Restoration

BAY WATCH

One year ago a major oil spill in San Francisco Bay marked the latest insult to a waterway already reeling from 150 years of degradation. But one of the most ambitious projects of its kind in the world continues to lift hopes for the bay's renewal, even among die-hard skeptics.

BY JANE BRAXTON LITTLE/PHOTOGRAPHY BY BROWN W. CANNON III

Brooke Langston, director of the Richardson Bay Audubon Center & Sanctuary, is flanked by ecologist Suzanne Olyarnik and researcher Lara Martin in front of a seine used for research. Opposite center: The sanctuary's historic Lyford House affords panoramic views of San Francisco and the Bay Bridge.

Dawn was just breaking over a pillow of pale gray clouds as Brooke Langston began prowling the Richardson Bay beach north of California's Golden Gate Bridge. Spotting an oddly blackened bird, she clambered through knee-deep mud until she was close enough to pop a net over the hapless creature—a surf scoter. Its distinctive orange-and-red bill poked out from a mess of oily feathers. Langston beamed as she moved the struggling scoter into a cardboard box for transport to a wildlife hospital: one small success in the midst of an ecological disaster.

On hundreds of miles of beaches and mudflats around San Francisco Bay, scientists and trained volunteers were duplicating Langston's early morning drill in the grim days a year ago following November 7, when a 900-foot containership smacked into the Bay Bridge, which connects San Francisco and Oakland. The 58,000 gallons of heavy fuel oil that spilled into the bay coated thousands of shorebirds and waterfowl, many of them just migrating in for the winter.

"It's heartbreaking to see birds struggling so—to have them look you in the eye and know their instincts are all about escaping," says Langston, director of the Richardson Bay Audubon Center & Sanctuary, near the town of Tiburon. Her elation over carrying the surf scoter to safety faded quickly. Most likely it died, she believes. Birds healthy enough to move generally escaped her net. She was able to catch only the sickest ones. "You can stand back and be a scientist, but when it's your turn to get a bird from the beach to the hospital, it's hard to stay objective. They are just so sad."

Furor over the November oil spill spurred thousands of Bay Area residents to donate time, money, and materials to the cleanup effort. For many of them this is depressingly familiar territory—the latest insult to San Francisco Bay. In one of the nation's most environmentally conscious regions, the public response to any assault on the bay is deeply personal. This catastrophe galvanized a collective commitment to redouble the effort already under way to restore the open waters and wetlands that are for many people their front yard, backyard, playground, and spiritual center. "It doesn't matter if you're a windsurfer or someone who lives miles away," says David Lewis, executive director of Save the Bay, the region's first organization dedicated to protecting the bay. "The bay occupies that special place in our self-identity. It's central to who we are."

> "Before the spill we were the weird bay and bird people who carried buckets of fish up the sidewalk. Now we're the people who go out on boats and look for birds and take care of them."

MAP BY MIKE REAGAN

Restoring San Francisco Bay was a daunting task even before the containership spilled its fuel oil. This is the largest and most ecologically important estuary on the U.S. Pacific Coast. In 1769, when Europeans first arrived in the bay, it was brimming with sandy beaches and wetlands. Salmon, sturgeon, and sea and river otters swam in its waters, and whales were a common sight. Snowy plovers nested on sandy beaches and salt flats, and the air was alive with California least terns, cormorants, and long lines of pelicans.

It all began to unravel as new settlers diked and drained wetlands for farmland and salt production. When hydraulic miners in the Sierra Nevada turned high-pressure water cannons onto mountainsides in their crazed quest for gold, they washed billions of tons of sediment downstream, smothering the bay in silt. Over the next 150 years California immigrants and entrepreneurs destroyed more than 500,000 acres of wetlands in the bay and delta. Developers filled them, farmers diked them, salt companies mined them, and everyone dumped into them. By the 1950s less than a quarter of the original tidal lands remained.

The devastation couldn't continue without protest—not in a place that would spawn the free speech movement, People's Park, and flower children. When the residents of the San Francisco area realized the bay itself was on the brink of extinction, they refused to let it go. The spark that lit the public fire was a 1960 map drawn up by the U.S. Army Corps of Engineers showing San Francisco Bay in 2020 as a narrow channel surrounded by development on filled land. Irate citizens mailed legislators sacks of sand with a ditty: "You'll wonder where the water went—if you fill the bay with sediment."

Their tactics worked. In 1965 the California legislature created the San Francisco Bay Conservation and Development Commission, the first body in the world established specifically to protect coastal waters, including wetlands. Since then the movement to bring back the bay has inspired the entire San Francisco region. Here, in the heart of one of the nation's larg-

Contributing editor **Jane Braxton Little***'s most recent* Audubon *story was "Pedaling for the Planet," in the March-April issue.*

The research team straightens out the seine used to collect bay creatures. The team compares life inside and outside of the bay's eelgrass beds.

est metropolitan areas, an alliance of scientists, public agencies, nonprofit organizations, and citizens' groups has launched the most ambitious restoration on the Pacific Coast. Their goal is to reestablish native habitat, from the salt-encrusted ponds south of San Francisco to the oak-studded hillsides as far north as Petaluma—in all, an area five times the size of Manhattan. And they aren't stopping at the water's surface. Encouraged by citizen groups, scientists representing seven different agencies are gathering information to restore more than 500 square miles of habitat beneath the briny bay.

"This is the biggest, most important tidal estuary on the West Coast. As degraded as it is, we still get millions of birds. If we do this right, we'll get millions more," says Sam Schuchat, executive officer with the Coastal Conservancy, a state agency charged with protecting and improving public access to the California coastline.

The restoration projects range from a 300-acre hayfield on Sonoma Bay to 80,000 acres of baylands. Thousands of volunteers spend weekdays and weekends in kayaks counting birds and planting coyote bush and sea lavender. Some work with the Coastal Conservancy to eradicate nonnative species of spartina, invasive plants that threaten to displace the native marsh habitat of the endangered California clapper rail and the saltmarsh harvest mouse.

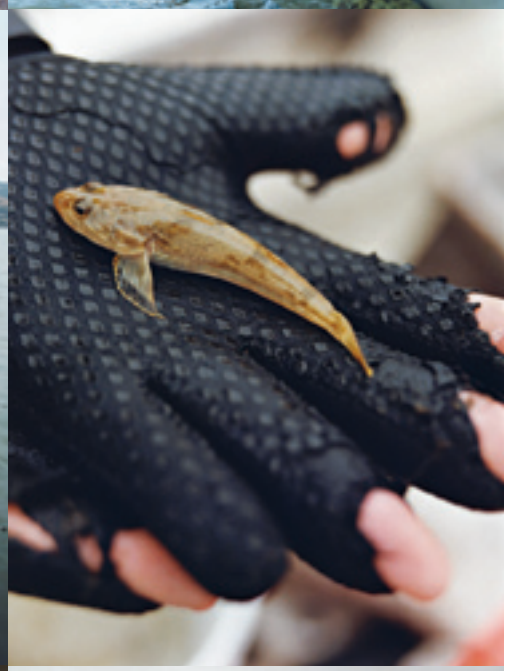
At Hamilton Airfield in Marin County, several agencies are restoring 988 acres of former runway and Army property to a natural tidal wetland. The first step is raising the ground level using seven million cubic yards of spoils being dredged from the Oakland Harbor shipping channel. The plan for Hamilton is to let bay waters flow back to form tidal marsh mudflats and submerged areas for worms and crustaceans as well as longfin smelt and birds, including the San Pablo song sparrow and the salt marsh common yellowthroat, both species of concern to state officials.

Farther east, another agency partnership is restoring more than 9,000 acres of salt-marsh habitat that has become dangerously saline. The idea is for the bay water to flush the hypersaline ponds to make them suitable for delta smelt, Dungeness crabs, and Chinook salmon.

The biggest project involves 15,100 acres of salt ponds in the South Bay, near Palo Alto. Owned until 2003 by Cargill Salt, a division of the agribusiness giant, a section of the area became part of the Don Edwards National Wildlife Refuge through a $100 million public acquisition. Over the course of the century that these former tidal marshes were exploited for commercial salt production, several salt-loving species adopted them. One of the challenges is to restore the native mudflats and marshes for clapper rails and



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saltmarsh harvest mice without eliminating the more saline areas that have become habitat and storm shelter protection for western sandpipers and several other species of shorebird.

At Richardson Bay, a 900-acre arm of San Francisco Bay managed as a sanctuary by Audubon California, efforts center on eelgrass and native oysters; both are fundamental to the health of estuaries worldwide. Oysters feed on plankton and literally clean up the waters where they live by filtering an astonishing 12 gallons a day per oyster. Like coral reefs, healthy oyster reefs shelter young sea life and protect shorelines. Eelgrass beds are one of the planet's most productive ecosystems, supporting a multitude of life that includes invertebrates and more than 20 species of commercially valuable fish. The plants, rooted in the muddy bottom, create a food chain that connects to shorebirds and marine mammals. The eelgrass filters nutrients and stabilizes coastlines as well.

At high tide on a calm morning three months before the spill, Langston heads out into Richardson Bay's shallow waters in Audubon's 17-foot whaler. Lithe and agile, her brown hair pulled into a ponytail, she is balanced in the bow gripping a boathook like a harpoon at the ready. I watch as a bobbing beige float comes into range off the starboard side. Langston lunges, hooking a rope beneath the buoy. Together we haul up a wire-mesh fish pot the size of a steamer trunk dripping with briny water. Mud and bay slime slosh onto our black rubber bib overalls as a fleet of crabs tumble out of the fish pot and scuttle across the boat's slick bottom.

The fish pot is teeming with life: small shrimp, sea squirts, and the plantlike strings of tiny tentacled hydrozoa. A ginger-colored tunicate the size of a cherry spits out a thin line of liquid at my touch; a bay pipefish flashes iridescent. From her post beside the dripping cage, Langston chases down as many crabs as she can reach, tossing them overboard to let them get on with their lives. "Calm down," she mutters to them in an almost maternal mantra. As we motor to the next fish pot in a bed of lush eelgrass, I peer into the water, hoping to see signs of native oysters. A harbor seal pokes up a curious head and gives us a wide-eyed blink.

The fish pot survey is part of the data Audubon scientists and their partners are gathering about everything that lives in Richardson Bay, from flocks of western grebes and the occasional red phalarope to northern anchovies and the crabs, algae, and microscopic organisms that inhabit the mud. The scientists are surveying a 300-foot stretch of beach for all signs of native oysters—dead, alive, or larval. The core samples they are taking help them understand the sediments at the bay's bottom.

Langston and the scientific team are particularly interested in the mysterious relationship between eelgrass and oysters. Studies in Chesapeake Bay and the Gulf of Mexico have shown that when healthy oyster reefs improve water quality, eelgrass beds flourish, providing better underwater habitat. Scientists understand little about either local species but know they are key to the estuary ecosystems that form the base of the San Francisco Bay food chain and the more than 500 native species it supports.

Langston picks a six-foot strand of eelgrass out of the fish pot and hands it to Wendy Norden, an Audubon scientist at the boat's helm. Norden opens a swelling on the blade, exposing white pinhead-sized seeds lined up like peas in a pod. These true flowering plants are natives of shallow marine areas like this one, where tides ebb and flow over muddy bottoms. Brant geese eat eelgrass leaves reaching for sunlight just below the water's surface. Pacific herring lay their eggs on leaves deeper down; later the plants provide a protective nursery for their young. Bacteria, fungus, small animals, and decayed matter coat the dead leaves, becoming food for small invertebrates.

Ten years ago few were aware that eelgrass even grew in Richardson Bay. In fact, scientists knew of only 315 acres of eelgrass in all of San Francisco Bay. In addition, almost no one was studying these subtidal ecosystems, despite the habitat and food they provide and the role they play as the bay's kidneys.

"These waters have been hammered by pollution for so many years. People thought they were dead," says Natalie Cosentino-Manning, a marine research specialist with the National Oceanic and Atmospheric Administration.

Then in 1999 people began finding small oysters along the shoreline. Almost no one believed it at first. Scientists thought *Ostrea conchaphila,* commonly known as the Olympia oyster, had been extinct in San Francisco Bay for decades. A staple food for Ohlone Indians, oysters were once so abundant their jagged shells helped create a glistening white beach that stretched for miles along the bay shore. But after 150 years of pollution from mining sediment, industrial discharge, and raw sewage, scientists assumed the native oyster was gone.

The loss of this keystone species could have led to a crash that cascaded through the subtidal ecosystem, they say. Without the filtration oysters provided, less sunlight reached the eelgrass colonies, which, in turn, died off. Without the protection of eelgrass, the Pacific herring runs collapsed. Brant populations plummeted. Other species that once thrived in the bay's shallow waters nosedived: crabs, shrimp, invertebrates—even microscopic organisms.

Yet here in 1999 was a live oyster, and genetic tests proved it was a native. The discovery generated a rush to restore this cherished species. Audubon workers placed bags of oyster shells in Richardson Bay to attract oyster larvae in hopes they would start colonizing. Marin Rod and Gun Club enthusiasts hung strings of oyster shells over their docks, and Save the Bay volunteers suspended settling plates in five places to entice oysters to inhabit their surfaces and grow into colonies. More than 16 government agencies, nonprofits, and scientific groups mobilized to save this species about as big as a silver dollar.

During all the frenzy over oysters, scientists discovered more eelgrass—10 times more than they originally thought existed. It marked another eureka moment on par with finding a native oyster, says Cosentino-Manning. Suddenly, restoring native *Zostera marina* became a scientific cause célèbre equal to oyster restoration because of the sheer value of eelgrass beds. Scientists are now studying whether flourishing eelgrass colonies in other estuaries are

Center: Deploying the 20-foot-long seine. Clockwise from top left: Fish pots, which show the quantity and diversity of bay species, have buoys for easy retrieval; native oysters grow on nonnative shells put in the water and taken out by Suzanne Olyarnik for study; a staghorn sculpin caught in the net; Langston tosses a fish pot; a snowy egret; Graham Chisholm, Audubon California's conservation director, raised funds for the project; the Lyford House, built in the 1870s, is a registered historical landmark.

Campers like Rhys Colman explore the sanctuary's 11 acres of oak woodlands, grasslands, and muddy shores.

often found near healthy oyster reefs. Could scientists and citizen groups bring back both of these San Francisco natives? All at once the prospect of restoring one of the most productive estuaries in the world seemed possible. "These are our native species," says Cosentino-Manning. "If we help them along, we hope to see a chain reaction, with birds and fish taking advantage of the new habitat."

With momentum for oyster restoration mounting throughout San Francisco Bay, scientists at Richardson Bay began monitoring the interaction between eelgrass and the native mollusk. At low tide on another August morning we are off in the boat again, this time wearing wet suits. Instead of a boathook, we carry a 20-foot net to seine for fish and other creatures at four designated spots. The first is over a healthy patch of eelgrass. Norden, the Audubon scientist, hops overboard with one end of the net. I jump in after her, grabbing the other end. When she has stretched the seine as far as it will reach, we begin a delicate two-and-a-half-minute dance circling the boat. I hold the pivot end; Norden walks the perimeter. Suddenly she disappears. "Probably a bat ray hole," she says when she resurfaces.

But Norden never drops the arc of the net or spills its precious contents. "We need this data to understand this ecosystem. Eelgrass is important to every part of the estuary, from birds down to the lowliest invertebrates. It's good for everything except swimmers. It tickles their legs," she says, grinning at her end of the moving net.

When Norden calls "time's up," we grab the under-edge of the seine, bringing the catch to the surface, where the counting begins. Wriggling in the net are walleyes, surf perch, top smelt, yellow-finned gobis, and a two-foot leopard shark, a slender bottom-feeder named for its distinctive spots. By the time we reach the fourth and final study plot, the seine seems heavier, the mud muddier. Another bat ray hole, and I'm in over my head, but the fish stay in the seine, keeping the scientific data unspoiled.

Seining in eelgrass beds has routinely yielded species in greater numbers and diversity than seining where there is no eelgrass. The fish pot surveys mirror these results: Audubon scientists are finding more individuals inside eelgrass beds, and a whopping three times more fish diversity. Oysters, too, seem to prefer eelgrass beds to mud and sand, and the scientists are designing new studies to explore these relationships in more detail.

Langston is mulling over this research nearly a year after the oil spill. Ironically, the containership disaster has boosted Richardson Bay's profile. Audubon's two years of research on eelgrass and oysters has contributed to new partnerships with other scientific agencies, which are now working to coordinate information gathering in key locations around the bay. One collaboration will bring scientists to Richardson Bay through the National Estuarine Research Reserve System, a network of protected areas that will use this bay as a living laboratory for long-term research.

"The spill put us on the map as an important player in Bay Area conservation," says Langston. "The tedious, careful, precise work we did before the spill now gives us credibility."

It has also defined for the local community what she and others are doing at Richardson Bay. People may not understand the connection between oysters and eelgrass, but they know that handling oiled birds is real conservation work, Langston says. "Before the spill we were the weird bay and bird people who carried buckets of fish up the sidewalk. Now we're the people who go out on boats and look for birds and take care of them. Drivers going past the center roll down their windows and yell, 'Thank you, Audubon.' Kids are bringing us the $50 they got as birthday presents."

Scientists are still not sure how the oil will affect the bay ecosystem over the long term. While wind and currents carried much of the gooey mass out to sea, some of it sank to the bay's bottom. Anything toxic will move through the aquatic food chain, passing the pollutants from prey to predators. Audubon scientists analyzed core samples they took immediately after the spill to chart the damage in Richardson Bay, but they have yet to find anything conclusive. They understand that nothing about this latest contamination bodes well for the eelgrass and oysters, or any of the other plants and animals that inhabit these waters. It adds to the existing mercury, PCBs, and dioxins that have lurked in the bay for decades, and to the concentrations of pesticides that are on the rise.

But no one has forgotten the lesson of the native oysters, whose revival fills scientists with optimism. After all, this is a bay with immense natural resilience, and today humans are giving it a boost. If a tiny mollusk can return on its own, there's hope for the entire ecosystem, says Schuchat, the Coastal Conservancy director. "When you undo the damage, nature comes back. It's astonishing how quickly this ecosystem can recover, given a little nudge."

By fall Richardson Bay is migration central as thousands of scaups and surf scoters wheel in from Alaska. Settling onto the water in an undulating carpet of mottled gray, the birds feast on small fish and crustaceans. Gulls and Forster's terns circle and dive, while a handful of brants, back from the Arctic, graze on eelgrass.

Langston stands on the beach as this ancient seasonal cycle unfurls. The oil spill is not the last of the disasters San Francisco Bay will suffer; something else will come along to batter it, she says. But conservationists will confront the next incident better prepared and with the confidence that the bay ecosystem will somehow survive. Watching a surf scoter emerge from an underwater dive, she welcomes its return to the bay as a sign of hope. "We're clinging to this renewal—embracing it. We knew it would come." ■

WEB EXCLUSIVE: To read about other successful oyster projects, go to audubonmagazine.org/oyster.