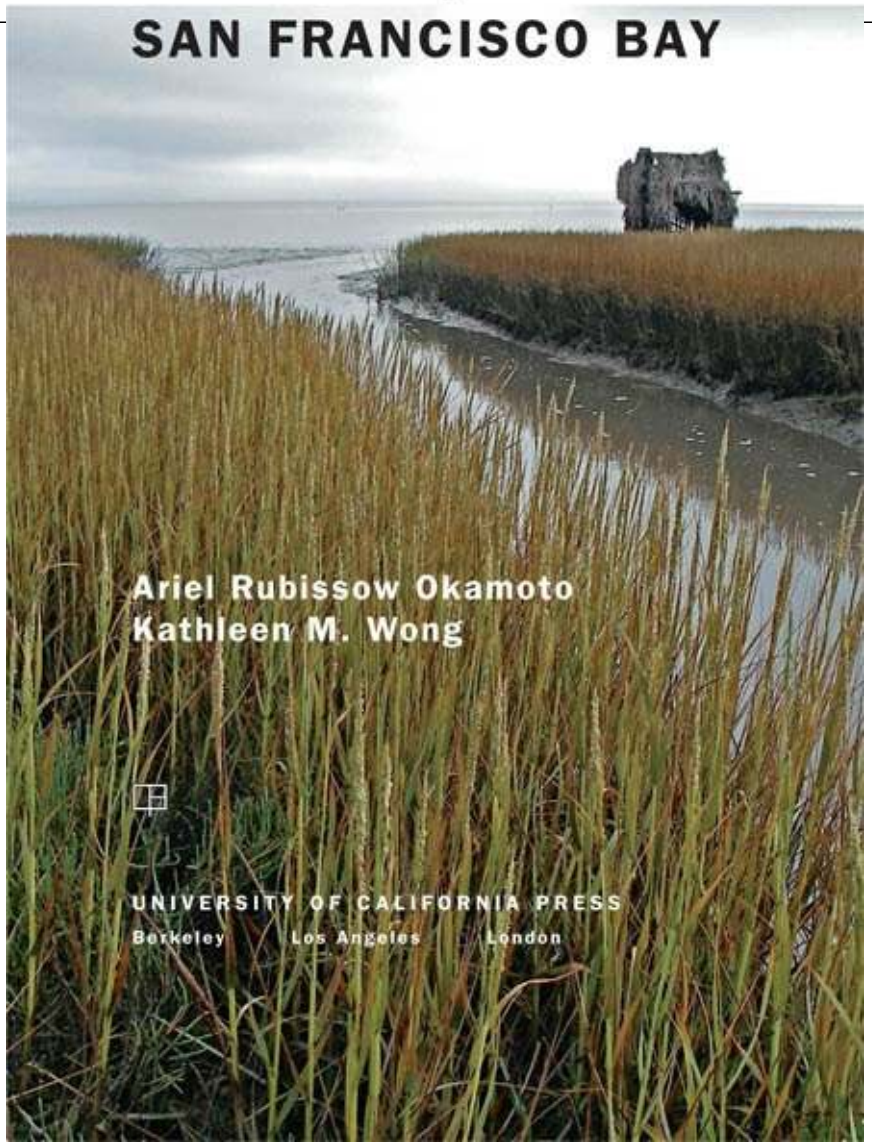
NATURAL HISTORY OF SAN FRANCISCO BAY

California Natural History Guides

Phyllis M. Faber and Bruce M. Pavlik, General Editors

Natural History of SAN FRANCISCO BAY



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off Keller Beach in Richmond (John Karachewski); left photo, container ships (Port of Oakland); middle photo, pickleweed (Kathle
M. Wong); right photo, juvenile Black-crowned Night Heron (Edward M. Nguyen).

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PROLOGUE

This book is unusual among the California Natural History Guides. It explores not only the natur history of San Francisco Bay but also its human history and how each affects the other. It may be th first in the series to describe a place so urbanized and to focus on a body of water rather than a pie of land, though land and water here are inextricably linked in their destiny.

This guide may also be the first to have so many voices in it. As a journalist who has researche and reported on water issues for over 20 years, I have come to know dozens of scientists, agenc staffers, activists, teachers, engineers, and businesspeople with a passion for the bay and its watershe By including so many quotes and memories from diverse people, I hope I've captured here th intensity with which people view the bay and the amount of energy they pour into studying understanding it, and caring for it.

Something else that may be different in this guide, in comparison to others, is the way in which explore my own particular interest in science and scientists, and the extraordinary ways in which the test their theories in a medium—water, waves, tides, mud—that is relatively challenging for humar to work in. I am personally fascinated by the lengths to which humans will go to learn, and I marvel the inventions they create to enable them to measure and track the subtle changes in the estuari environment and all that lives in it.

As I observe our millennial battle for control of nature, I am encouraged that we humans continu to seek our proper place within it. I am heartened that we can not only build a dam but also take down, as well as by the fact that we can spend hours counting weeds, sifting bay mud for tiny forms life, following a plastic drifter downriver, or trying to mimic nature so that we can better balance ou relationship with the ecosystem.

Perhaps the human race is destined to find the meaning of life on-screen, but I, for one, am all f getting hands dirty and feet wet.

Ariel Rubissow Okamoto

ACKNOWLEDGMENTS

Ariel Rubissow Okamoto

In the two decades that I have been writing about the waters that run down from the Sierra into Sa Francisco Bay and the Pacific, three people in particular helped me find my voice as an environment writer: Marcia Brockbank, Tim Ramirez, and Kim Taylor. As they worked to push the envelopes o estuarine science and ecosystem management—often within cumbersome bureaucracies steeped convoluted water politics—they remained unfailingly inspiring and supportive of my work and m voice.

Thanks also to those who have consistently helped me to think big across disciplines and see th connections: Gary Bobker, Jim Cloern, Bruce Herbold, and Phil Williams. They were critical to m being able to pull together a book of such broad scope.

I also appreciate those who always return my calls and emails, and who have made the time explain complicated science and politics to me throughout my water-writing life: Jon Burau, Ja Davis, Kathy Heib, Rainer Hoenicke, Jim Kuwabara, Wim Kimmerer, Sam Luoma, Peggy Olofso Steve Ritchie, Dave Schoellhamer, Stuart Siegel, Tina Swanson, Jan Thompson, and Will Travis.

In addition, much of my work over the last few decades has involved writing documents conveyin the work of government science to stakeholders and the interested public. I drew heavily in this boo on my earlier work on the annual San Francisco Estuary Project *State of the Estuary* reports, th project's *ESTUARY* newsletter, and CALFED *Science Action* publications. I also found invaluab such bibles as Andy Cohen's *An Introduction to the San Francisco Estuary*, The Bay Institute's *Fro the Sierra to the Sea* report, the *Baylands Ecosystem Habitat Goals* report and *Species Profiles*, an the annual *Pulse of the Estuary* from the San Francisco Estuary Institute. To remind me how to tell good bay story, I used Harold Gilliam's *San Francisco Bay*. And I will always be grateful to m professor, Annie Dillard, who told me I was no good, which made me work to prove her wrong.

Thanks also to my wonderful cowriter, Kathleen Wong, and the other writers who helped m complete the book: Cariad Hayes, Lisa Owens Viani, and Susan Zakin.

Particular thanks to everyone whom I interviewed for the book (see the References); to those wh read the book back to front for me: Bruce Herbold, Rainer Hoenicke, Jim McGrath, and Peter Moyl and to my editors, Phyllis Faber and Jenny Wapner, for engaging me in such a unique project. I als was enchanted by how the book communicated a whole new level of information about the bay via th wonderful photography donated by Max Eissler, Francis Parchaso, and Jude Stalker, among others.

Special thanks to the Bay Area Clean Water Agencies for providing critical gap funding for th book's production. BACWA is a joint powers agency whose members own and operate municipa sewer systems in the nine county San Francisco Bay Area. BACWA and its members are publi agencies governed by elected officials and managed by professionals charged with and committed protecting public health and the San Francisco Bay environment.

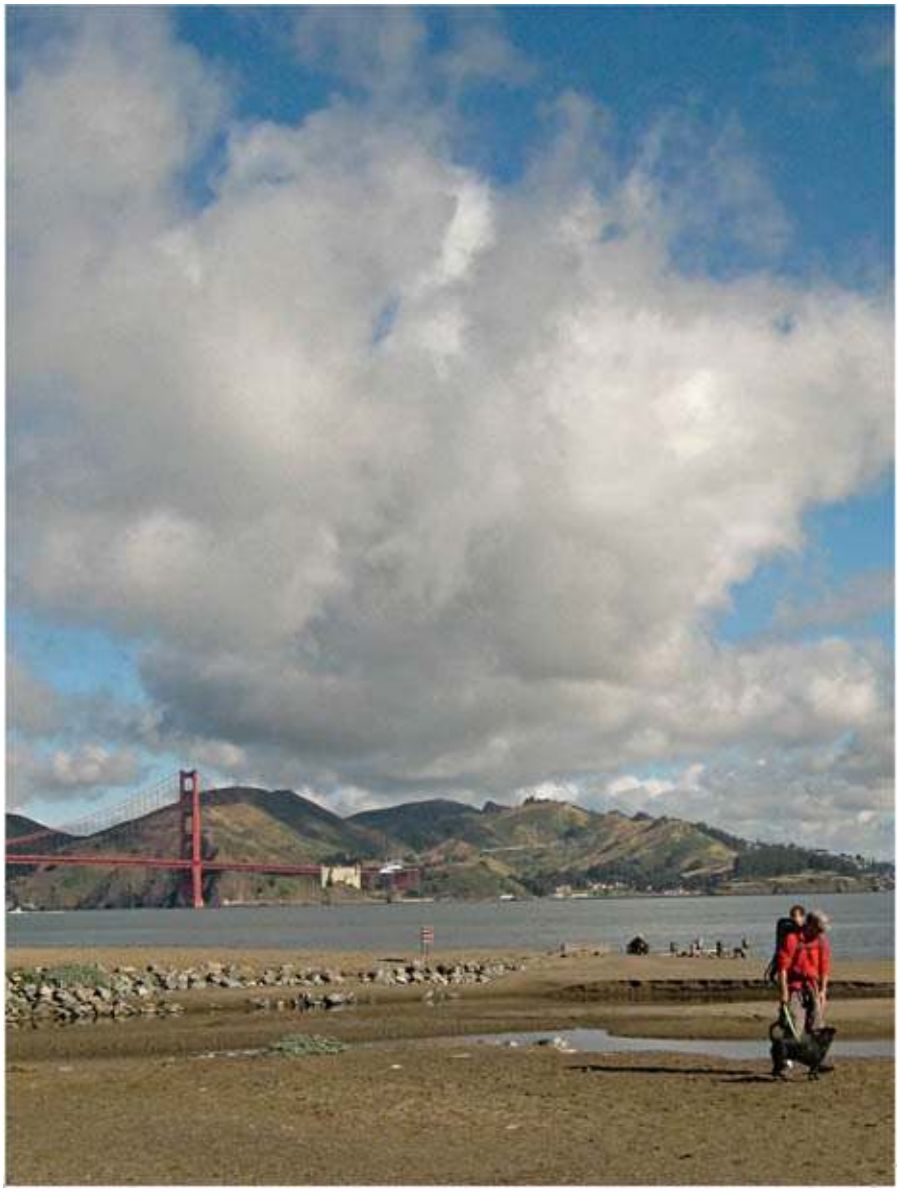
Last, I could not have written this book without the faith and love of my family—Paul, Tira, Mikk and my mother, Joyce Carlyle. Thank you for sticking with me through my werewolf moments.

Kathleen M. Wong

First and foremost, I am indebted to my coauthor, Ariel Rubissow Okamoto, for making my long standing dream to write a book come true. Her strong relationships with bay scientists and broa knowledge of California water issues have shaped my reporting and sparked a whole new appreciatio for the wonders of the bay.

I am also grateful to the many researchers, engineers, activists, and photographers I interviewed f this book. They were generous with their time and professional expertise. In particular, I would like t thank Peter Baye, Laurel Collins, Robin Grossinger, John Largier, Marilyn Latta, Jeff Miller, Tim Ramirez, Christopher Richard, and Sarah Warnock.

The one I have leaned upon most during this journey, however, is my husband, Max Eissler. H enthusiasm for exploring strange corners of the bay and his zeal to capture better photos for the boo never waned. I couldn't ask for a better companion in life or love.



One day when I was at the 1939 World's Fair I watched the sun going down from Treasure Island, reflected in all the windows in Berkeley and Oakland, a blaze of fire over there. The Bay Bridge was new at that time, and I looked up at this bridge in the sky, and the bay reflecting the sunset light, and I thought, "Wow, what a place, I've got to live here someday."

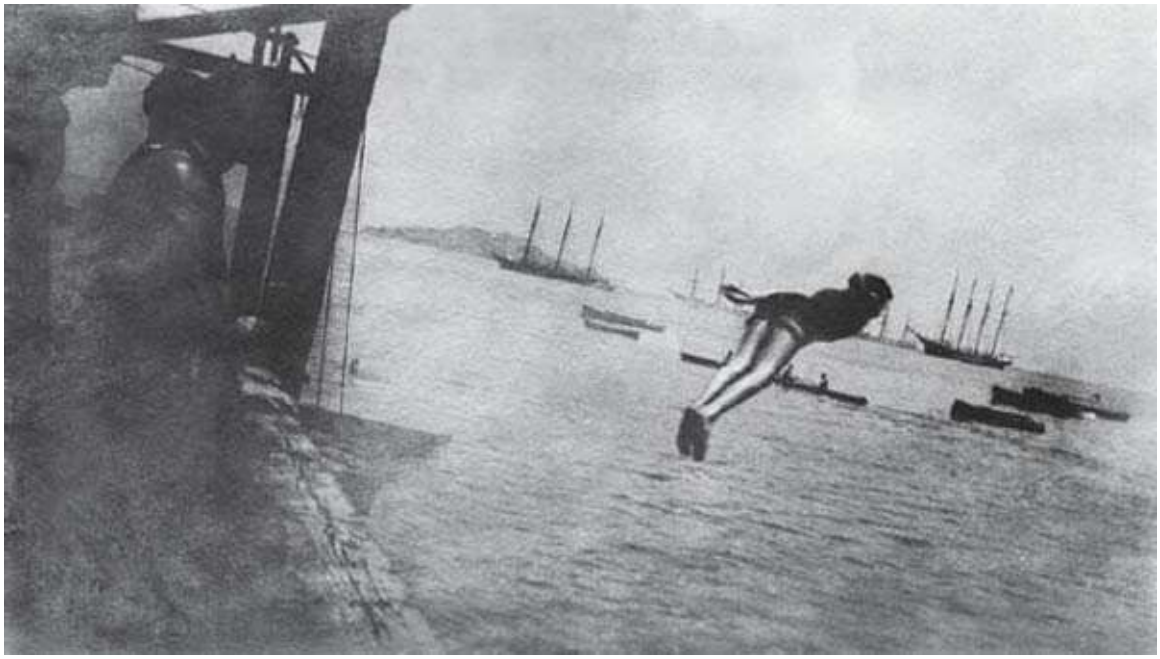
HAROLD GILLIAM, JOURNALIST & WRITER

EMMA MACCHIARINI SWAM before she walked. On the morning of July 12, 1989, she got up earl dressed in a sparkly swimsuit with a pink bow, smeared herself with Vaseline, and stepped into th bay. Swimming from Fort Point under the southern tower of the Golden Gate Bridge to Lime Point o the opposite shore, she aimed to cross a coastal opening where currents surge with all the force of a entire ocean on one side and the state's mightiest rivers on the other. She recalls thinking while in th water that they'd got the tides all wrong. The swim was much more work, and took much longer, tha she'd imagined.

At one point during her swim, Emma feared she wasn't going to make it. But she kept lifting h arms and kicking her feet in the freezing grey water, accompanied by her father swimming beside h and her mother paddling a boogie board. At another point, a container ship cut across her path, and th two bar pilots shadowing her in a Zodiac signaled wildly to both the towering vessel and the slip of girl to watch out. Eventually she was able to see the beach ahead, but never seemed to get there. The she remembers her father saying, "Stand up, Emma," as she found her footing on the Marin Coun shore.

The headline in the *San Francisco Chronicle* the next day read: "Girl, 8, Conquers Gate." Th black-and-white photo hid the green algae on her face. Macchiarini was one of the youngest peop ever to swim the mile-wide channel under the red bridge. She got fan mail, and television coverage her feat.

On that foggy day decades ago, Macchiarini swam across the deepest part of San Francisco Ba where the bottom lies 330 feet below sea level. But most of the bay, which encompasses 470 squa miles of open water between the narrows of the Golden Gate and the Carquinez Strait, is less than feet deep. From one end to the other, the bay is about 42 miles in length and ranges from 5 to 13 mil in width. Before radar and sonar, ships regularly hit the fog-obscured rocks at its entrance. And gol seekers abandoned so many vessels off the tiny town of San Francisco that new residents built right top of them. These opportunists became the first in a long line of Bay fillers who saw more doll signs along the waterfront than up in the mother lode.



Girl dives into the bay in the early 1900s. (Courtesy of The Dolphin Club, Shirley Coleman Collection)

Today, 7 million people live on the shores and hills surrounding San Francisco Bay. Around th

extraordinary natural harbor, they and their predecessors have built 46 cities, 6 ports, 4 airports, ar 275 marinas, not to mention myriad industrial centers, oil refineries, and military bases. They hav also set aside miles of bayshore for recreation and wildlife in the form of 135 parks, refuges, ar reserves.

To locals, the bay is a breathing space, a blue prairie of water outside their windows and besid their communities. To tourists, it's the water under the Golden Gate Bridge, the rippling backdrop t one of the engineering marvels of the West.

An Ever-Changing Environment

San Francisco Bay is an estuary where rivers draining 40 percent of California's landscape meet ar mix with the Pacific Ocean; where coastal and inland ecosystems overlap; where seabirds ar songbirds ply the skies; where sharks swim with sardines; and where species both native and alie compete for space and food alongside some equally competitive primates.

Here at the edge of the North American continent, cool ocean water and air encounter their warm inland counterparts, shaping an environment in constant flux. One minute the sun may blaze dow from above, whereas the next is wet with fog drip. Tides coming in may suddenly go out; wave train may collide, encountering a shifting breeze or a change of current; and brown plumes of sedimen laden fresh water from the rivers upstream may dissolve into the bluer bay just west of the Carquin Bridge or drive a muddy arrow through the Golden Gate and out to the Farallon Islands.

In this coastal zone, the continental and oceanic plates of the planet can shift against one another any moment, sending a bridge or levee collapsing into the water. It can grow hot and dry enough fo fire to consume most of Angel Island in one night, and cold enough for snow to stick on Mou Tamalpais. El Niño and La Niña rearrange the water layers every two to seven years, and every fe decades the whole North Pacific experiences a change so profound that entirely different types of fis take up residence in the bay.

A scientist samples a square meter of the estuary for invasive plants. White plastic quadrats provide measuring tools for diver organisms and bay conditions. Some of the longest standing records of bay conditions reside with the U.S. Geological Survey, whi set up the very first tide gauge at the Golden Gate more than 100 years ago. (Francis Parchaso)

"The bay is not a static thing," says aquatic ecologist Jim Cloern of the U.S. Geological Surve Cloern had been studying the bay for over 20 years when he saw plankton growing in places and times they had never been seen before. His state colleagues surveying fish began pulling in more so than halibut and seeing unusual surges in bottom-dwellers. "In terms of these biological communitie it's almost like the bay flipped from one state to another state. Ecologists call these 'regime shifts' 'crossing a threshold,' " he says.

To survive in such a changeable place, local fish and wildlife must be unusually resilient—able endure winter floods and summer droughts, as well as times of scarce food between times of plent Lately, however, more than a few species have been having a tough time adapting to the mo dramatic changes of all: the arrival of people. During the past 150 years, entrepreneurs and enginee have straightened rivers, culverted creeks, drained marshes, and paved coastlines. They have al rerouted the flow of water from land to sea, directing the lion's share into reservoirs, faucets, ar irrigation pipes.

"We have plumbed more of our system and diverted more of our fresh water for longer tha anyone, anywhere, on the West Coast," says the U.S. Geological Survey's Jan Thompson. Thoug Thompson has spent most of the last two decades studying an alien clam decimating the bay food we she remains optimistic. "What better system to prove that you can turn something around than o that has been so manipulated, and one we can still manipulate?"

TABLE 1. San Francisco Bay through History

	1700	TODAY
Bay surface area	~800	~580 square miles
Bay Area human population	10,000	8 million
Tidal marsh	190,000	45,000 acres
Freshwater flows through Bay	~30	~20 million acre-feet/year
Salmon returning to spawn	>2 million	<150,000 (only 1/5 wild origin)
Spring shorebird count	millions	hundreds of thousands

Sources: Data from Bay Conservation and Development Commission; Margolin 1978; *Habitat Goals*; Department of Water Resources; California Department of Fish and Game.

Saving the Bay

Californians are as changeable as the bay itself. Many come to the Golden State expressly to escap their former lives or to experience something new. People arrive ready to fight for a dream, wheth gold or freedom or tolerance or redwood trees. And one of the dreams they've fought hardest for is healthy bay.

By the 1950s, the bay was more stinky and ugly than healthy. For years, locals had been dumpin their garbage at shoreline landfills, draining their sewage into creeks and tidelands, and banishin their industries, refineries, and canneries to the waterfront. Fish kills, oil spills, and bay fills—th dumping of dirt into the shallows to create new real estate—were considered a normal part of doin business. The shore was not a place to go for recreation and exercise, as it is for many Bay Are residents today, but a place to avoid.

In 1961, Berkeley's plan to fill several thousand acres of the bay lit a fire under three of i residents. Kay Kerr, Esther Gulick, and Sylvia McLaughlin could see the muddying of the waters an the changes to the shore from their living room windows up in the hills. Investigating the matter, th women heard city council members discussing the removal of all of the coves to achieve tid waterfronts, and saw an Army Corps of Engineers map in which the wide waters of the bay had bee confined to a narrow channel in the name of progress. The women sent a flyer out to a thousan neighbors and fellow citizens, emblazoned with the words, "Bay or River?" The response w disbelief.

"[Most local citizens] thought the bay belonged to everybody," one of the women, the elega Esther Gulick, recalled in a 1987 oral history. "Then, when they found out that a good part of it alon the edge belonged to corporations like Sante Fe [railroad], they just couldn't believe it, and the couldn't do enough . . . to help."

The women proved adept at channeling citizens' outrage through a new organization they founde called the Save San Francisco Bay Association. That first flyer garnered about 2,500 memberships $1 a piece—the founders wanted saving the bay to be affordable. By 1970 they had 18,000 membe and activist cells in the East Bay, on the peninsula, and in Marin. Known today as Save the Bay, th group was one of the first citizens' organizations formed to save a body of water rather than a ra bird or pretty canyon. With a lot of persuasion and considerable political clout, the association soo legislated stewardship of the bay through the creation of the San Francisco Bay Conservation an Development Commission (BCDC)—a first in regional governance.

Over the years, many other Bay Area residents have taken up that torch, working to protect th wetlands, clean the water, cap the landfills, and preserve the salmon. Today, more than 20 environmental groups have their headquarters in the San Francisco Bay Area; many focus in some wa on the health of the bay. Natural resource managers arriving here from jobs in other parts of th country are always amazed at the forest of hands raised, number of speeches made, and degree passion expressed at public meetings.

Fishers on a shore of concrete riprap. (Max Eissler)

OWNERSHIP & GOVERNANCE

- The state was granted ownership of San Francisco Bay, as well as "swamp and overflowed lands" throughout the estuary and delta, in the early 1850s. Since then, the state has granted roughly half the lands in the Central and South bays to local municipalities.
- State records of historic sales suggest that more than 200,000 acres of baylands, floodplain, beach and water lots in the Bay Area may have been sold to other public and private landowners. No specific estimates of total acreage in private ownership are available.
- Nine counties and 46 cities extend underwater into the bay.
- Agencies with regulatory authority to manage land and water uses of the bay include the San Francisco Bay Conservation and Development Commission and the State Lands Commission.
- Other agencies involved in bay shoreline land-use planning include the California Coastal Conservancy and the Association of Bay Area Governments.
- The bay's environmental quality is protected and overseen by the San Francisco Bay Regional Water Quality Control Board, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, and the National Marine Fisheries Service, among others.

"The [Bay Area] contains a fortuitous assemblage of citizens with a special culture and style

life, a special environmental awareness and appreciation. There is a heady mixture of internation cosmopolitanism, of varied shorelines with the flavor of ships and water, of the free spirit of th frontier, and of youthful and harmonious living," wrote Rice Odell in a 1972 Conservation Foundatio booklet about saving the bay. His words are every bit as valid today.

Inside and Out

Most people living in the 46 cities that ring the bay know a nearby place for a bayside barbecue, Sunday stroll through the marshes, an afternoon fishing expedition, or a salty swim. Many run ar pedal the trails now gracing the levee-tops and waterfronts, or take their city dogs to romp along th wide open spaces of a bay beach.

SITTIN' ON THE DOCK OF THE BAY

Soul singer Otis Redding and guitarist Steve Cropper wrote what has become the bay's signature song, and Redding's best-selling album, in the late 1960s. Redding came up with the first line—"I watch the ships come in and I watch them roll away again"— while staying in a houseboat on the Sausalito waterfront. On radio station playlists ever since, the song strikes a familiar chord fo most Bay Area residents.

But the bay attracts more than those in search of exercise or family time. People leap from th Golden Gate in their hour of despair, or sip champagne on a bay cruise in their hour of celebratio Blue Angels zoom over the bay during Fleet Week, fireworks burst over the water on the Fourth o July, and fireboats spew fountains into a crowd of sailboats during April's Opening Day on the Bay.

Equally riveting can be the natural wonders that appear on San Francisco's watery doorstep. 1985, a 36-ton Humpback Whale dubbed "Humphrey" wandered delta waterways for over a month. took a flotilla of boats banging on steel pipes to make enough noise—a Japanese fishing techniqu known as *oikami*—to drive him back to sea. In May 2007, the Sacramento River once again beckone to whales, this time an injured mother and her calf.

Avocets showing off the orange plumage of breeding season. (Robert M. Chilvers)

Central Bay kiteboarders. (Max Eissler)

Signs of nature abound in the bay for those ready to see them. Most locals have admired flocks
ducks paddling air as they lift off the water and the glistening domes of seal heads noodling offshor
Tourists come to marvel at the sea lion colony lolling on San Francisco's Pier 39 and to visit th
Aquarium of the Bay. Here, a walk through an underwater tube reveals the Armored Sturgeon, Skew
eyed Halibut, and flashing schools of herring that live below the bay's blue surface. In the region

shoreline parks, visitors can see curlews and peeps poke their beaks into the mud for goodies, an pelicans and terns dive-bomb for fish.

Of course there are many more up-close and personal ways to experience the bay. Emm Macchiarini's father belongs to the South End Rowing Club, one of several thousand residents wh have joined open water swimming clubs in San Francisco. Just as many enjoy catching bay waves an winds with kiteboards, ketches, catamarans, and boogie boards, or indulging in the age-old pastime fishing.

Jim McGrath races formula boards, the latest and lightest type of windsurfing rig. In a good ra under the right conditions, this retired port environmental manager can skim from Berkeley to Sa Francisco and back again in an hour and a half. He has raced in the confines of Washington Columbia River and through what he calls the "organized" waves off Hawaii, as well as in the b warm swells off Florida. To him, the bay is rougher, bigger, more unpredictable than those locale Experienced though he is, McGrath has lost his gear and had to be rescued more than once from ba waters.

Anthony Mirkovich likes working in an urban fishery. "You can eat a fancy lunch in the be restaurant on the Wharf and be out fishing that night," he says. Mirkovich fishes for herring in th bay, helps a friend crab outside the Golden Gate, and heads to Alaska for salmon. Doing all three job is the only way to make a living fishing on this coast now, he says. Yet in the 1900s, every Bay tow had a fisherman's wharf, and every other a sardine cannery; the shallows grew oysters, and the cove teemed with shrimp.

Mirkovich's grandfather used to fish out of Seattle, but Anthony didn't inherit his boat and gea from family. His pride and joy is a 32-foot bow-picker called the *Masterpiece*—a herring boat. Mo years the herring fleet is not allowed to bring in more than a few thousand tons of the tiny, silvery ba fish. It's a quota set by the state to protect the fishery. In 2007, Mirkovich brought in 72 tons, his mo recent big catch.

Mirkovich started fishing when he was 12 years old, when 130 herring boats worked the ba Today, the local fleet numbers around 30. But the handful of guys Mirkovich fishes and barbecue with all help each other out, and he enjoys the camaraderie. "In the early morning, there's the smell diesel on the docks, with the boats warming up, the guys slinging gear back and forth, seagulls cawin radio chatter. That's when bay fishing comes alive," he says.

Herring fishery research vessel tied up on San Francisco's Embarcadero. Seagulls often follow fishing expeditions looking for ea pickings. (Ryan Bartling)

Apart from the last few fishermen, some residents still know the ways of the bay with the intima of the past, when more of the local populace relied on the bay for food, transport, and a living. B pilots guide the wallowing tankers and top-heavy container ships in and out of the Golden Gat Miners claw and suck sand from the bay bottom to fill freeway beds, and dredgers do the same to kee shipping lanes and port berths safe for marine navigation. Ferry operators still zip to and fro in bus white boats, powered by the jet engines that have replaced the early paddlewheels. Their wake is s powerful it sometimes erodes the mud from bayshore marshes. Engineers still make salt by trappi sheets of bay water in the sun. And builders still negotiate with the shifting elements to raise bridg and anchor waterfront seafood joints over and around the water.

But most people only cross the bay or admire it from afar. They may not know the bay intimatel but its bridges and freeways keep them apprised of its moods and colors. Almost everyone smiles the sight.

"The bay gives our region its name and creates a sense of place which defines the communi where we live," says Will Travis, 20-year leader of BCDC, the government agency in charge preserving this watery regional treasure. "The bay is our Eiffel Tower, our El Capitan, our Big Ben. is a visual icon which gives our region its identity as a place different from everywhere else."

But to all those who live or visit here, perhaps the most amazing quality of the bay is its proximit "To me, the bay is direct access to wild nature—unmanaged, unmanicured nature," says swimm Emma Macchiarini.