

South San Diego Bay Coastal Wetland Restoration and Enhancement Project

Restoring the Western Salt Ponds

Levee breaching



Cover photo: California cordgrass in restored Pond 10, taken in September 2020

Light-footed Ridgway's Rail



photo: Becky Matsubara

“The restoration of the western salt ponds has enhanced foraging, roosting, and breeding habitat for migratory and resident coastal dependent bird species in San Diego Bay. It has also improved water quality and is providing new opportunities for environmental education and outreach for both residents and visitors.”

Carolyn Lieberman, Coastal Program Coordinator, U.S. Fish & Wildlife Service's Carlsbad Fish and Wildlife Office



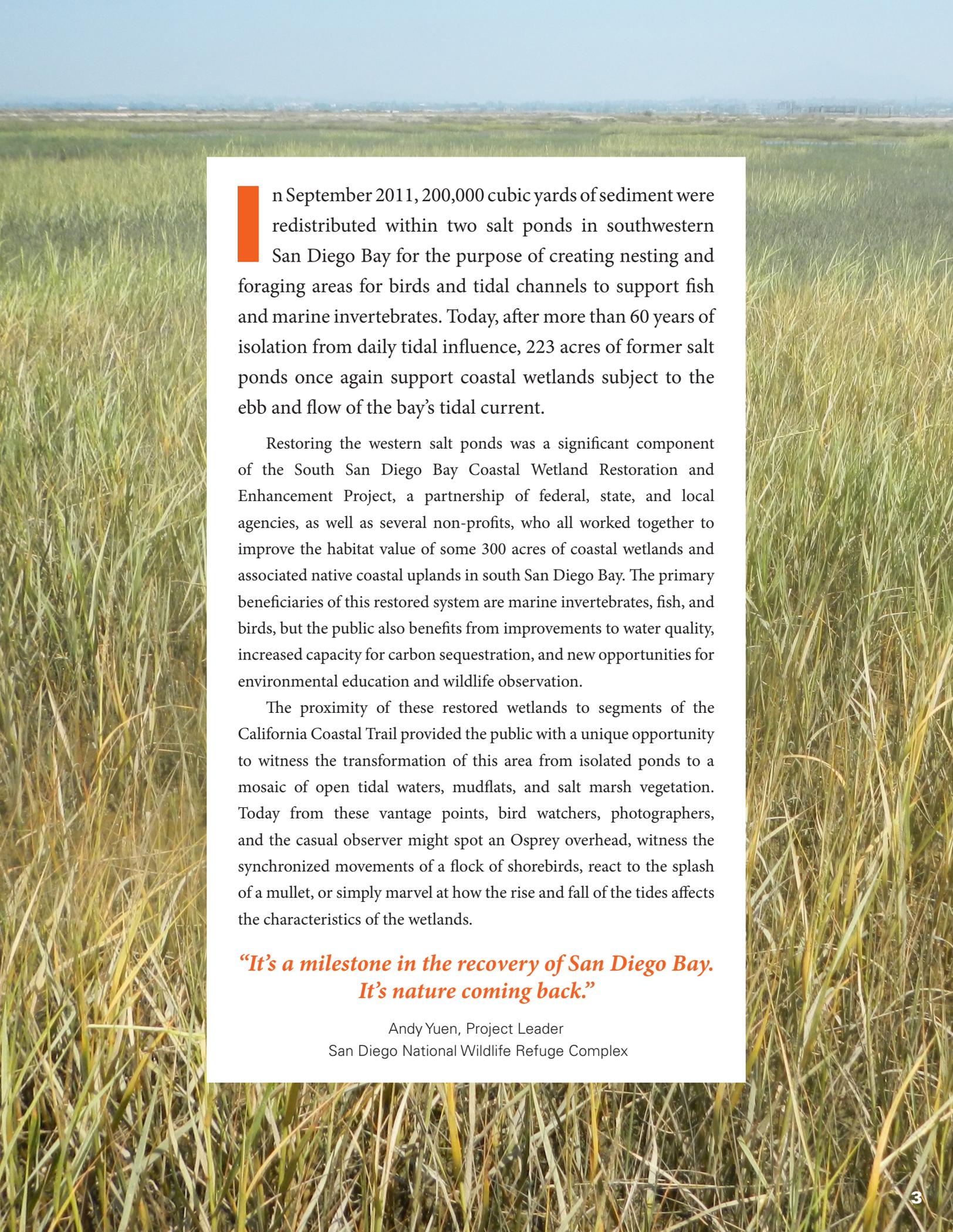
Salt marsh plants ready for planting



photo: Craig Chaddock

Great Blue Heron and Longtail Goby

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Chris Nordby, Nordby Biological Consulting • Publication design: Ellen Toomey • Learn more about this project at:
https://www.fws.gov/refuge/San_Diego_Bay/what_we_do/ResourceManagement/Salt_Pond_Restoration.html



In September 2011, 200,000 cubic yards of sediment were redistributed within two salt ponds in southwestern San Diego Bay for the purpose of creating nesting and foraging areas for birds and tidal channels to support fish and marine invertebrates. Today, after more than 60 years of isolation from daily tidal influence, 223 acres of former salt ponds once again support coastal wetlands subject to the ebb and flow of the bay's tidal current.

Restoring the western salt ponds was a significant component of the South San Diego Bay Coastal Wetland Restoration and Enhancement Project, a partnership of federal, state, and local agencies, as well as several non-profits, who all worked together to improve the habitat value of some 300 acres of coastal wetlands and associated native coastal uplands in south San Diego Bay. The primary beneficiaries of this restored system are marine invertebrates, fish, and birds, but the public also benefits from improvements to water quality, increased capacity for carbon sequestration, and new opportunities for environmental education and wildlife observation.

The proximity of these restored wetlands to segments of the California Coastal Trail provided the public with a unique opportunity to witness the transformation of this area from isolated ponds to a mosaic of open tidal waters, mudflats, and salt marsh vegetation. Today from these vantage points, bird watchers, photographers, and the casual observer might spot an Osprey overhead, witness the synchronized movements of a flock of shorebirds, react to the splash of a mullet, or simply marvel at how the rise and fall of the tides affects the characteristics of the wetlands.

***“It’s a milestone in the recovery of San Diego Bay.
It’s nature coming back.”***

Andy Yuen, Project Leader
San Diego National Wildlife Refuge Complex



U.S. Coastal Survey T-sheets, 1851–1889, historic wetlands South San Diego Bay

In 2000, only 30% of San Diego Bay’s historic salt marsh habitat and 16% of its original intertidal mudflat habitat remained intact, drastically reducing the historical distribution and abundance of San Diego Bay’s many native plant and wildlife species.

Concerns for Action

By the 1970s, the public was openly expressing concern about the long-term effects to wildlife and water quality from ongoing dredging and filling projects in the bay. Those coastal habitats that remained were and continue to be a vital component of the Pacific Flyway, providing resting, feeding, and nesting areas for tens of thousands of migratory shorebirds, colonial seabirds, and wintering waterfowl. The need to restore the physical and biological processes characteristic of healthy wetland ecosystems was and still is a high priority.

It was public support for the protection of these wetlands that led to the establishment of a National Wildlife Refuge in South San Diego Bay in 1999. The Refuge is managed to ensure the protection of a diversity of endangered, threatened, migratory, and resident native species and their habitats in the midst of San Diego County’s highly urbanized coastal environment.

Historical San Diego Bay Wetland Losses

In 1859, San Diego Bay was a fertile, shallow, flat-bottomed bay with adjacent intertidal habitats that encompassed approximately 18,500 acres, but the bay and surrounding wetland habitat have changed significantly since that time. The first major dredging project in the bay’s shallow subtidal habitat occurred in 1914. This was followed by the dredging and filling of substantial areas of the bay’s intertidal habitats to accommodate Port, Navy, and commercial development. At the southernmost end of the bay, a significant portion of the original salt marsh habitat was diked to create solar evaporation ponds for the purpose of producing salt.

Year	1859	2000	% lost
Entire Bay	18,500 acres	15,694	15%
Shallow Subtidal	6,400 acres	3,712 acres	42%
Intertidal Mudflat	6,148 acres	984 acres	84%
Salt Marsh	2,785 acres	855 acres	70%

San Diego Bay Wetlands through time

Early 1900s

Initial conversion of salt marsh to solar salt evaporation ponds

1914

First major dredging project in shallow subtidal habitat

1930s–40s

Substantial filling around perimeter of the bay

1950s

Western salt ponds created

1970s

Increasing awareness of wetlands value

Belding's Savannah Sparrow



photo: John Fitch

Forster's Tern



"It is unlikely that the losses to Southern California's historic coastal wetlands will ever be fully reversed; therefore, it is essential that restoration efforts be funded and implemented wherever opportunities exist to restore functional coastal habitats."

from National Coastal Wetlands Conservation Grant application

Species in Peril

The southern portion of San Diego Bay is considered a vital stopover site for shorebirds, seabirds, and waterfowl traveling along the Pacific Flyway and is recognized as a Western Hemisphere Shorebird Reserve Network Site and a Globally Important Bird Area. Federally and state listed threatened and endangered species, including the Light-footed Ridgway's Rail, California Least Tern, Western Snowy Plover, Belding's Savannah Sparrow, and east Pacific green sea turtle, are supported by the habitats in the south bay.

From late February to early September of each year, the area also provides nesting and foraging habitat for a unique assemblage of ground nesting seabirds, such as the California Least Tern, Black Skimmer, Elegant Tern, Forster's Tern, Royal Tern, Gull-billed Tern, and Caspian Tern.

The shallow subtidal waters in the south bay and the restored salt ponds provide equally important habitat for a diverse array of fish, including species managed under the Coastal Pelagic Species and Pacific Groundfish Fishery Management Plans. Also present are fish species that provide forage for the California Least Tern and other seabirds.

Light-footed Ridgway's Rail



Black Skimmer



photo: M. Sadowski

1999

South San Diego Bay included in the National Wildlife Refuge System

2006

Comprehensive Conservation Plan completed for the San Diego Bay NWR

2008

Restoration partnerships established; first grant awarded

2009

NOAA restoration funding via the American Recovery and Reinvestment Act

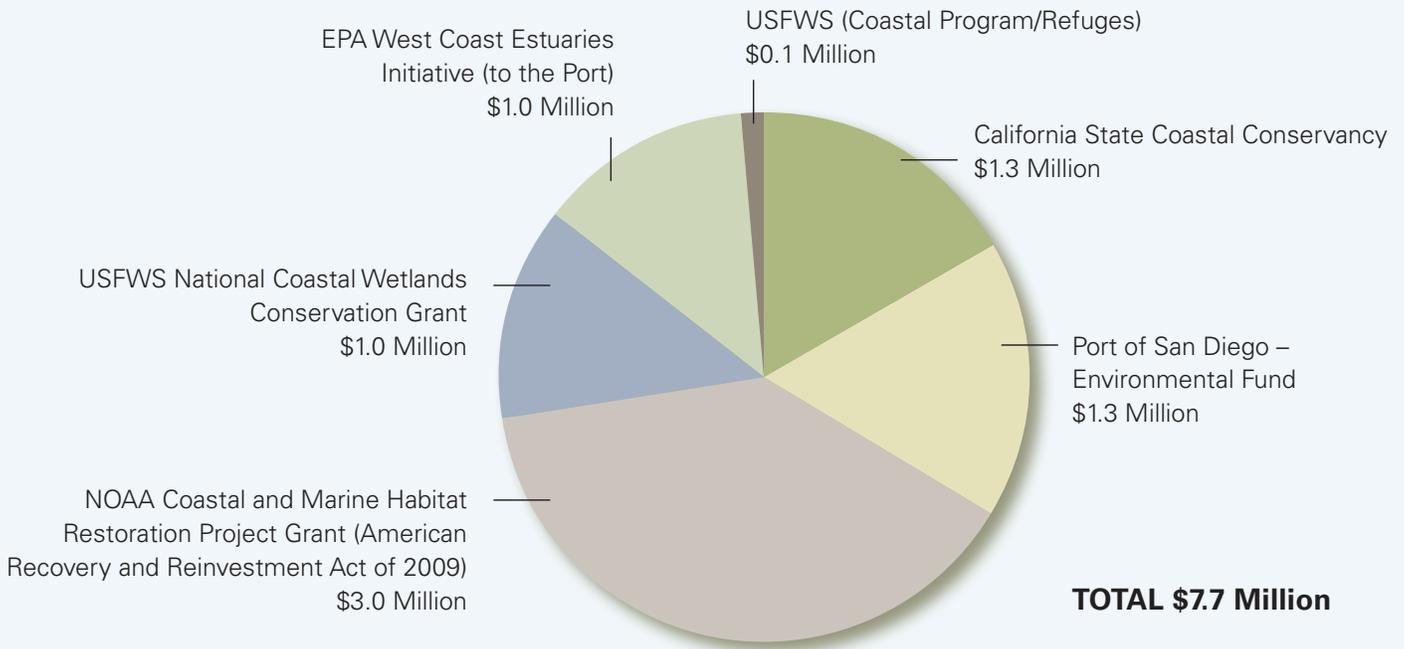
2011

Tidal exchange in the western salt ponds restored; monitoring begins

2012 to Present

Ongoing restoration actions throughout San Diego Bay

Funding Sources



PARTNERING IN RECOVERY

In 2008, approximately 1,625 acres in South San Diego Bay were identified for future coastal wetland restoration or enhancement, but large-scale wetland restoration requires substantial funding and cooperation among a range of partners. Between 2008 and 2009, an interagency partnership was created for the purpose of securing funding to restore wetlands in and around the southern end of the Bay, including the western salt ponds. This team of dedicated partners successfully secured a combination of grants and other funding needed to restore and enhance 265 acres of coastal wetlands and 35 acres of adjacent native coastal uplands in South San Diego Bay.



Elevation and Hydrology

For nearly 60 years, the western salt ponds functioned as part of a salt making operation that relies on the evaporation of sea water to produce salt. Despite the long-term use of these ponds for salt production, the pond bottoms were left relatively undisturbed and remained at their historic elevations; elevations generally suitable for the reestablishment of salt marsh. Because no elevation changes were required, modifications for the restoration of Pond 10 were limited to cutting subtidal channels to facilitate tidal exchange. No dredging or filling of Pond 10a, which is connected to Pond 10 via a culvert, was required, as it already included sinuous tidal channels and elevations that supported salt marsh vegetation.

In Pond 11, the elevations were lower, with some areas only suitable for supporting subtidal and mudflat habitats. This was addressed by placing the sediment produced during the dredging of tidal channels in Pond 10, as well as during dredging of several tidal channels in Pond 11 onto the lower areas of Pond 11 to achieve elevations appropriate for salt marsh vegetation.

Once the appropriate elevations were achieved within Ponds 10 and 11, the tide gate in Pond 10 was removed, the northeastern corner of the Pond 11 levee was breached, and openings were cut in the levee that separated Ponds 10 and 11. These actions restored semi-diurnal tidal influence to all three ponds.



Pickleweed planted October 2011

Habitats and Vegetation

Restoring roughly 89 acres of intertidal salt marsh, 41 acres of intertidal mudflats, 28 acres of subtidal wetlands, and 10 acres of native upland habitat was one of four major goals for this restoration project. To ensure successful restoration of the site, 40,000 California cordgrass (*Spartina foliosa*) plants, along with other native marsh and upland plant species, were installed at appropriate elevations throughout the site. Monitoring results documented by wetland scientists from the Tijuana River National Estuarine Research Reserve and the U.S. Fish and Wildlife Service confirmed in 2016 that the habitat goal for the project had been achieved.



Birds

The extensive loss of historical wetlands throughout coastal California has left many bird species, including the Light-footed Ridgway's Rail, California Least Tern, and Western Snowy Plover, struggling to survive. The habitats restored within the western salt ponds address the specific needs of these species, while also increasing the overall ecological productivity of the south end of San Diego Bay.

Rails have benefited most directly through the restoration of cordgrass-dominated low marsh, while mid- and high-vegetated marsh supports Belding's Savannah Sparrows and provides refuge for rails during high tides. The restored intertidal mudflats provide foraging opportunities for plovers and other shorebirds and the subtidal channels support open water bird species, including the terns that nest on the nearby salt pond levees.



Marbled Godwit



Osprey

photo: Gary Meredith



COOL INFO!

Although most of their meals are obtained from the nearby ocean waters, endangered California Least Terns can also be seen plunge diving for slough anchovies in the tidal channels of the restored salt ponds.

California Least Tern

Long-billed Curlew



Shortfin Corvina



Black-necked Stilt



photo: Tim Anderson

American Avocet



Fish and Invertebrates

Fish and invertebrates (such as clams, snails, shrimp, crabs, and worms) are key components of the biodiversity of San Diego Bay. These species are typically numerous in natural ecosystems, and play important roles in them, including forming the basis of the food chain. Long-term monitoring programs initiated prior to restoration found the populations of fish and invertebrates in the ponds were much poorer than what is being found today. Some of the target species for this restoration included flatfish, sharks, and rays. After restoration, California halibut, diamond turbot, smoothhound sharks, butterfly rays, bat rays, and stingrays, have all been found in the restored habitats. Baitfish, such as anchovies and topsmelt, are among the most common fish of the restored ponds.

Some of the notable invertebrates now found in the ponds include fishery species such as market squid, swimming crabs, and brown shrimp. Dozens of other species of crustaceans, molluscs, and worms have also been found in the restored tidal channels. Various scientific studies have highlighted the changes in food webs of South San Diego Bay spurred by salt marsh restoration.

COOL INFO!

The warm waters of the bay support species characteristic of subtropical zones, but there has been an increase of tropical species associated with recent warming trends. These warm-water species include the longtail goby, Mexican brown shrimp, and arched swimming crab (a close relative the East Coast blue crab).



Round Stingray



Slough Anchovy

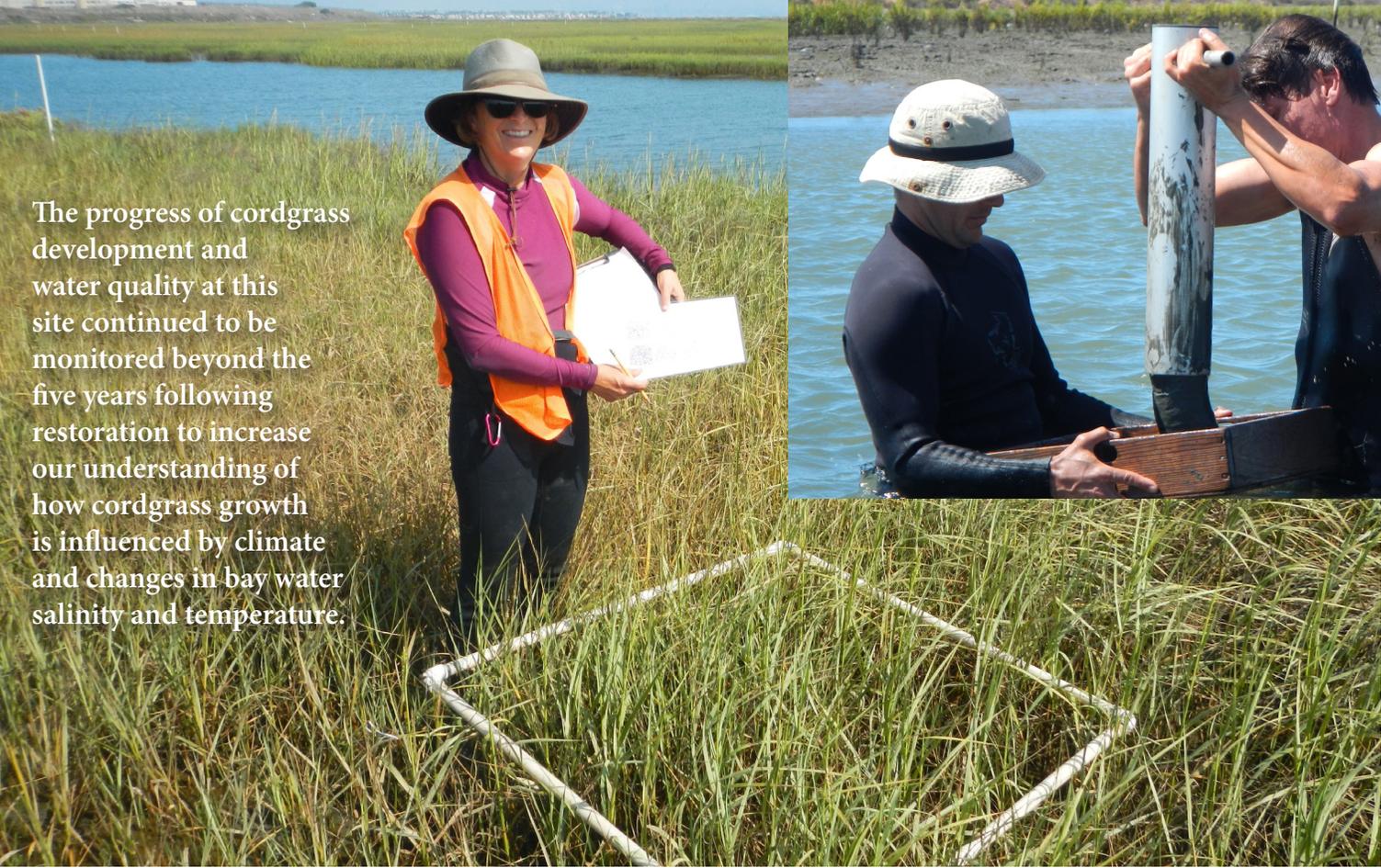


Mexican Brown Shrimp



Round Stingray

The progress of cordgrass development and water quality at this site continued to be monitored beyond the five years following restoration to increase our understanding of how cordgrass growth is influenced by climate and changes in bay water salinity and temperature.



Restoration Monitoring

Observations of site conditions before and after restoration was an essential part of this restoration project. Monitoring was conducted for one year prior to restoration to establish pre-project conditions and five years post-restoration to determine if and to what extent the desired restoration objectives were achieved. Researchers collected physical data from the site related to tidal amplitude, bathymetry, and water quality and biological data related to plants, fish, benthic invertebrates, and birds.

Before restoration, fish diversity and abundance in the ponds was very low, as was the diversity of benthic

invertebrates and birds. This was likely the result of poor water quality and high salinity levels. Today, the restored ponds are once again connected to the influences of the bay. The ebb and flow of the tides provide improved water quality and nutrients to support a greater abundance and diversity of fish and invertebrates, along with the development of salt marsh vegetation, including cordgrass. By 2018, the first sighting of a Light-footed Ridgway's Rail was made within the restored habitat, signaling that after more than 60 years, this area may once again support a breeding population of this very rare and secretive bird.



photo: Craig Chadlock

Large Mexican Fiddler Crab

COOL INFO!

In summer 2018, an unusual crab was photographed at the Bolsa Chica Ecological Reserve and posted on iNaturalist. It was identified as a large Mexican fiddler crab (*Uca princeps*). Prior to this sighting, the northern range of this crab was thought to be in Baja California. Posts through 2020 continue to confirm the crab's presence in various California coastal wetlands, including on the San Diego Bay NWR. Today, the large Mexican fiddler crab is considered one of only two species of fiddler crab found along the California coast.

What's in it for you?

Restored wetlands and how they function provide insight into a full range of scientific topics from biology to water chemistry to hydrological processes. They serve as a living classroom for students of all ages and interests to observe and ponder. They can also provide an opportunity for quiet observation of movement, sounds, and smells, or become transformed through art or photography into a lasting memory.

An exciting aspect of this restoration is the opportunity for nature-based observation. Web-based platforms such as iNaturalist.org and eBird.org provide an opportunity for the public to share their discoveries. These observations also can serve as valuable pieces of scientific information. Citizen scientists who have posted

on iNaturalist have improved our understanding of the ecology of South San Diego Bay, including documenting the presence of warm-water species such as seahorses and gobies, as well as documenting the food chain at work.

Birdwatchers from around the world come to enjoy the variety of bird species supported by the wetland and upland habitats at the south end of San Diego Bay. Many record their observations on **eBird.org**. 179 bird species were included on the checklist as of October 2020, for the *Bayshore Bikeway — 7th St., San Diego, US-CA* birding hotspot. View the checklist and get more information about the best times to observe specific species by visiting <https://ebird.org/hotspots>.



photo: Ronald Forster



photo: Craig Chaddock

Great Blue Heron and Giant Seahorse



photo: Craig Chaddock

Close-up of Giant Seahorse (*Hippocampus ingens*)

“We are proud to be a partner in this historic and significant project. It is through the work of many partners that this salt marsh habitat is returning to its former beauty, benefiting both wildlife and the people who come here to experience it.”

Megan Cooper, Project Manager
California State Coastal Conservancy



Captive bred Light-footed Ridgway's Rails take flight over the restored salt marsh

The partners responsible for the successful completion of the South San Diego Bay Coastal Wetland Restoration and Enhancement Project include:



U.S. Navy
City of Imperial Beach
San Diego Oceans Foundation
Ocean Discovery Institute

San Diego Audubon
Coronado Cays Homeowners Association
Tijuana River National Estuarine
Research Reserve