

WINGS LANDING TIDAL HABITAT RESTORATION PROJECT

FIELD GUIDE

to the natural resources
of Suisun Marsh





Table of Contents

| | |
|---------------------------|-----|
| Site History | 4 |
| Wings Landing Restoration | 5 |
| Tidal Marsh Ecosystems | 6-7 |
| Fish | 8-9 |
| Waders and Marsh Birds | 10 |
| Raptors | 11 |
| Mammals | 12 |
| Invertebrates | 13 |
| Reptiles & Amphibians | 14 |
| Native Tidal Marsh Plants | 15 |
| Special Status Plants | 16 |
| Index | 17 |

WINGS LANDING HISTORY

In the late 1800s, much of the Suisun Marsh was diked for water management to support agriculture and duck hunting. Wings Landing was converted from tidal marsh to agriculture, and has been intermittently managed as a duck club since the 1940s, until its restoration back to tidal marsh in 2020.

The 267-acre Wings Landing site was restored from a duck hunting club to a natural tidal marsh ecosystem to benefit native marsh species that have been impacted by habitat degradation and habitat loss throughout the region. Marsh restoration is a requirement of permits issued to the California Department of Water Resources for their operations and management of California's water systems.



A water control structure historically used for duck club management.



An individual Delta smelt (*Hypomesus transpacificus*); photo taken by Matt Young of the United States Geological Survey.

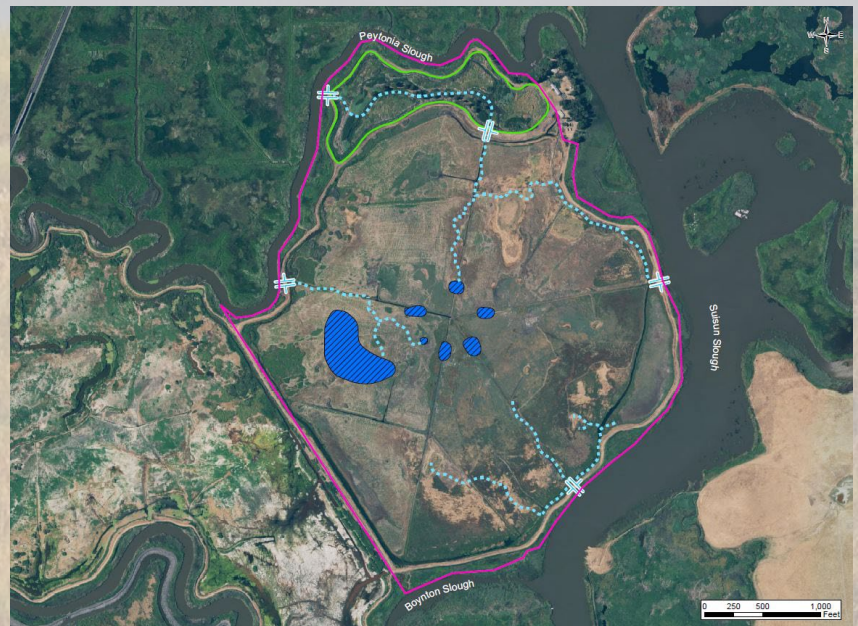
The Wings Landing Tidal Habitat Restoration Project benefits dozens of species native to California, but was specifically designed to benefit Delta smelt, longfin smelt, and salmonids.

WINGS LANDING RESTORATION

The Wings Landing restoration design replicated historic features visible in aerial photos of the site including marsh plain, tidal channels, tidal depressions, and an area of muted tidal marsh. The restored marsh is well connected to other natural and restored tidal marsh habitats, increasing local and regional benefits to species.



A map of Wings Landing using satellite imagery from 1948.



A map depicting Wings Landing restoration features constructed in 2020.

RESTORATION OBJECTIVES

- Create appropriate habitat for Delta smelt, longfin smelt, salmonids, and other native fish.
- Enhance food web productivity within, adjacent to, and in the vicinity of the Project Site.
- Enhance the quality of habitats to support special status and native species.
- Avoid promoting conditions, such as invasive species infestations, that are in conflict with these objectives.

TIDAL MARSH ECOSYSTEM

Wetlands are known for their significant benefits to wildlife.

BIODIVERSITY

Wetlands support the same number and variety of plants and animals as rainforests and coral reefs. Their shallow, nutrient rich water produces a high number of microscopic species that support the base of the food web.

FOOD PRODUCTION

Wetlands support tiny plants and animals living in the marsh that provide plentiful food for other animals, including threatened and endangered fish and birds. Restoring Wings Landing to a tidal marsh wetland has improved important food sources for aquatic species, including Delta smelt, longfin smelt, Chinook salmon, and steelhead.

PACIFIC FLYWAY

The Suisun Marsh is part of the Pacific Flyway, an important stopover site for thousands of migrating birds. Restoration of Wings Landing provides important habitat where these birds may rest and feed on their long migration routes.

IMPORTANCE OF TIDAL MARSHES

It is important to restore and conserve tidal wetlands because they provide many significant benefits to humans and wildlife.

ECOSYSTEM SERVICES

Ecosystem services are the ways in which an ecosystem directly or indirectly benefits humans. Wetlands, such as those restored at Wings Landing, are important for the ecosystem services they provide, including:

- Flood regulation and storm resilience
- Groundwater recharge
- Water filtering
- Carbon sequestration
- Erosion control and sediment transport

FISH

Fish species found in Suisun Marsh provide food and recreational opportunities like fishing. Smaller fish species, such as Sacramento splittail, are prey to larger fish species like the invasive striped bass.

SACRAMENTO SPLITTAIL *Pogonichthys macrolepidotus*



State Species of Special Concern

Threats to Native Fish

- Increased water turbidity
- Increased salinity
- Low dissolved oxygen
- Low food availability
- Non-native/invasive fish predation

GREEN STURGEON *Acipenser medirostris*



Federally Threatened
(Juvenile pictured above)

STRIPED BASS *Morone saxatilis*



Invasive, non-native species
sport-fishing favorite

Notes:

FISH

Many fish species found in Suisun Marsh are anadromous or semi-anadromous, meaning they can live in both fresh water (rivers) and saltwater (marsh and the ocean). Each of the species below are anadromous or semi-anadromous.

DELTA SMELT

Hypomesus transpacificus



Federally Threatened,
State Endangered

LONGFIN SMELT

Spirinchus thaleichthys



Federal Candidate Species,
State Threatened

STEELHEAD - Central Valley Population

Oncorhynchus mykiss irideus



Federally Threatened

CHINOOK SALMON

Oncorhynchus tshawytscha



State and Federally
Threatened/Endangered

Notes:

WADERS and MARSH BIRDS

Wading birds and marsh birds are uniquely adapted to live in marshes and mudflats. The shape and length of their beaks relate to the types of food they eat, and the length of their legs determines how deep they can wade to find them.

GREAT BLUE HERON
Ardea herodias



RIDGWAY'S RAIL
Rallus obsoletus



State and Federally Endangered

CALIFORNIA BLACK RAIL
Laterallus jamaicensis coturniculus



State Threatened

WESTERN SANDPIPER
Calidris mauri



Notes:

RAPTORS

Raptors use tidal marsh habitat as feeding and breeding grounds. They prey on rodents and fish found throughout wetlands and use trees as nesting sites.

WHITE-TAILED KITE
Elanus leucurus



State Fully Protected

NORTHERN HARRIER
Circus hudsonius



State Species of Special Concern

AMERICAN KESTREL
Falco sparverius



RED-TAILED HAWK
Buteo jamaicensis



Notes:

MAMMALS

Small mammals play important roles in the tidal marsh food web. They help maintain native plant communities by feeding on aquatic plants, insects, and smaller animals like crayfish, clams, and fish. They are also an important food source for birds of prey, reptiles, and other predators.

SALT MARSH HARVEST MOUSE
Reithrodontomys raviventris



State and Federally Endangered

MUSKRAT
Ondatra zibethicus



SUISUN SHREW
Sorex ornatus sinuosus



State Species of Special Concern

RIVER OTTER
Lontra canadensis



Notes:

INVERTEBRATES

Invertebrates serve key tidal marsh ecosystem functions, including facilitating nutrient cycling and serving as prey for larger ecologically and economically important species such as Delta smelt.

OPOSSUM SHRIMP
Neomysis mercedis



CALIFORNIA BAY SHRIMP
Crangon franciscorum



CALANOID COPEPOD
Pseudodiaptomus forbesi



CALANOID COPEPOD
Eurytemora affinis



Notes:

REPTILES & AMPHIBIANS

Reptiles and amphibians found in Suisun Marsh thrive in freshwater aquatic environments. Tidal marshes supply an abundance of insect, rodent, and fish species as prey.

WESTERN POND TURTLE
Actinemys marmorata



State Species of Special Concern

GIANT GARTER SNAKE
Thamnophis gigas



Federally and State Threatened

SIERRAN TREE FROG
Pseudacris sierra



PACIFIC RING-NECKED SNAKE
Diadophis punctuatus amabilis

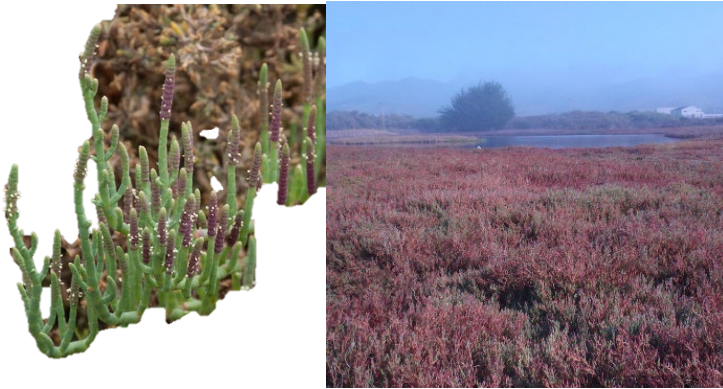


Notes:

NATIVE TIDAL MARSH PLANTS

Most plants need freshwater to survive, but native tidal marsh plant species are able to survive in salty water.

PICKLEWEED
Salicornia pacifica



TULE / BULRUSH
Schoenoplectus spp.



Three tule species can be found at Wings Landing: hardstem, California, and three-square bulrush.

CATTAIL
Typha spp.



Three cattail species can be found at Wings Landing: narrowleaf, broadleaf, and southern.

SALTGRASS
Distichlis spicata



Notes:

SPECIAL STATUS PLANTS

Special status plant species are rare and/or threatened in their native habitat. They can be hard to spot because of their tiny size, but their blooms stand out.

MASON'S LILAEOPSIS
Lilaeopsis masonii



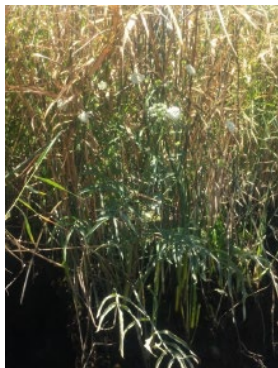
- California Rare Plant Rank: 1B.1
- State Endangered Species Act Listing: Rare
- Rare in CA & elsewhere
- Seriously threatened in CA
- Found on the water's edge at lower tides

DELTA TULE PEA
Lathyrus jepsonii var. *jepsonii*



- California Rare Plant Rank: 1B.2
- Rare in CA & elsewhere
- Moderately threatened in CA

BOLANDER'S WATER HEMLOCK
Cicuta maculata var. *bolanderi*



- California Rare Plant Rank: 2B.1
- Rare in CA, more common elsewhere
- Seriously threatened in CA

SUISUN MARSH ASTER
Symphotrichum lentum



- California Rare Plant Rank: 1B.2
- Rare in CA & elsewhere
- Moderately threatened in CA

Notes:

INDEX

| Species | Page |
|--|------|
| AMERICAN KESTREL (<i>Falco sparverius</i>) | 10 |
| BOLANDER'S WATER HEMLOCK (<i>Cicuta maculata</i> var. <i>bolanderi</i>) | 15 |
| CALANOID COPEPOD (<i>Eurytemora affinis</i>) | 12 |
| CALANOID COPEPOD (<i>Pseudodiaptomus forbesi</i>) | 12 |
| CALIFORNIA BAY SHRIMP (<i>Crangon franciscorum</i>) | 12 |
| CALIFORNIA BLACK RAIL (<i>Laterallus jamaicensis coturniculus</i>) | 9 |
| CATTAIL (<i>Typha</i> spp.) | 14 |
| CHINOOK SALMON (<i>Oncorhynchus tshawytscha</i>) | 8 |
| DELTA SMELT (<i>Hypomesus transpacificus</i>) | 8 |
| DELTA TULE PEA (<i>Lathyrus jepsonii</i> var. <i>jepsonii</i>) | 15 |
| GIANT GARTER SNAKE (<i>Thamnophis gigas</i>) | 14 |
| GREAT BLUE HERON (<i>Ardea herodias</i>) | 9 |
| GREEN STURGEON (<i>Acipenser medirostris</i>) | 7 |
| LONGFIN SMELT (<i>Spirinchus thaleichthys</i>) | 8 |
| MASON'S LILAEOPSIS (<i>Lilaeopsis masonii</i>) | 15 |
| MUSKRAT (<i>Ondatra zibethicus</i>) | 11 |
| NORTHERN HARRIER (<i>Circus hudsonius</i>) | 10 |
| OPOSSUM SHRIMP (<i>Neomysis mercedis</i>) | 12 |
| PACIFIC RING-NECKED SNAKE (<i>Diadophis punctuatus amabilis</i>) | 14 |
| PICKLEWEED (<i>Salicornia pacifica</i>) | 14 |
| RED-TAILED HAWK (<i>Buteo jamaicensis</i>) | 10 |
| RIDGWAY'S RAIL (<i>Rallus obsoletus</i>) | 9 |
| RIVER OTTER (<i>Lontra canadensis</i>) | 12 |
| SACRAMENTO SPLITTAIL (<i>Pogonichthys macrolepidotus</i>) | 7 |
| SALT MARSH HARVEST MOUSE (<i>Reithrodontomys raviventris</i>) | 11 |
| SALTGRASS (<i>Distichlis spicata</i>) | 14 |
| SIERRAN TREE FROG (<i>Pseudacris sierra</i>) | 13 |
| STEELHEAD - Central Valley Population (<i>Oncorhynchus mykiss irideus</i>) | 8 |
| STRIPED BASS (<i>Morone saxatilis</i>) | 7 |
| SUISUN MARSH ASTER (<i>Symphyotrichum lentum</i>) | 15 |
| SUISUN SHREW (<i>Sorex ornatus sinuosus</i>) | 11 |
| TULE / BULRUSH (<i>Schoenoplectus</i> spp.) | 14 |
| WESTERN POND TURTLE (<i>Actinemys marmorata</i>) | 13 |
| WESTERN SANDPIPER (<i>Calidris mauri</i>) | 9 |
| WHITE-TAILED KITE (<i>Elanus leucurus</i>) | 10 |



Help with biological tracking by reporting threatened and endangered species sightings on the California Natural Diversity Database (CNDDDB):
[www.wildlife.ca.gov/Data/CNDDDB](http://www.wildlife.ca.gov/Data/CNDDB)