in size from the tiny pygmy blue with a wing span of one-half inch, to the two-tailed swallowtail with a wing span of over four inches. California butterflies also come in a rainbow of different colors and hues. Some of the butterflies you're likely to encounter on the coast are the red admiral, painted lady, monarch, anise swallowtail, and cabbage butterfly.

It's simple and easy to entice these enchanting creatures to your yard. Adult butterflies require a lot of energy and they get that energy from nectar. You, the gardener, provide the nectar in flowers, so while planning or renewing your garden this spring, think butterflies.

Butterfly gardening tips:

- Select a protected site out of the wind.
- Most butterfly flowers require at least six hours of sun each day, so choose the sunniest part of your yard. Butterflies are coldblooded and they, too, relish the warmth.
- Butterflies sip nectar from a coiled tube (proboscis), so flower structure and size are important considerations. Small tubular shaped flowers (lantana and lilac) and composites (Shasta daisies, Michaelmas daisies, and helianthus) are especially suited to butterflies plus they offer a perch or resting place while the butterflies feed.
- Plant the flowers in large clumps—3 feet x 3 feet or larger. The more butterfly flowers you have, the more butterflies you'll attract. Annuals (French marigolds, scabiosa, zinnias, sweet alyssum), and perennials (butterfly weed, Shasta daisies, purple coneflowers, phlox, wallflowers, liatris, etc.) provide quick and easy beds. No room? Try filling containers with annuals or pot shrubs such as lantana or *Escallonia rubra* and group together in a sunny spot to form a large display.
- Incorporate a large variety of other nectar plants throughout your garden to extend the bloom period:

Flowering Trees: silk tree, California buckeye

Shrubs: Butterfly bush, rosemary, Pride of Madeira, English lavender

Native Plants: Ceanothus, wild buckwheat, rabbit brush, coyote brush

Weeds: Dandelions, clover, thistles, nettles (if you and your neighbors can put up with them).

Check with your local certified nursery or native plant society for the species best suited to your individual locale. Remember that to get a variety of butterflies, you must also plant food plants appropriate for different caterpillars.

- Butterflies have an excellent sense of smell and are attracted to fragrant gardens. They also like mud puddles, sand bars, and even manure piles.
- Never use the bacterial insecticide Bacillus thuringiensis in your butterfly garden. In fact, don't use insecticides at all.
- Keep a record of plantings, bloom times, and butterfly visitors. It can be as simple as jotting information on the calendar; or you may want to start a butterfly gardening journal.
- Don't recognize your visitors? Identification books are a great asset. Recommended:

The Butterfly Garden by M. Tukulsky, Harvard Common Press, Boston, MA: 1985.

A Field Guide to Western Butterflies by J.W. Tilden and A.C. Smith, Peterson Field Guide Series, Houghton Mifflin, Boston, MA: 1986.

California Butterflies by J.S. Garth and J.W. Tilden, California Natural History Guide, No. 51. University of California, Berkeley, CA: 1986.

Butterflies of Greater Los Angeles, by R. Mattoni, Lepidopterist Research Society
9620 Heather Rd.
Beverly Hills, CA 90210.
Poster or field guide is $10, including tax and postage.

Butterfly Gardening: Creating Summer Magic in Your Garden, by Xerces Society,
10 S.W. Ash St., Portland, OR 97204
$19.00 (Also sells self-help sheets on butterfly gardening—ask for sheet No. 7 and send $2.50 plus a self-addressed business envelope with $ 0.52 postage.)

Other sources:

North American Butterfly Association
39 Highland Ave.,
Chappaqua, NY 10514;
phone (914) 238-1602.
Members receive *American Butterflies* magazine.

National Wildlife Federation
Urban Wildlife Program,
1400 16th St., NW,
Washington, DC 20036-2266.
Their "Gardening with Wildlife Kit" contains butterfly information.

Nancy Ferris is a wildlife gardener. She lives in Suisun, CA.

In this space, Coast & Ocean *invites readers to express their opinions about coastal issues.*

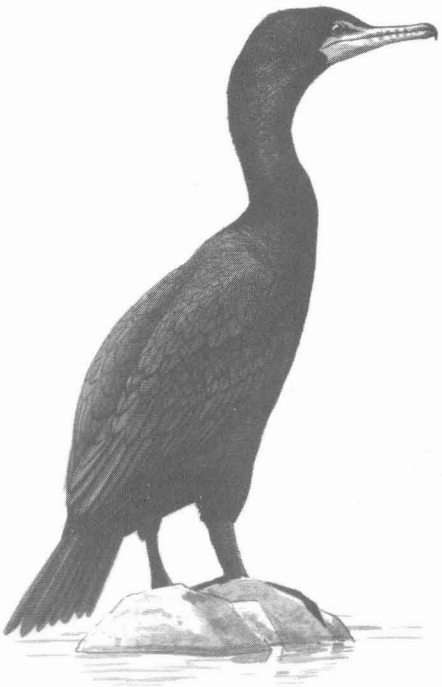
Who's Looking Out for San Diego Bay?

by William E. Claycomb

Unless some drastic steps are taken soon to protect what's left of wildlife habitat in San Diego Bay, some day people will wonder: "Where have all the birds gone?"

San Diego Bay is irreplaceable as habitat for shorebirds, waterfowl, and other marine life. It is the largest protected marine embayment between San Francisco Bay and Bahia de San Quintin. In just the southern part of the bay, 127 species of birds, 44 species of fish, and 127 species of bottom-dwelling animals were found during 1988-89 studies, according to the South San Diego Bay Enhancement Plan (1990). The south bay mud flats are a significant stopover for shorebirds on the Pacific Flyway and the largest shorebird feeding grounds in San Diego County. On the bay's open waters, scoter, scaup, and other diving ducks congregate during the winter.

Double-crested Cormorant



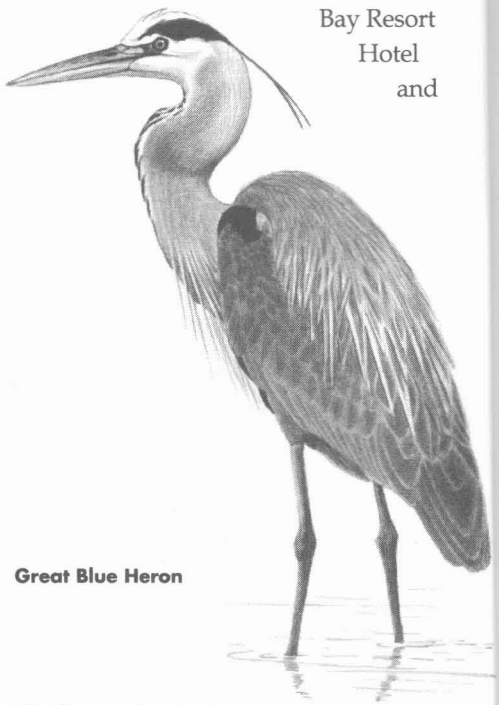
Human abuse of the bay's natural resources, however, has taken a terrible toll. The bay has been developed into a major military and domestic port through the destruction of much of its wetlands. By 1984, only nine percent of the salt marsh, 19 percent of intertidal sand and mud flats, and 28 percent of the shallow habitats (zero to six feet below mean low water) remain. Since the 1960s, the populations of wintering diving ducks have declined by 90 percent. The suspected cause of this drastic decline is the huge increase in boat traffic. Black brant were seen by the tens of thousands less than a century ago. The official 1989-90 midwinter count by the U.S. Fish and Wildlife Service amounted to only 35.

How did this happen? Was nobody paying attention? Let's look at the last ten years' record.

In November 1983, a 330-slip marina, 210-space parking lot, and 200-space recreational vehicle campground were approved by the California State Park and Recreation Commission for the Silver Strand, on the west side of the bay. No environmental impact report (EIR) was done. No environmental watchdog groups commented.

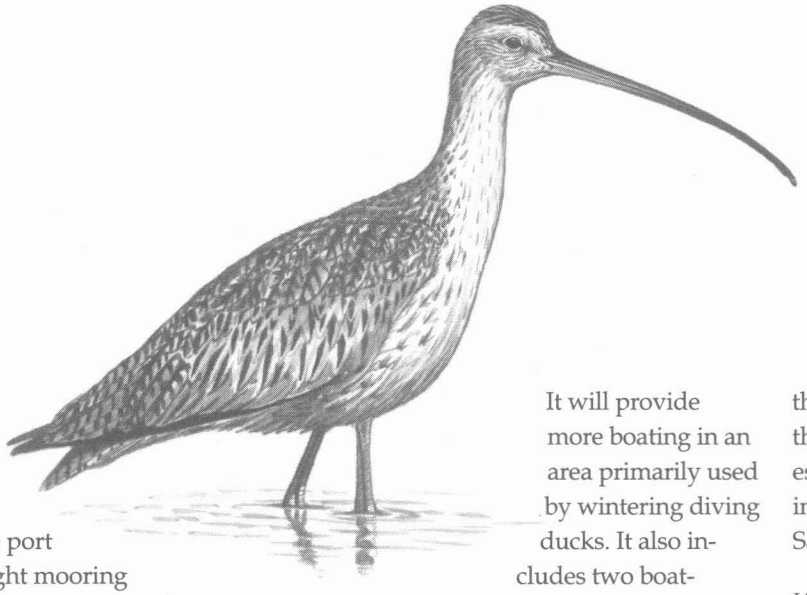
In July 1985, 1,495 feet of breakwater, 210 feet of 12-foot-wide piers, a 31-slip marina, and more were authorized for construction in a lease granted by the San Diego Unified Port District to the South Bay Boatyard in Chula Vista. No EIR was done. No environmental watchdog group commented.

In January 1987, no environmental watchdog group commented on the EIR done for the construction of the massive Loew's Coronado Bay Resort Hotel and 97-slip marina just south of the planned California State Parks and Recreation Department development.



Great Blue Heron

On February 10, 1987, without environmental analysis or comment by any environmental activist group, the port district zoned most of San Diego Bay for water skiing, jet skiing, regattas, and, finally, thunderboat (a 25- to 30-foot boat traveling at about 125 miles per hour) races in the Central Bay, and also, with a five miles per hour speed limit, for ca-



Curlew

noeing and kayaking in the south bay. On that same date, the port established eight mooring areas, including one (A-8) in the heart of an area heavily used by wintering diving ducks. There was an EIR for these areas (and no environmental group comment), but it did not include any discussion of zoning for the various water vehicles that was approved.

During the summers of 1990-92, we had Cinema on the Bay, subsidized by the port district. No environmental analysis had been performed, and no environmental groups commented on the effects on birds and other wildlife of movies projected to a screen floating offshore.

On August 25, 1991, without environmental analysis or comment by any environmental activist organization, the first thunderboat races were held on the central bay.

In each case, there had been comment from wildlife protection agencies—but no support for the life of the bay from citizens groups.

A glimmer of hope for the bay became visible three years ago when the Audubon Society, Sierra Club, Citizens Coordinate for Century III, and the Environmental Health Coalition got together and defeated a plan to cut a second entrance into San Diego Bay. Will they be there for what's on the horizon?

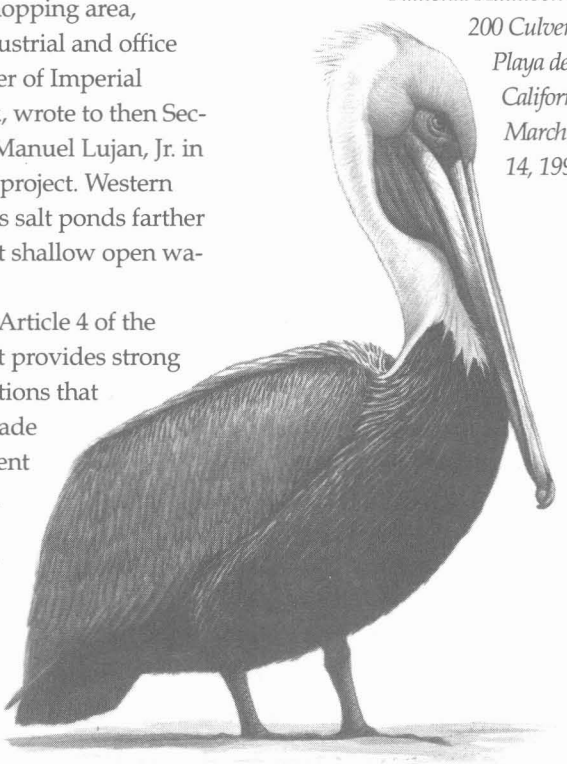
The port district's capital improvement program for 1992-96 includes a Nautical Activity Center for Chula Vista. It will provide more boating in an area primarily used by wintering diving ducks. It also includes two boat-launching ramps just north and just south of Coronado Cays, across from Chula Vista. There is a marina for more than 200 boats for National City near this same relatively undeveloped portion of the bay. The Navy proposes another 400-boat marina nearby.

Imperial Beach dreams of its own special marina and water park at the extreme south end of the salt ponds, near the site Western Salt Co. is eyeing for a marina, hotel, shopping area, parks, and a light industrial and office park. The city manager of Imperial Beach, Ronald C. Jack, wrote to then Secretary of the Interior Manuel Lujan, Jr. in 1991, supporting this project. Western Salt plans to extend its salt ponds farther into the southernmost shallow open waters of the bay itself.

And all the while, Article 4 of the California Coastal Act provides strong safeguards against actions that would seriously degrade the marine environment of San Diego Bay and the state's coast. As this sorry chronology shows, these provisions have been ignored. If development proceeds as planned for San Diego Bay, one day everybody will wonder: Where have all the birds gone? And the fish, the crabs, the snails? Most California wetlands and estuaries have groups of "Friends" acting as stewards. Where are the friends of San Diego Bay?

William Claycomb, of Imperial Beach, is attempting to organize an advocacy group for San Diego Bay.

Bird paintings by Jonathan Alderfer. They are illustrations for the National Audubon Society's new young people's field guides to birds of Southern California wetlands. Courtesy of National Audubon Society, Education Division/Los Angeles. Alderfer's work will be on exhibit at the National Audubon Society, 200 Culver Boulevard, Playa del Rey, California, from March 28-May 14, 1993.



Brown Pelican

A Look on the Wild Side

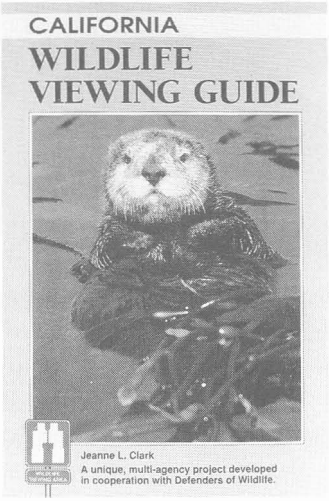
California Wildlife Viewing Guide,
by Jeanne L. Clark.
Defenders of Wildlife and Falcon Press Publishing Co. Inc., Helena and Billings, MT: 1992. $7.95, 160 pp

The *California Wildlife Viewing Guide* is an attractive, sturdy, and handy-sized pocket booklet, well worth its acquisition cost. Its objectives are clearly illustrated by regional maps, intriguing color diagrams of complex wetland ecosystem interactions, and the Pacific Flyway patterns with brief simplified text descriptions of their functioning. California is here divided into eight regions. Each is represented by a detailed road map, color-coded by page margins for easy reference, and includes a consecutive listing of the 150 selected viewing sites. Each site has a brief description of habitat and geography, directions to get there, plus advice on weather and road conditions, acreage size, and ownership. Included are visitor center phone numbers, and an array of icons about wildlife viewing potential and recreational and visitor facilities. Consistency in icons, style, format, and organization greatly enhance the usefulness and effectiveness of this guide.

Any Californian can benefit from exploring and enjoying these viewing sites along major state highways. Collectively, these viewing sites are unsurpassed in the Union in their diversity, bounty, and splendor.

Interspersed among site descriptions are a few clear and unique wildlife photos that make browsing through the guide a real treat. The author and her advisors have diligently chosen the 150 best viewing sites throughout the state to instill public awareness and respect for California's extraordinary biodiversity, its wildlife, and the richness in extremes of landscapes that range from the isolated rugged Pacific Coast to the craggy tops of the High Sierras and the extreme desolate expanse of the fragile deserts.

Great differences exist in the quality of the visitor's experience when visiting the various sites. Federal sites are often extensive and of exceptional rare beauty and solitude. They have listings beyond wildlife of endangered resources of great archaeological and historic value, resource monitoring and management programs, mitigation measures, detailed maps of critical habitats, and a staff of ecologists, archaeologists, geologists, botanists, and wildlife specialists to enhance visitor experience. State sites and many of the smaller sites have more



limited staff and rely more on local seniors and volunteers.

One wishes that the *California Wildlife Viewing Guide* had alerted the visitor to explore the rock paintings, ancestral ceremonial sites, and other places of historic value for which these viewing sites are world renowned.

The guide does not advocate the wise use and enjoyment of this invaluable California heritage. It fails to alert the visitor to the need for many daily cultural changes that are required to safeguard our heritage, and to save the global environment for posterity.

It does not inform about destructive land management activities and recreational uses of these viewing sites. For instance, the Klamath Basin National Wildlife Refuge and many other wetland viewing sites are constantly subjected to changing water allotments and quotas, depleting their marshes to meet agricultural irrigation needs, and becoming infiltrated withtoxic pollution-laden agricultural runoff draining into critical breeding grounds. Recreational activities like sport hunting (lead shot) for wildlife and waterfowl, and fishing (lead sinkers) induce long-term aquatic lead poisoning and botulism. Use of off-highway vehicles on the Nipomo Dunes and many desert sites elsewhere impacts wildlife habitat and breeding, and destroys plant cover. Motor vehicle access and other human intrusions can be disastrous to California wildlife.

Reviewed by Rudolf W. Becking, professor emeritus, natural resources, Humboldt State University.

The Top Predators

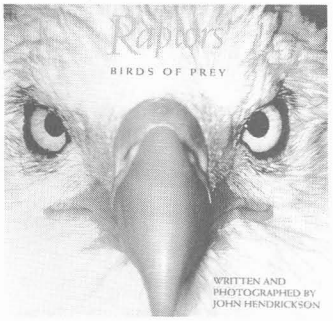
Raptors: Birds of Prey,
by John Hendrickson.
Chronicle Books, San Francisco, CA: 1992.
Cloth: $29.95; paper: $18.95, 96 pp

Raptors serves well as an impassioned introduction to the birds of prey—hawks, falcons, vultures, eagles, and owls. In the opening pages, John Hendrickson relates how a childhood experience with a baby owl, fallen from the nest,

excited a lifelong interest in these fierce, yet beautiful, animals. The help he felt impelled to offer the endangered young owl is extended in this volume to all raptors endangered by the habitat loss and contamination attendant to human population expansion. This is an above-average coffee table book on raptors. John Hendrickson has raptors in his heart.

The author's color photography is outstanding and will be appreciated by the casual reader and expert and novice birders alike. A barn owl, one wing extended, defending its nest; a perching hawk in silhouette against a lightning-streaked sky; a great horned owl in snow-covered camouflage; and a golden eagle, shot and hung on a barbed wire fence, are among the many powerful images captured by Hendrickson and printed with quality in this book. An annoying omission is the lack of clear species identification for some of the photographs. A rough-legged hawk, captured in flight on page 23, is incorrectly identified as an osprey. The same bird, shown perched (page 53), is not identified at all.

The text provides well-written basic information on the biology, behavior, and ecological significance of raptors combined with engaging personal anecdotes from the author's considerable experience in observing and photographing these birds. The strong conservation message presented in the third and fourth sections of the book will help to inform, and hopefully awaken, the active concern of readers unacquainted with these birds but attracted by the dynamic photographs.



Raptors is an excellent reference book for biological science classrooms and libraries, from middle school through college, combining as it does such engaging photographs with a clearly informative text. For example, by first relating a moving, personal observation of the gradual encroachment on the nesting territory of a pair of red-tailed hawks, the author prepares the reader to understand and appreciate his discussion of the ecological principles of limiting factors and the carrying capacity of a habitat.

The widely divergent objectives of different groups and individuals in our society are clear in this discussion. This book underscores once again the dilemma of our time: "As human populations increase, wildlife populations decline"—especially among top predators. Hendrickson points out that "throughout the world most raptors are listed as endangered, threatened, or 'species of special concern' in at least part of their range." The challenge of our time is worldwide conservation of critical habitat containing a "web of life" sufficient to support the remaining populations of these fierce feathered hunters, the raptors.

Reviewed by Allan Ridley, biology teacher at the Urban School of San Francisco.

Promoting Biodiversity

Conserving Biodiversity, A Research Agenda for Development Agencies, *National Research Council, Report of a Panel of the Board on Science and Technology for International Development. National Academy Press, Washington, D.C.: 1992*

Convention on Biological Diversity,
United Nations Conference on Environment and Development/United Nations Environment Program. 160 Route de Florissant, P.O. Box 80, Geneva, Switzerland. FAX: (41-22)789-3536/EcoNet: unced@-gc.org.

The relation of science to policy is always difficult. Science demands a high level of certainty, which is often at odds with the demands of others for action to avert catastrophic consequences to public health or the environment. In the past decade, this conflict has become even more difficult, in the United States and the world, by the hyperpolitization of environmental issues.

Nowhere has this been more true than in the debate about conservation of the planet's biological diversity (biodiversity). Indeed, the failure of the United States to sign the *Convention on Biological Diversity* at the conclusion of the "Earth Summit" held in June 1992 in Rio de Janeiro, produced a major international flap.

The Bush administration justified its refusal to sign by claiming there was insufficient scientific certainty about the cause and effect relationships and about the need to act. This same argument has been made by both the Reagan and the Bush administrations to justify their support for more study and little action regarding most

important national and global environmental problems, including acid rain and climate change.

In this context it is perhaps telling that the recently released National Research Council's book, *Conserving Biodiversity, A Research Agenda for Development Agencies*, prepared by a panel of U.S. scientists, states emphatically: "The agenda presented here is an ambitious one, but the urgency of the situation requires that it be implemented immediately, and to the fullest extent feasible; a delay of even five years will be too late to prevent irreversible losses. Moreover, we already know a great deal about what needs to be done to preserve biodiversity. We must take immediate steps to reduce losses; we must not wait for research to reveal in full detail how we may sustain biodiversity permanently."

Conserving Biodiversity was the result of a request to the National Research Council from the federal Agency for International Development "for a research agenda to provide the critical information needed by decision-makers in formulating policy and designing programs to conserve biodiversity."

Biological diversity refers to the variety and variability among living organisms and the ecological complexes in which they occur, such as forests, savannas, grasslands, deserts, lakes, wetland, coastal communities, or marine ecosystems.

The book's most important contribution may be the "integrated development" message it seeks to convey to international development personnel and development practitioners, including nongovernmental and private volunteer organizations. The integrated development approach advocates development and conservation policies that address environmental, political, economic, cultural, and community issues simultaneously. Perhaps most importantly, the book stresses that effective policies and strategies must include a role for the people most affected. The authors maintain that the conservation of biodiversity is an essential element of sustainable development.

The book is organized as a guide to important basic and applied research that should be undertaken in order to develop effective actions focused on several important research and action initiatives, many implicitly involving reforms in the programs and projects of the major U.S. development agencies, the Agency for International Development, and the World Bank.

As the authors make clear, in large measure the risks to biodiversity are greatest in the developing world because development policies and lending practices transfer financial resources from the developing countries and thereby undermine the capacity of these countries to manage their own natural resources sustainably.

If development agencies were to aggressively pursue the many suggestions made in the book, significant improvements could be made in addressing both scientific and policy concerns related to conserving biological diversity.

The Convention on Biological Diversity presented and signed at the Rio Earth Summit addresses the most important issues related to conserving global biological diversity.

The convention's goals are to conserve biological diversity and to promote the sustainable use of its components and the fair and equitable sharing of benefits "arising out of the utilization of genetic resources." "Sustainable use" is use that does not lead to the long-term decline of biological diversity. The convention notes that "where there is a threat of significant reduction or loss of biological diversity, lack of full

scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat."

Taken together, the two efforts provide a clear agenda of the complex research that must be undertaken and the actions that the international community must take, focused on the local and regional level, if successful advances are to be made in conserving global biodiversity.

Reviewed by Marc Beyeler, manager of the Conservancy's Urban Waterfronts Program.

Get on Your Sea Legs

The Northern & Southern California Boater's Guide to Harbors & Marinas *(Volume 8, 1992/1993 Edition), by Roger L. and Robert R. Dinelli. Bald Eagle Enterprises, San Francisco, CA: 1992. $17.95, 202 pp*

The *Boater's Guide* is an indispensable tool for California boaters and potential boaters. It provides a wealth of information on many marinas in San Francisco Bay, in the delta, along the California coast, and even includes one in Hawaii. The authors tried to choose those that were most accessible and welcomed both power and sail boaters.

The 8 x 11-inch guide has maps of marina location and layout, detailing the location of guest docks, fuel docks, restrooms and showers, harbor office, telephones, on-site restaurants, launch ramps, and haul-out facilities. This type of information is particularly valuable when trouble occurs, such as when you are very low on fuel and need to know how to get to the nearest fuel dock. For each marina, the book lists address, phone number, office hours, facilities available, berth and launch charges, depth and tide correction, and other services in the area, such as groceries, restaurants, laundromats, post offices, and much more. Information on yacht clubs at the marinas is also included.

The format is well thought out and user friendly. For each marina the map and information are on facing pages and lie flat because of the spiral binder. The guide is available at many chandleries and some marinas. If you cannot find a copy call Bob Dinelli at (415) 826-8905.

Reviewed by Ron Kukulka, Deputy Executive Officer of the Conservancy, an avid sailor and wharf rat.

Now Available

Lessons from the States: Strengthening Land Conservation Programs through Grants to Nonprofit Land Trusts, *by Phyllis Myers. Land Trust Alliance, Washington, D.C., 1992, $19.00, 71 pp*

Public funds are scarce these days. That's why more states are working with nonprofit land trusts to stretch limited public dollars available for acquiring conservation lands. *Lessons From the States* tells how 13 state agencies do just that—and how California's State Coastal Conservancy is the "grandaddy" of all of these public/private programs.

The book starts with a background of the land trust movement, which has grown from 400 groups to 1,000 nationwide in the past ten years. A four-page matrix summarizes the state programs, including contact names and numbers. The next section four case studies—is the most lively, and features a chapter on the Coastal Conservancy entitled "Doing Whatever Works." The final third of the book presents findings from case studies, analyzing the programs' structures and key issues. It concludes with recommendations for putting new state/nonprofit partnerships in place.

To order, send $19.00 to Land Trust Alliance, 900 17th St., NW, Suite 410, Washington, D.C. 20006, or call (202) 785-1410.

The Coast Miwok Indians of the Point Reyes Area, *by Sylvia Barker Thalman. Point Reyes National Seashore Association, Point Reyes, CA, 1993, $6.00, 40 pp*

Out for a jaunt among the wildflowers? Contemplate this: the Miwok marked the end of spring with the Seed Day Dance.

The headwoman, or maayen, called for this dance when she saw the flowers dropping. Flowers were hung outside the dancehouse, and if the weather was good, three men and three women danced outside in a brush enclosure. All wore pelican skins. To learn more about the ways of this peaceful people, order *The Coast Miwok Indians* from MAPOM, 2255 Las Gallinas, San Rafael, CA 94903. Enclose $7.70.

Ambivalent on Aquaculture

Editor:

I have noted the articles on California aquaculture in your 1992 summer and fall issues. About five years ago, the California aquaculture industry was challenged by the Department of Fish and Game to develop hatcheries to produce fine-quality striped bass for state mitigation programs on the Sacramento-San Joaquin delta. The industry responded by developing private hatcheries and shipping high-quality striped bass to the delta for a number of years, only to have Fish and Game "suspend" the program in 1992, devastating our striped bass farmers. (It stopped planting bass because the bass were eating baby salmon.)

Fish and Game is currently considering building a new salmon hatchery for the San Joaquin River system. The price tag for the construction alone is $20 million to $30 million. Private aquaculture has facilities that can produce high-quality trout and salmon fingerlings and smolts. It can play a strong role in producing fish for any such mitigation effort, saving the state millions of unnecessary construction dollars and operational costs.

Fish and Game has praised "the job private aquaculture accomplished in the striped bass program" and further stated that it is "currently assessing the potential for a greater contribution from private aquaculture in the planting of fish throughout the state."

The words are reassuring. However, some of Fish and Game's current activities seem to be heading in an opposite direction.

H. Roy Gordon, Chairman,
California Aquaculture Association

More Trouble With Tuna

Editor:

As the manager of a U.S. flag purse seiner, fishing in the Eastern Tropical Pacific's yellowfin fishery, I was impressed by the insightful and balanced reporting in Mick Kronman's article, "The Trouble With Tuna," in the fall 1992 issue. However, the information given about the passage of the International Dolphin Conservation Act was incorrect. A five-year moratorium on fishing in association with dolphin in the ETP will be imposed on the U.S. fleet starting March 1994 only if Mexico or Venezuela signs on to the moratorium idea. Both nations have rejected the moratorium in favor of the "La Jolla Agreement," a true multilateral agreement that protects dolphins, tuna, sharks, billfish, other species of fish, and the ecology of the ETP. It has been signed by 13 countries and recognizes that people have a place in this ocean, too.

Teresa Platt, Vice President
Kozpla Fishing Corp., La Jolla

Editor's Note: We regret the error, which occurred during production.

Eat Plants Instead

Editor:

As a physician who treats heart disease, diabetes, cancer, and osteoporosis eight hours a day, I was very disappointed in one part of your fall 1992 article on Morro Bay. Overall, it was an excellent article. I liked reading about watershed management to prevent coastal runoff pollution. However, I was disturbed by the flippant discussion of cattle grazing as a good use of the land.

The high-fat, high-protein, flesh-based diet is destroying our nation's health. The chronic diseases caused by the cattle-centered diet are driving our nation's health care costs out of control. Over-grazing, methane gas production, and manure in our streams, rivers, and coastal waters are three more reasons why cattle raising is not a good use of our land. It is true that fruit, vegetable, and grain production may have negative environmental impacts, but at least they have no negative health impacts.

Gordon LaBedz
Seal Beach

Coast & Ocean Index Available

If you would like an index to articles published in this magazine's 1989-92 issues, we can supply one. Please send a self-addressed envelope with 29 cents in stamps.

Did you do it?

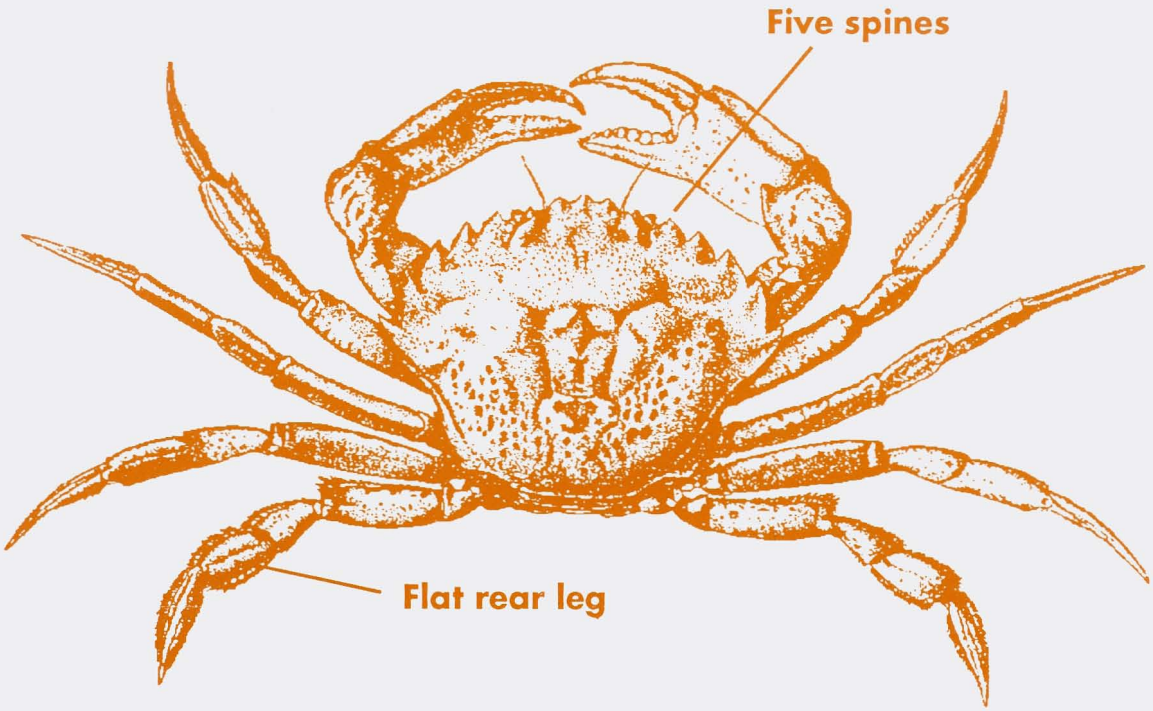
Have you filled out the reader survey and mailed it to us? Please do so today. We need the information we requested as soon as possible. Thanks. The editors.

WANTED

Have you seen this crab? Biologists are trying to map the distribution of the Atlantic green crab, which recently appeared in San Francisco Bay. If you see it, please note the date and precise location and call Andrew Cohen at (510) 848-1029, or write to him at:

The Energy and Resources Group
Building T-4
Room 100
University of California
Berkeley, CA 94705.

Then let us know at *Coast & Ocean*, and a free subscription is yours.



LAST ISSUE'S MYSTERY SOLVED:

About half of California's coast is publicly owned. Congrats to Joyce Craig and Carol Proctor for solving this one.

NELIA FOREST

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