STATE OF OUR ESTUARY

Reporting on the Health of the San Francisco Estuary

2025 State of the Estuary Conference

Laura Feinstein, Ph.D. | San Francisco Estuary Institute

1. Introduction to *ourestuary.org*

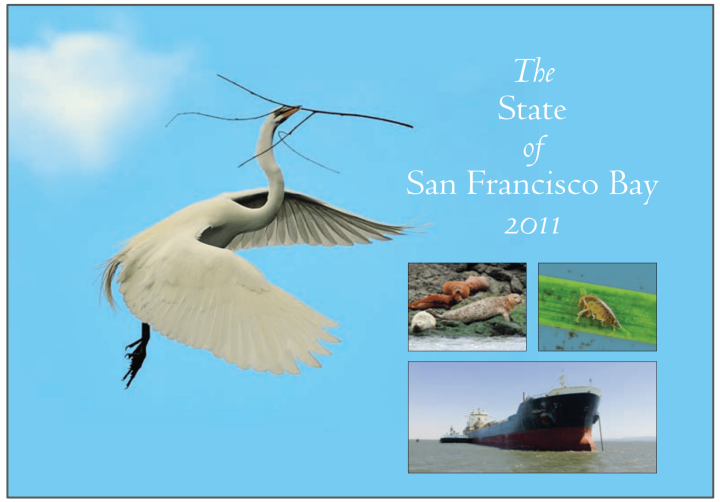
2. Key Findings

3. Lead Scientists

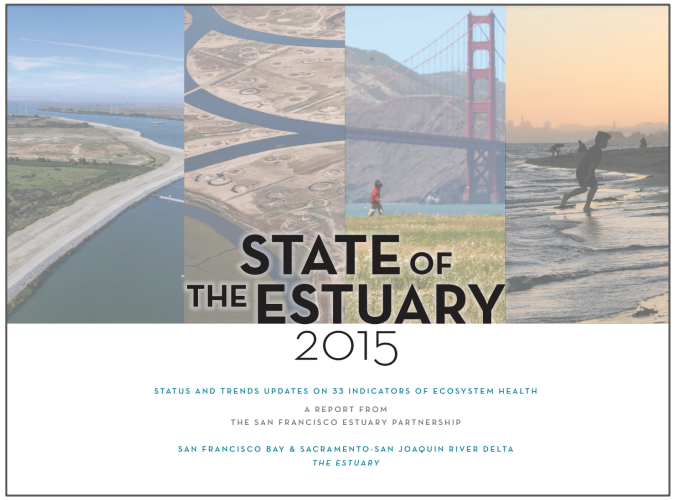
4. State of the Birds

Tracking the Estuary's Health

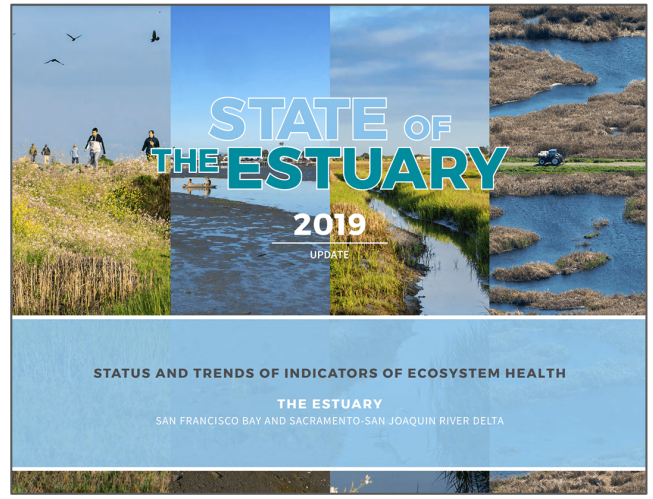
2011



2015

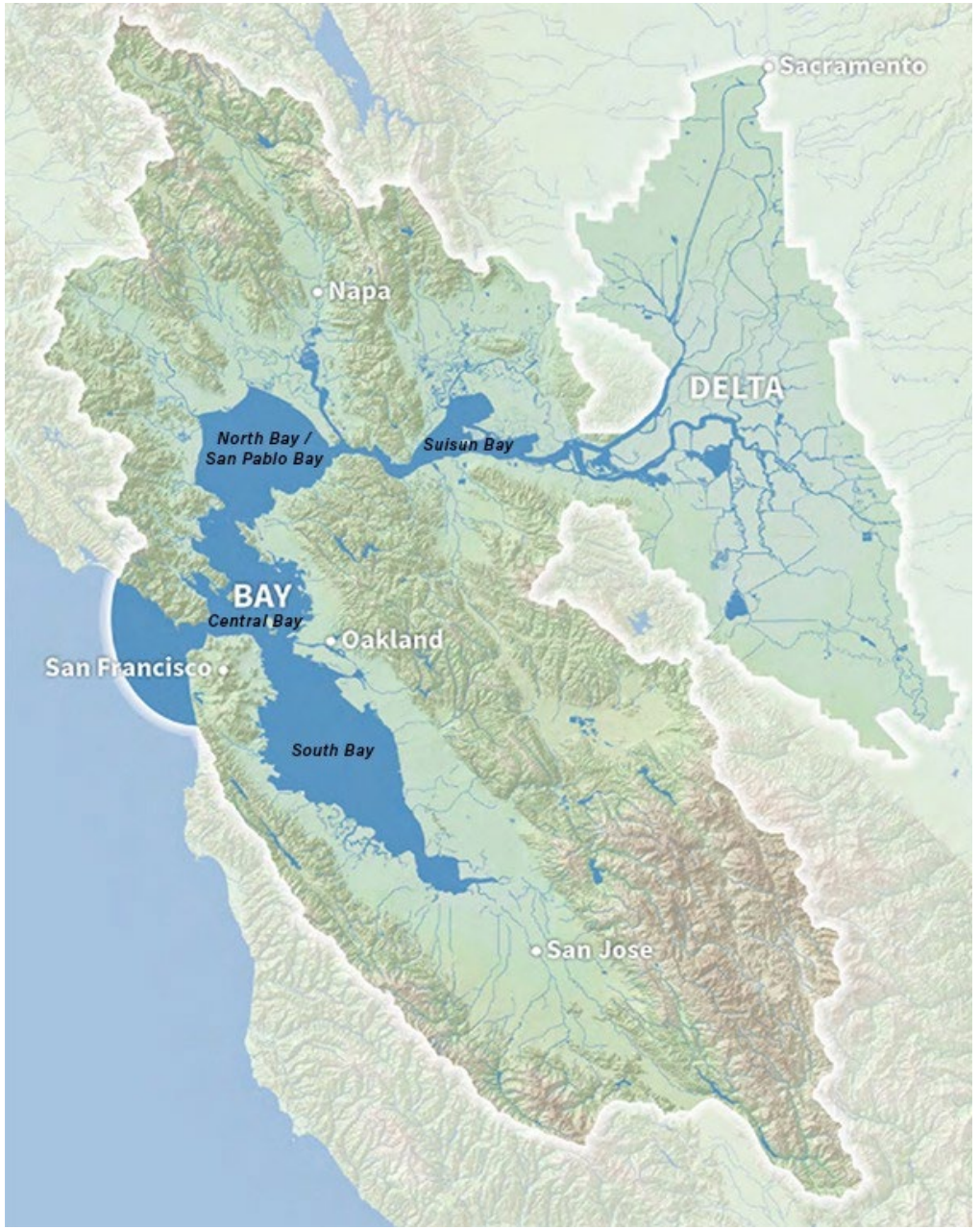


2019

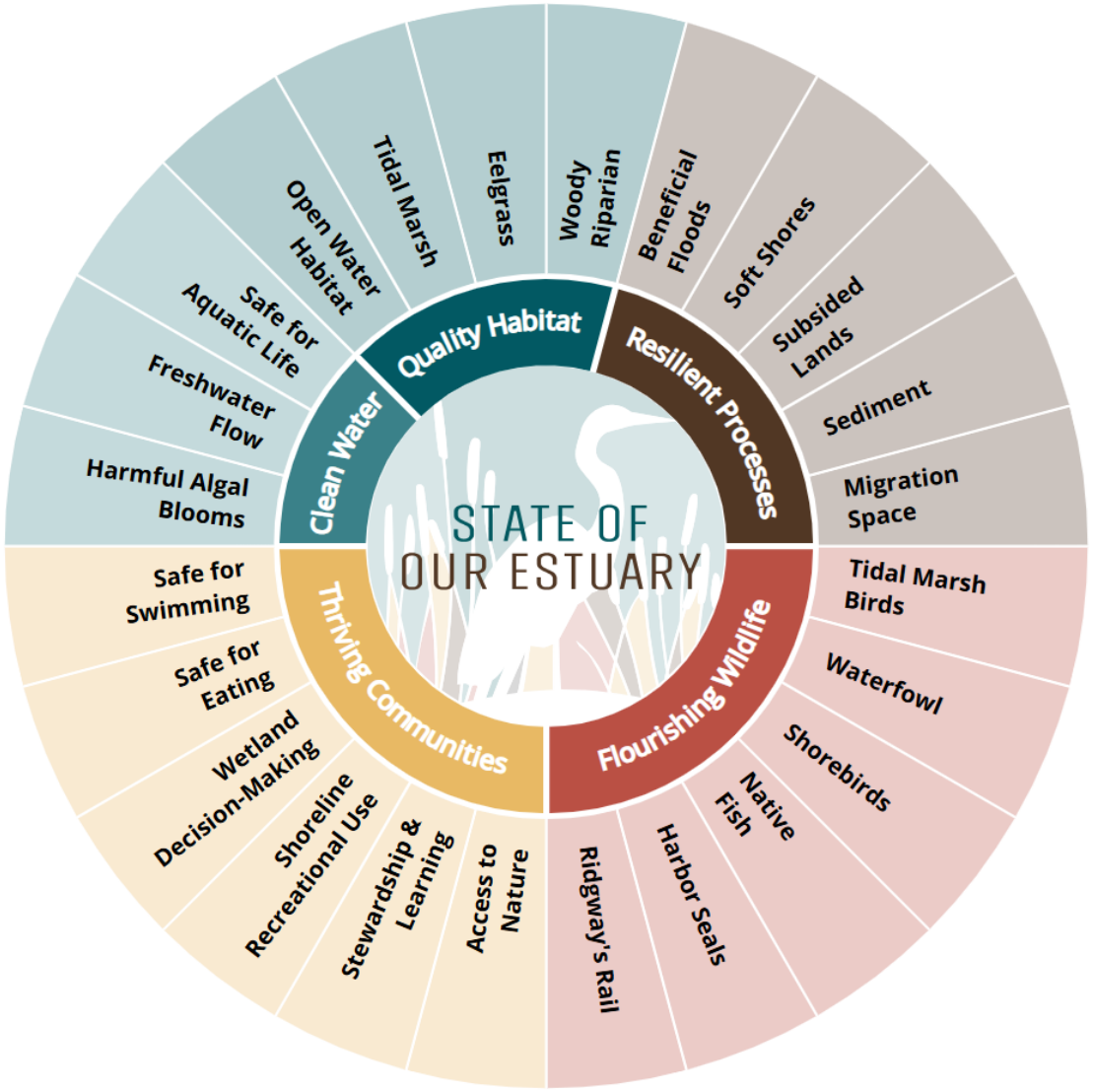


ourestuary.org

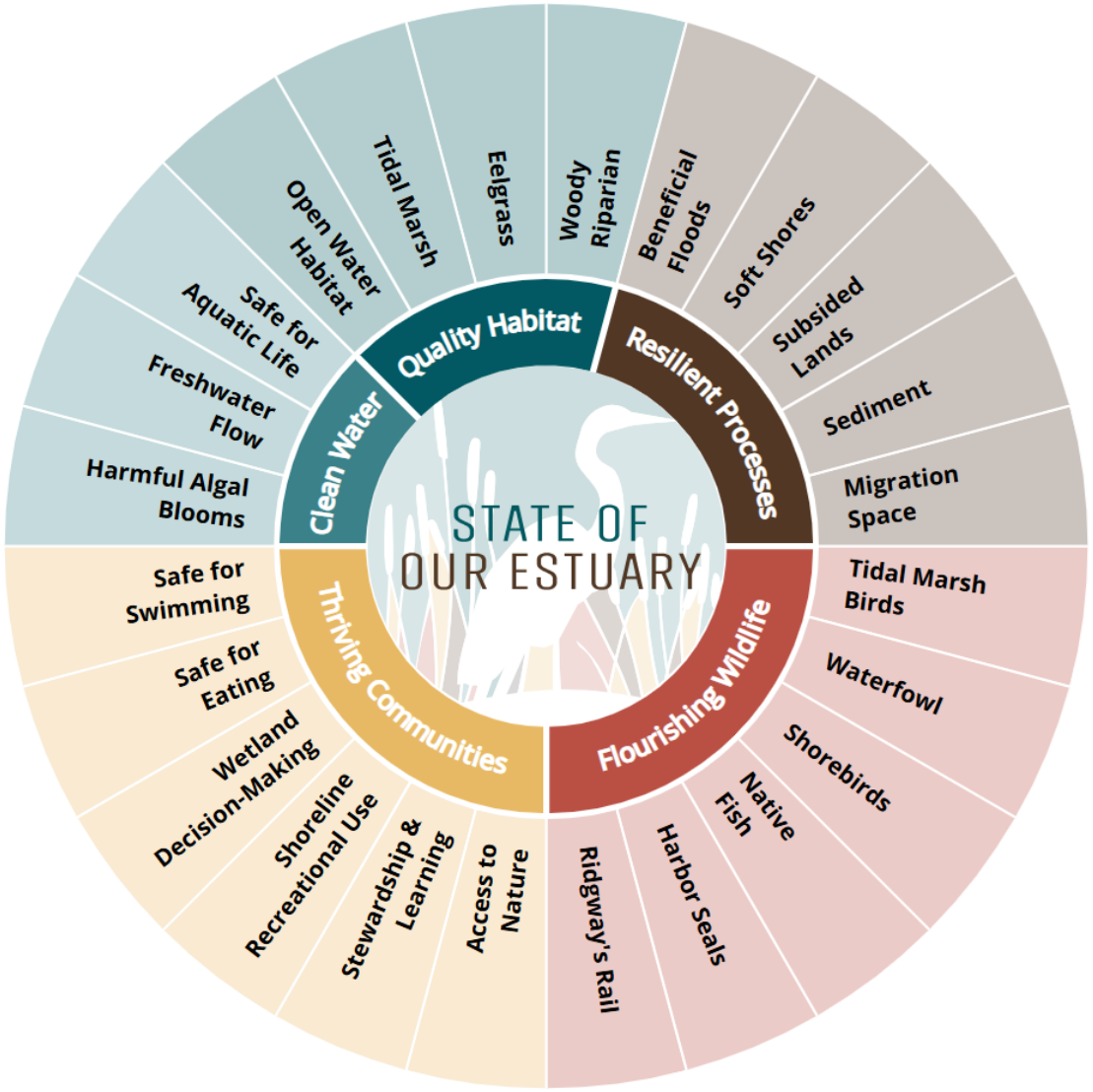
Geographic Scope



Twenty-Four Indicators

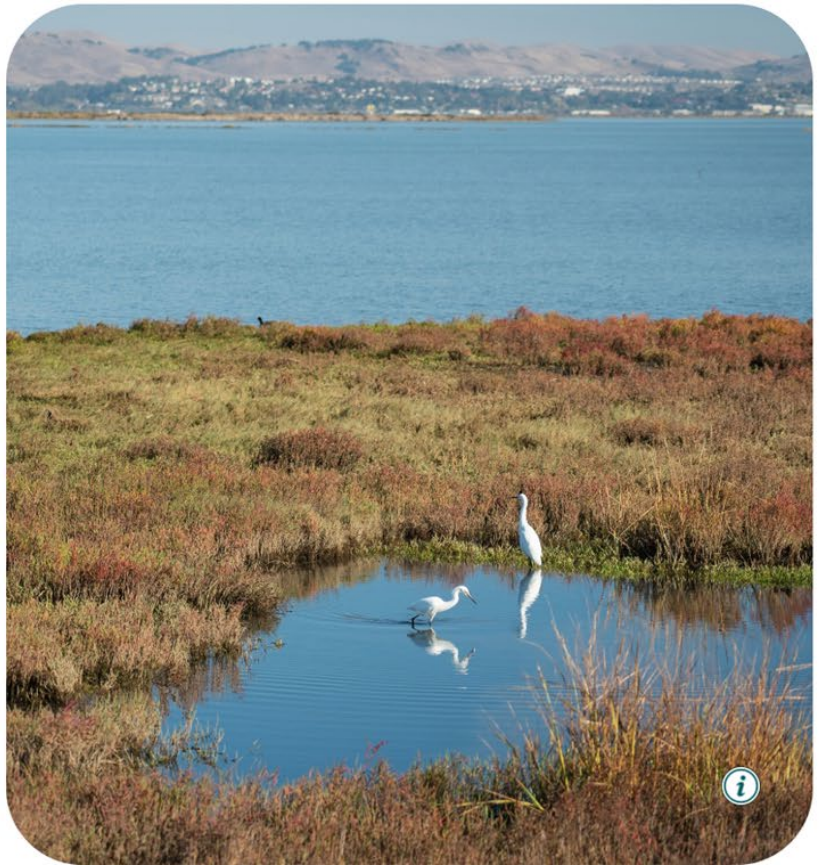


Five Categories



Thriving Communities

Designed for Multiple Audiences



TIDAL MARSH

Status & Trend

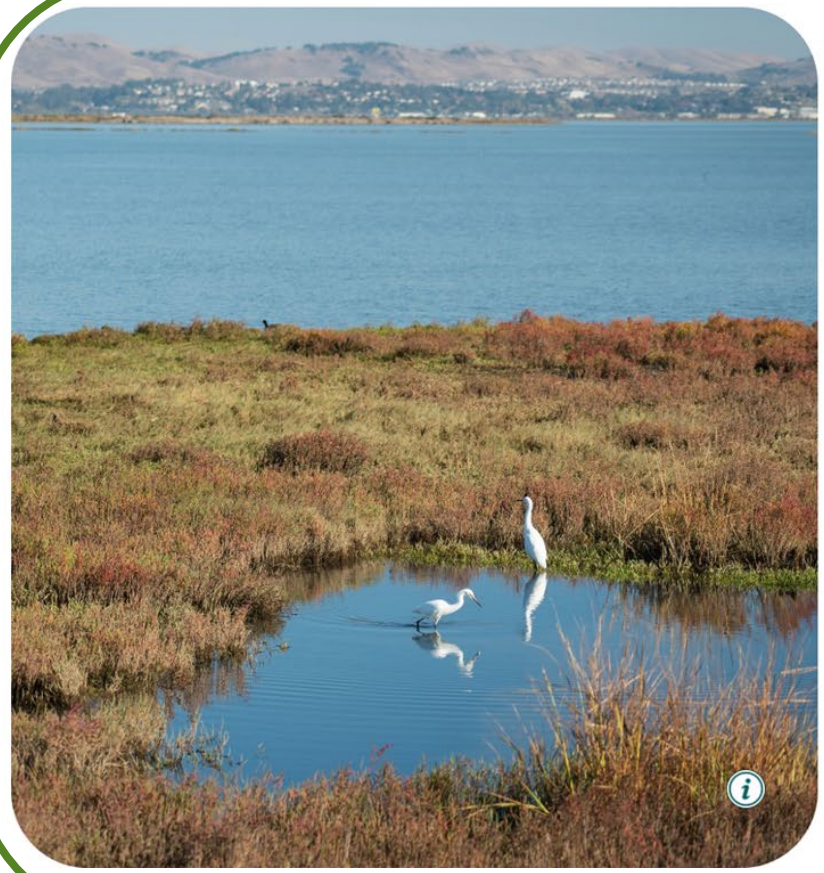
Latest Update: October 2025

BAY DELTA

The acreage of tidal marsh in both the Bay and Delta is increasing, leading to Improving scores for both regions. The Bay is in Fair condition in terms of total acres, while there is still far too little marsh in the Delta, which warrants a Poor status. Tidal marsh extent in the Bay, including places that have been restored, has increased from about 52,800 acres in 2019 (see State of the Estuary 2019) to nearly 57,800 acres in 2024 (a 9.5% increase).

Technical Appendix

High-Level Takeaways



TIDAL MARSH

Status & Trend

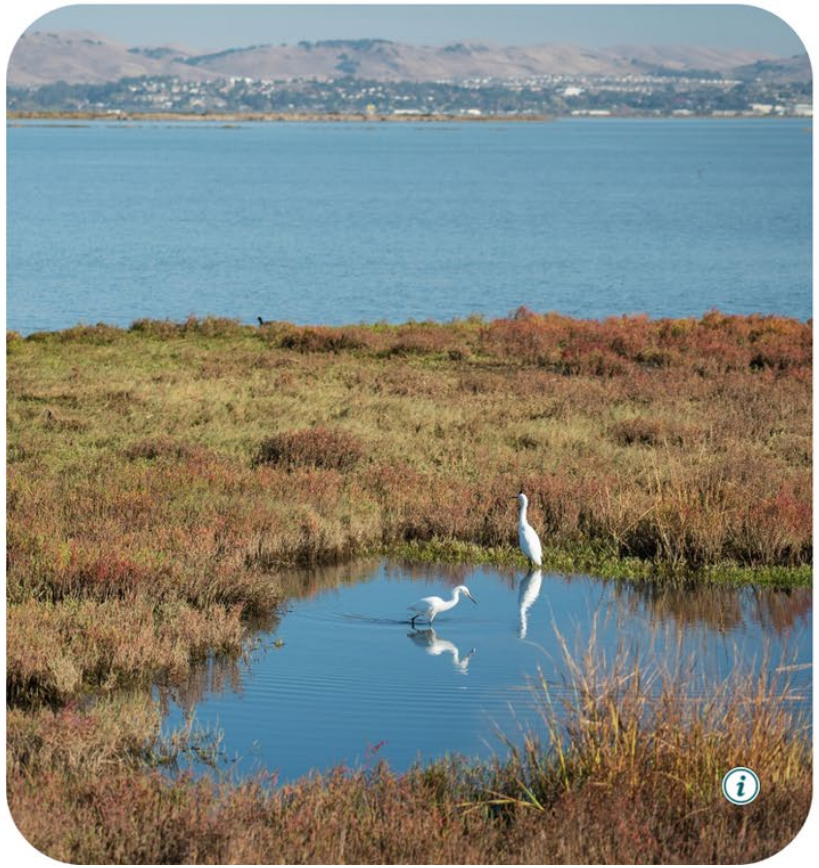
Latest Update: October 2025

BAY DELTA

The acreage of tidal marsh in both the Bay and Delta is increasing, leading to Improving scores for both regions. The Bay is in Fair condition in terms of total acres, while there is still far too little marsh in the Delta, which warrants a Poor status. Tidal marsh extent in the Bay, including places that have been restored, has increased from about 52,800 acres in 2019 (see State of the Estuary 2019) to nearly 57,800 acres in 2024 (a 9.5% increase).

Technical Appendix

Backed By Rigorous Science



TIDAL MARSH

Status & Trend

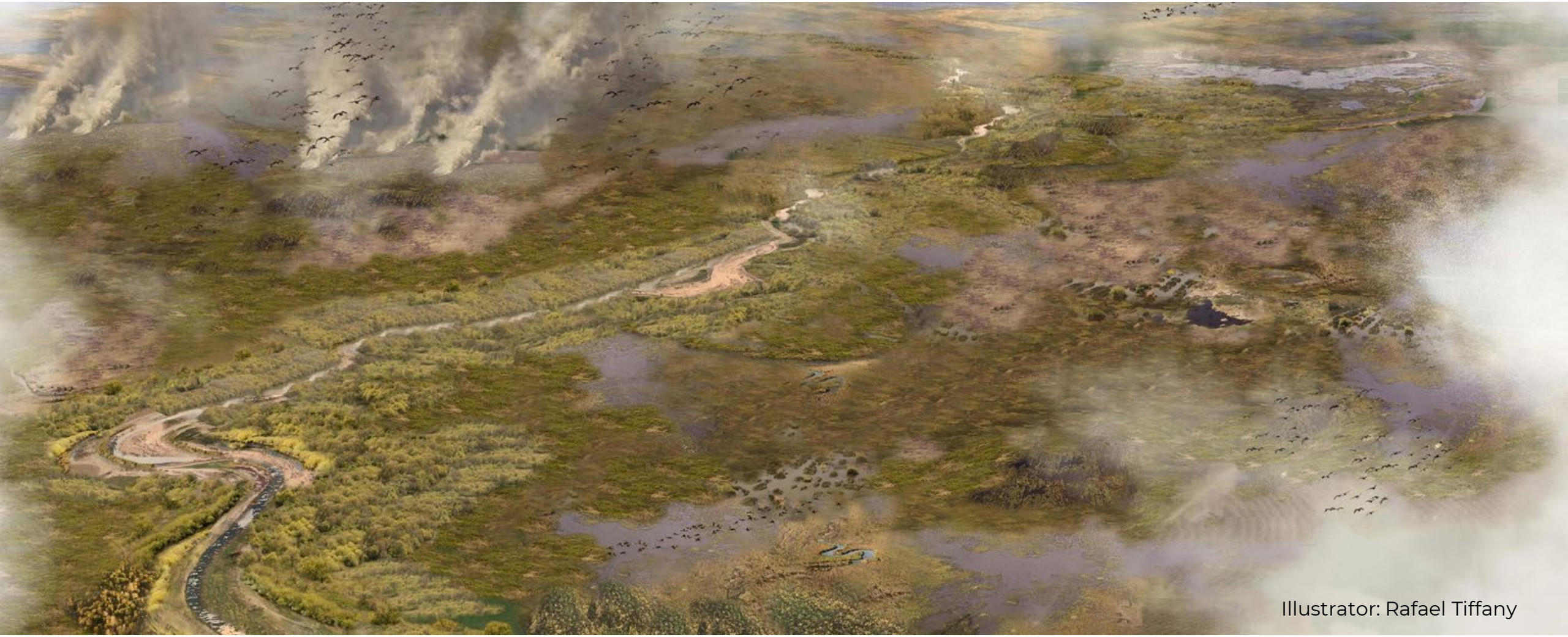
Latest Update: October 2025

BAY DELTA

The acreage of tidal marsh in both the Bay and Delta is increasing, leading to Improving scores for both regions. The Bay is in Fair condition in terms of total acres, while there is still far too little marsh in the Delta, which warrants a Poor status. Tidal marsh extent in the Bay, including places that have been restored, has increased from about 52,800 acres in 2019 (see State of the Estuary 2019) to nearly 57,800 acres in 2024 (a 9.5% increase).

Technical Appendix

What is this moment in history?

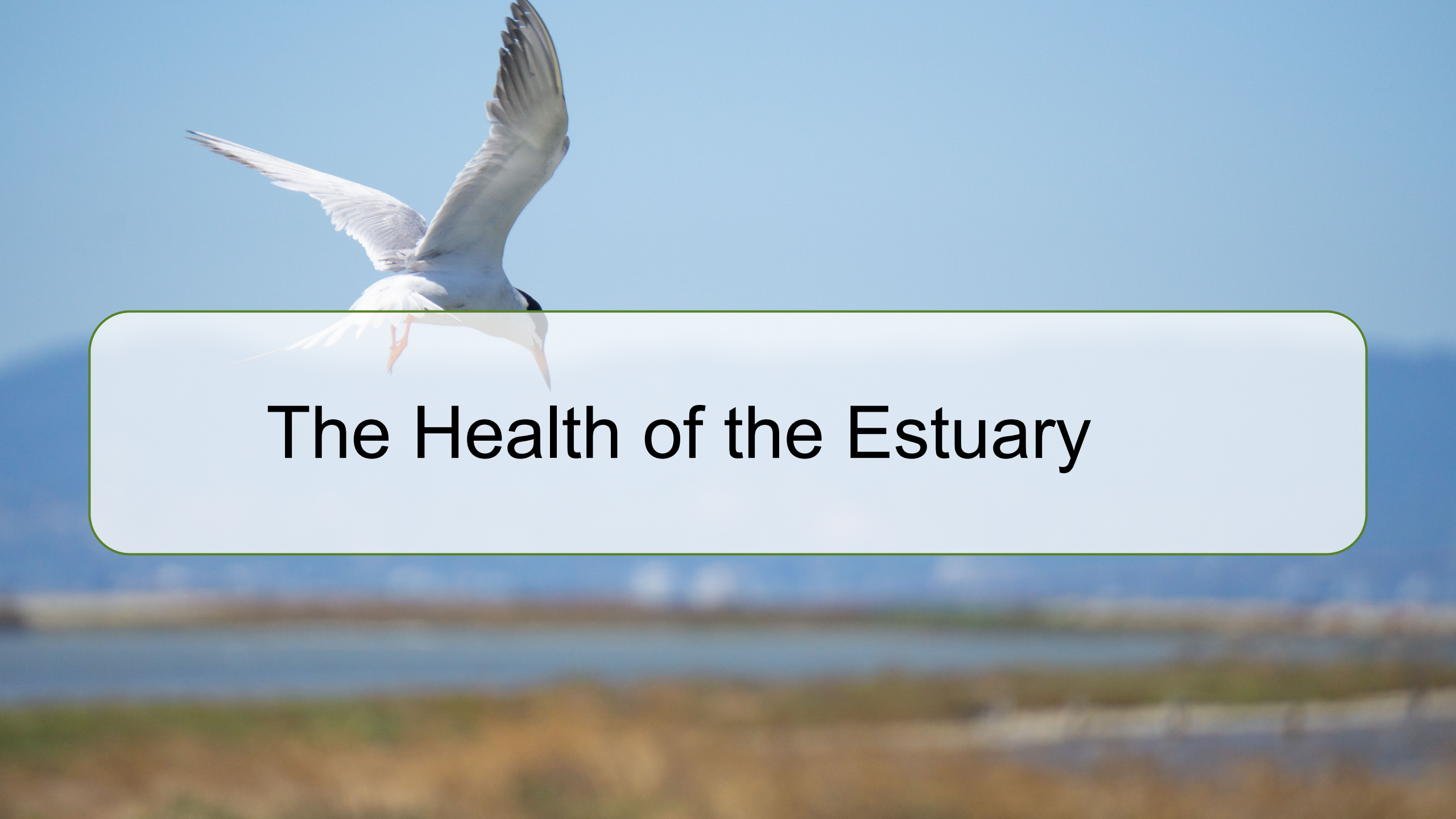


Illustrator: Rafael Tiffany

What is this moment in history?

What is this moment in history?

What is this moment in history?



The Health of the Estuary

Key Takeaway

Where the approaches to restore ecosystem health are well-understood and managers have taken action on the ground, results are visible.

Photo Credit: Aviva Rossi

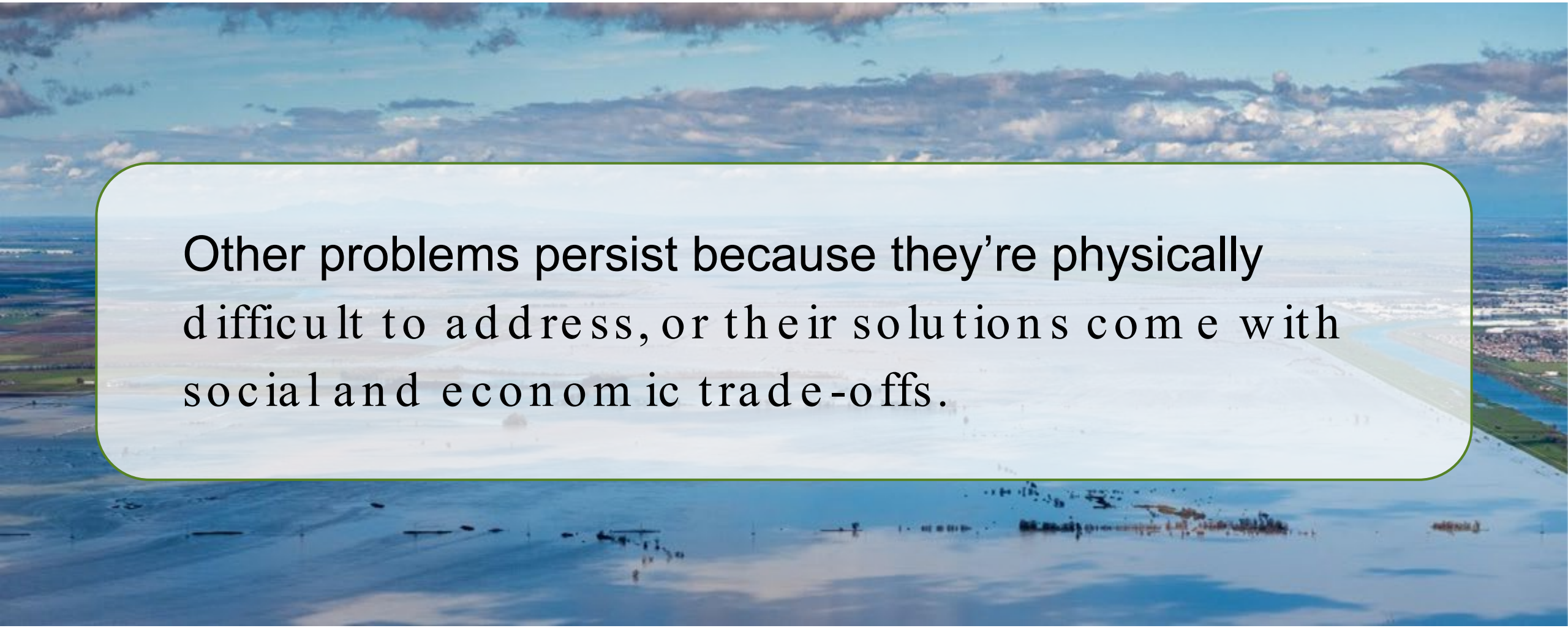
Tidal Marsh and Marsh Birds

Tidal Marsh
BAY DELTA

Photo Credit: Joey Kotfica

Tidal Marsh and Marsh Birds

Key Takeaway

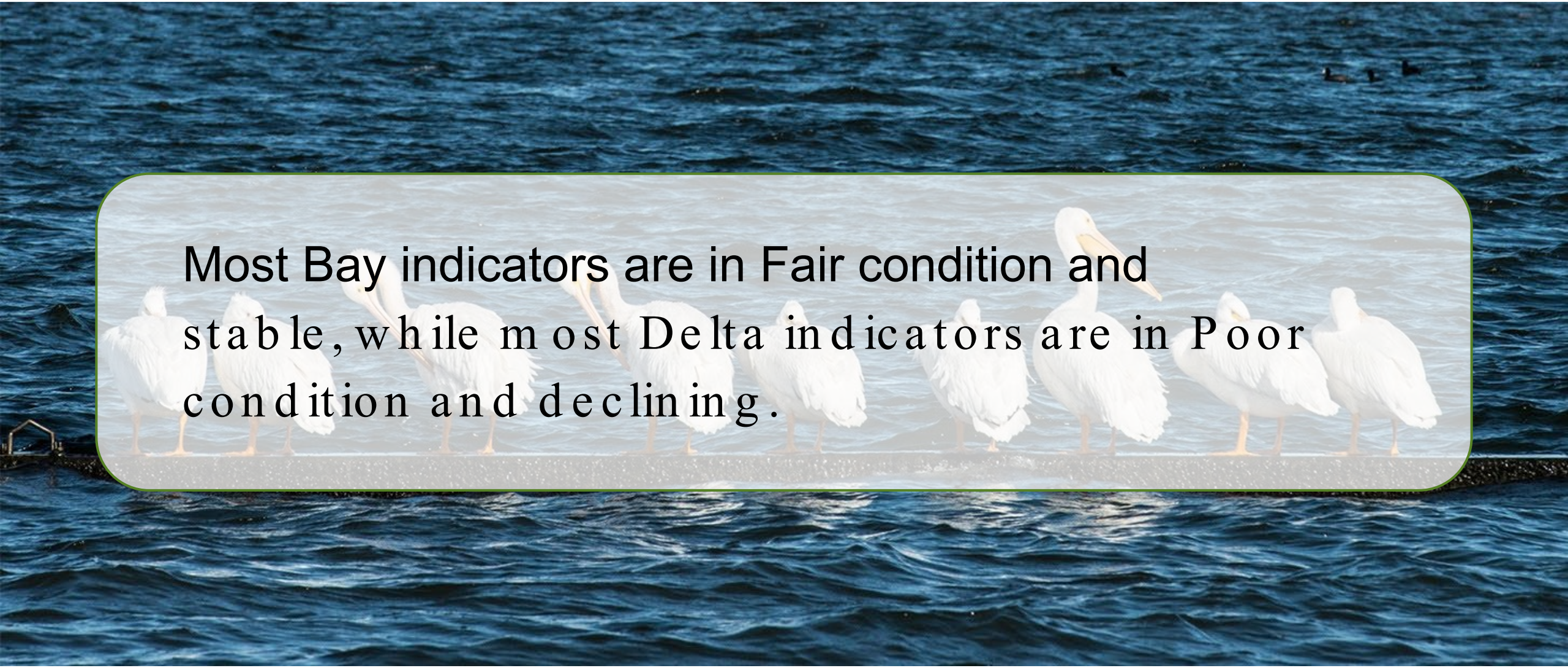


Other problems persist because they're physically difficult to address, or their solutions come with social and economic trade-offs.

Beneficial Floods

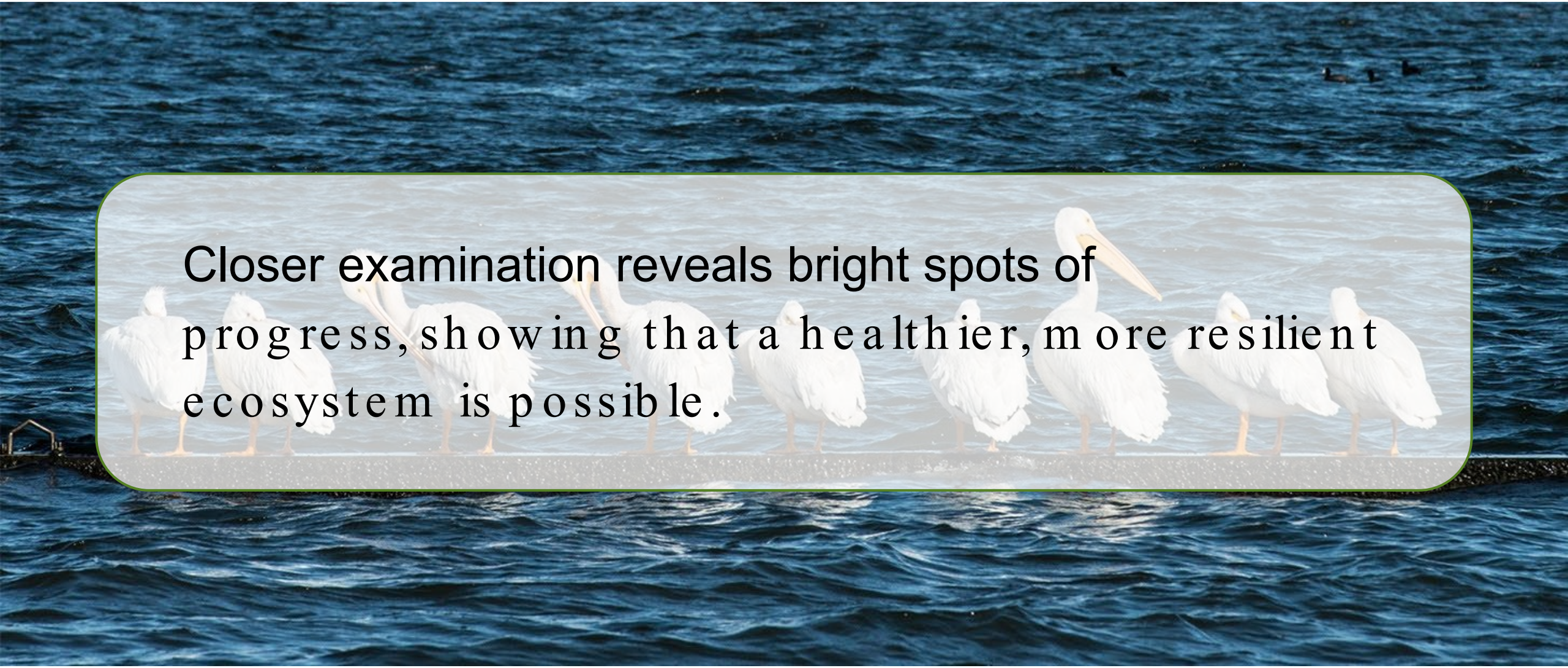
Fish Safe For Eating

Key Takeaway



Most Bay indicators are in Fair condition and stable, while most Delta indicators are in Poor condition and declining.

Key Takeaway



Closer examination reveals bright spots of progress, showing that a healthier, more resilient ecosystem is possible.

Reading the Scorecard

Good

Fair

Poor

Our Estuary 2025 Scorecard

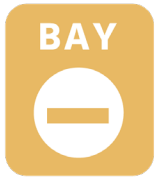
Freshwater Flow

Native Fish

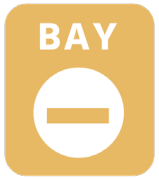
Waterfowl

Beneficial Floods

Safe for Aquatic Life



Harbor Seals



Eelgrass

Migration Space

Safe for Eating

Shorebirds

Open Water Habitat

Soft Shores

Safe for Swimming

Tidal Marsh Birds

Tidal Marsh

Subsided Lands

Our Estuary 2025 Scorecard

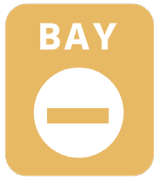
Freshwater Flow

Native Fish

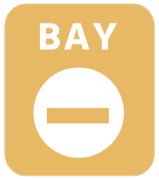
Waterfowl

Beneficial Floods

Safe for Aquatic Life



Harbor Seals



Eelgrass

Migration Space

Safe for Eating

Shorebirds

Open Water Habitat

Soft Shores

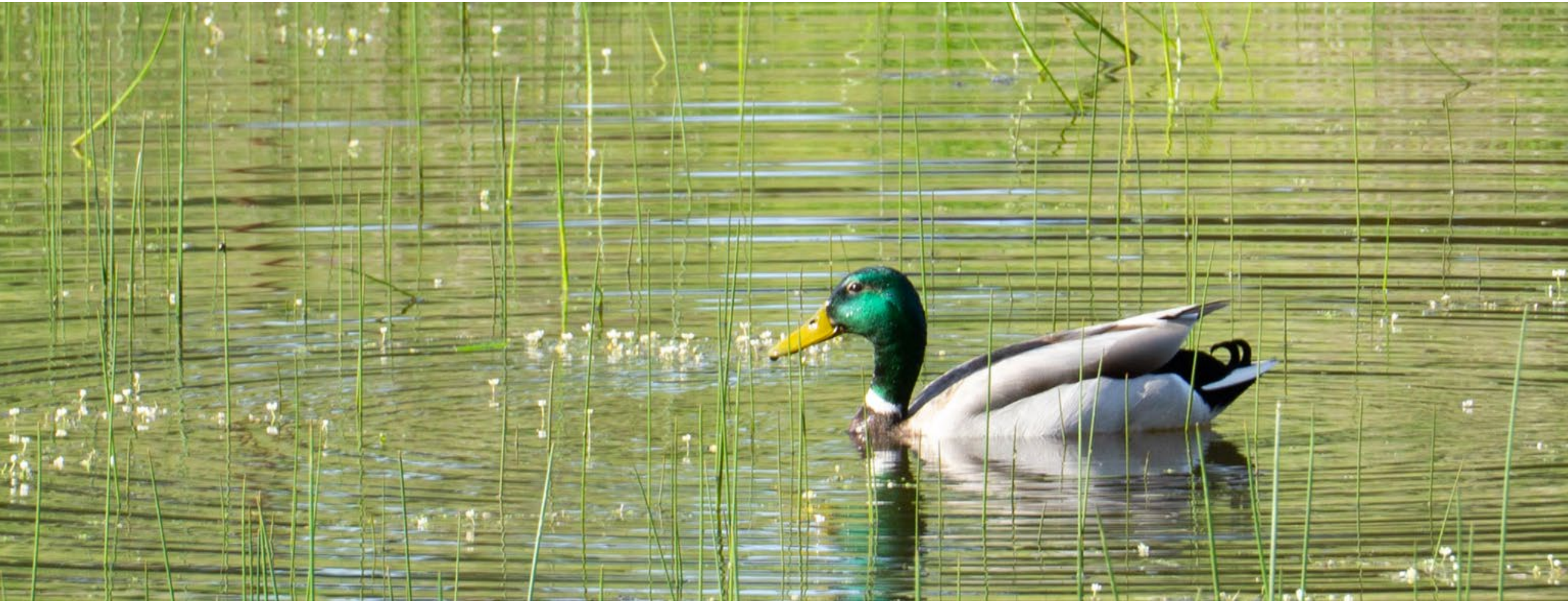
Safe for Swimming

Tidal Marsh Birds

Tidal Marsh

Subsided Lands

Waterfowl

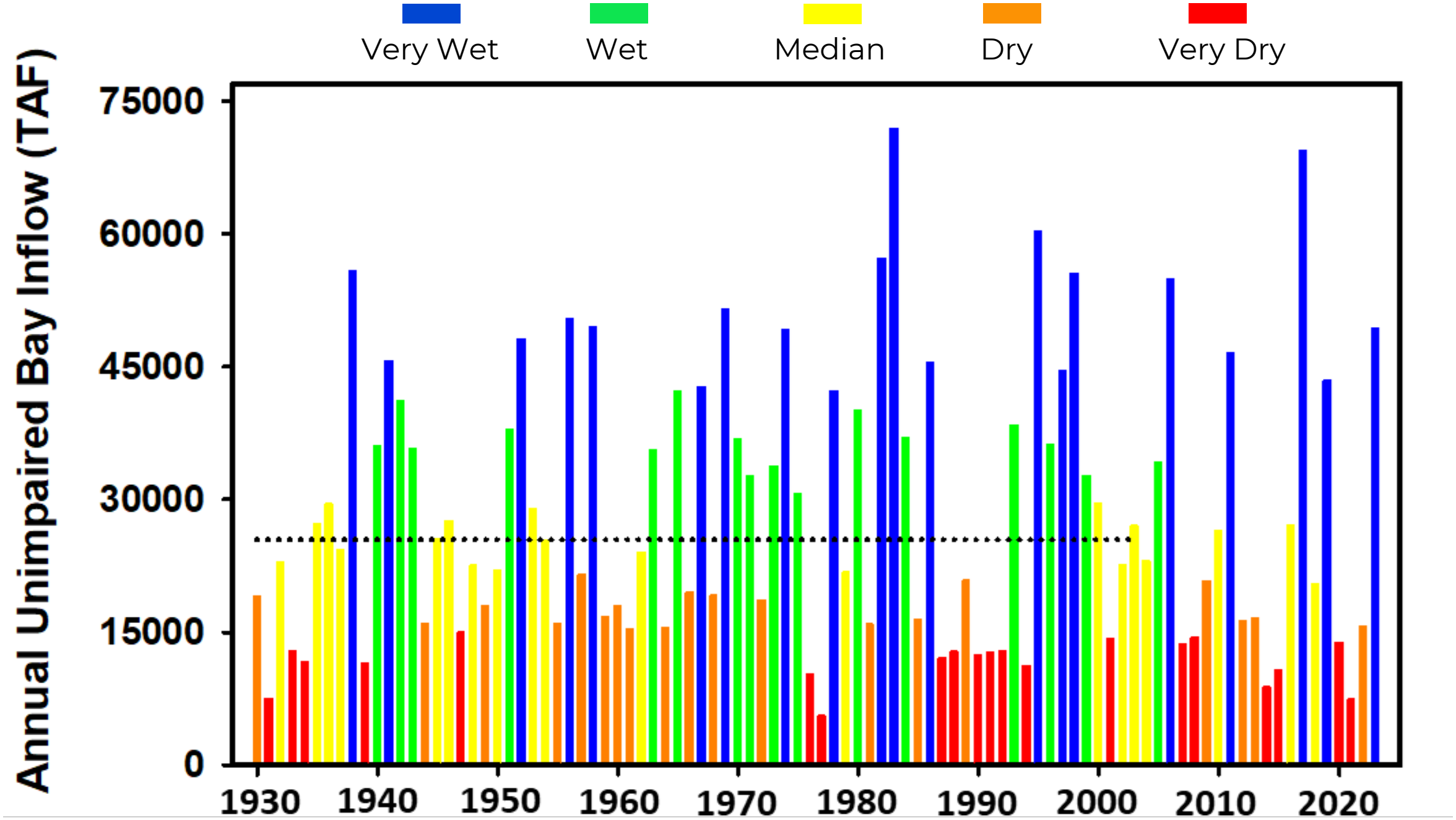


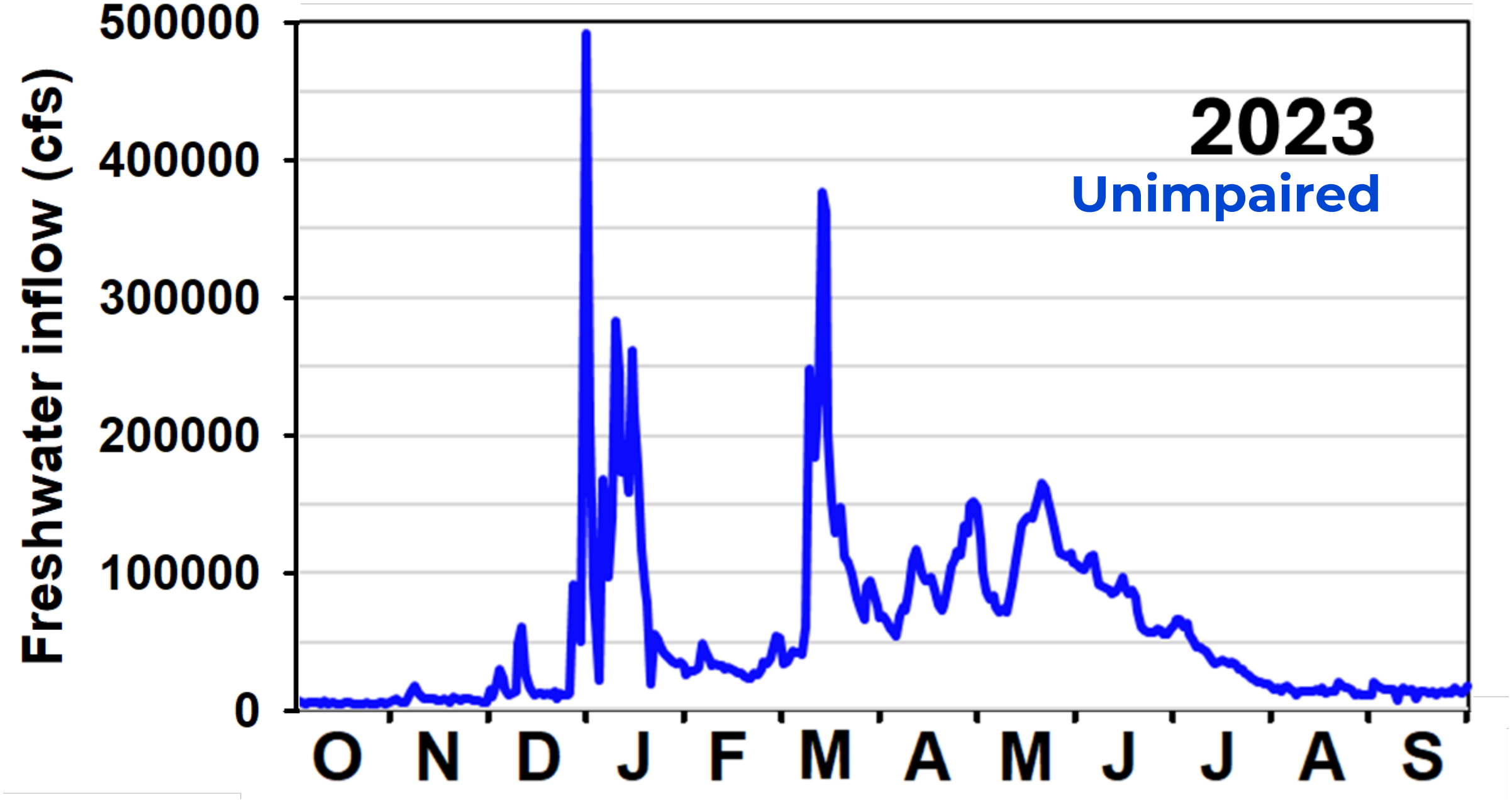
Flows, Floods, and Habitat

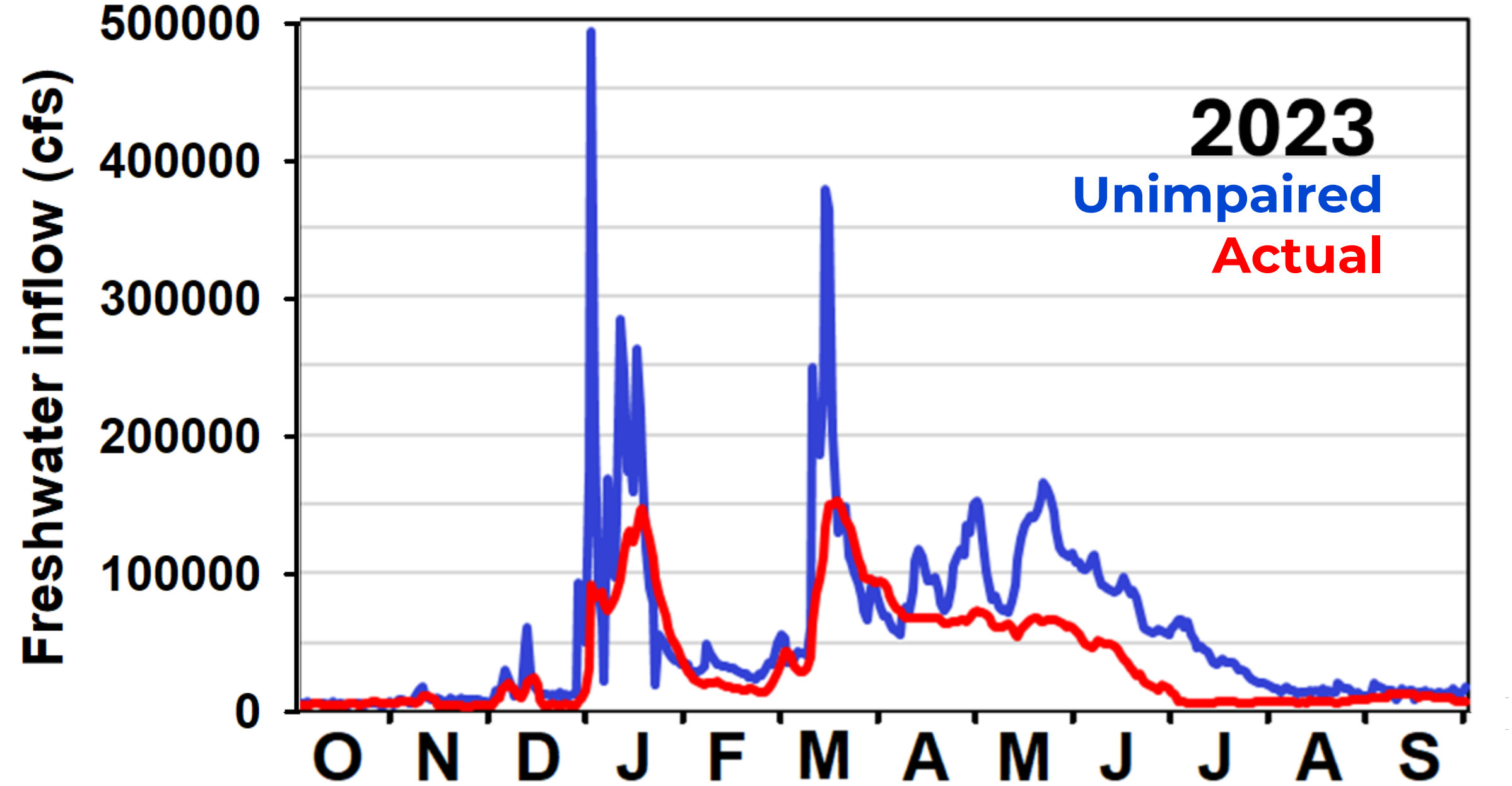
How Water Defines the Health of the Estuary

State of Our Estuary 2025 Update

Christina (Tina) Swanson, Ph.D.
tinaswanson7870@gmail.com


Very Wet
Wet
Median
Dry
Very Dry
Annual Unimpaired Bay Inflow (TAF)
75000
60000
45000
30000
15000
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020


Freshwater inflow (cfs)
500000
400000
300000
200000
100000
0
2023
Unimpaired
O
N
D
J
F
M
A
M
J
J
A
S


Freshwater inflow (cfs)
500000
400000
300000
200000
100000
0
O
N
D
J
F
M
A
M
J
J
A
S
2023
Unimpaired
Actual

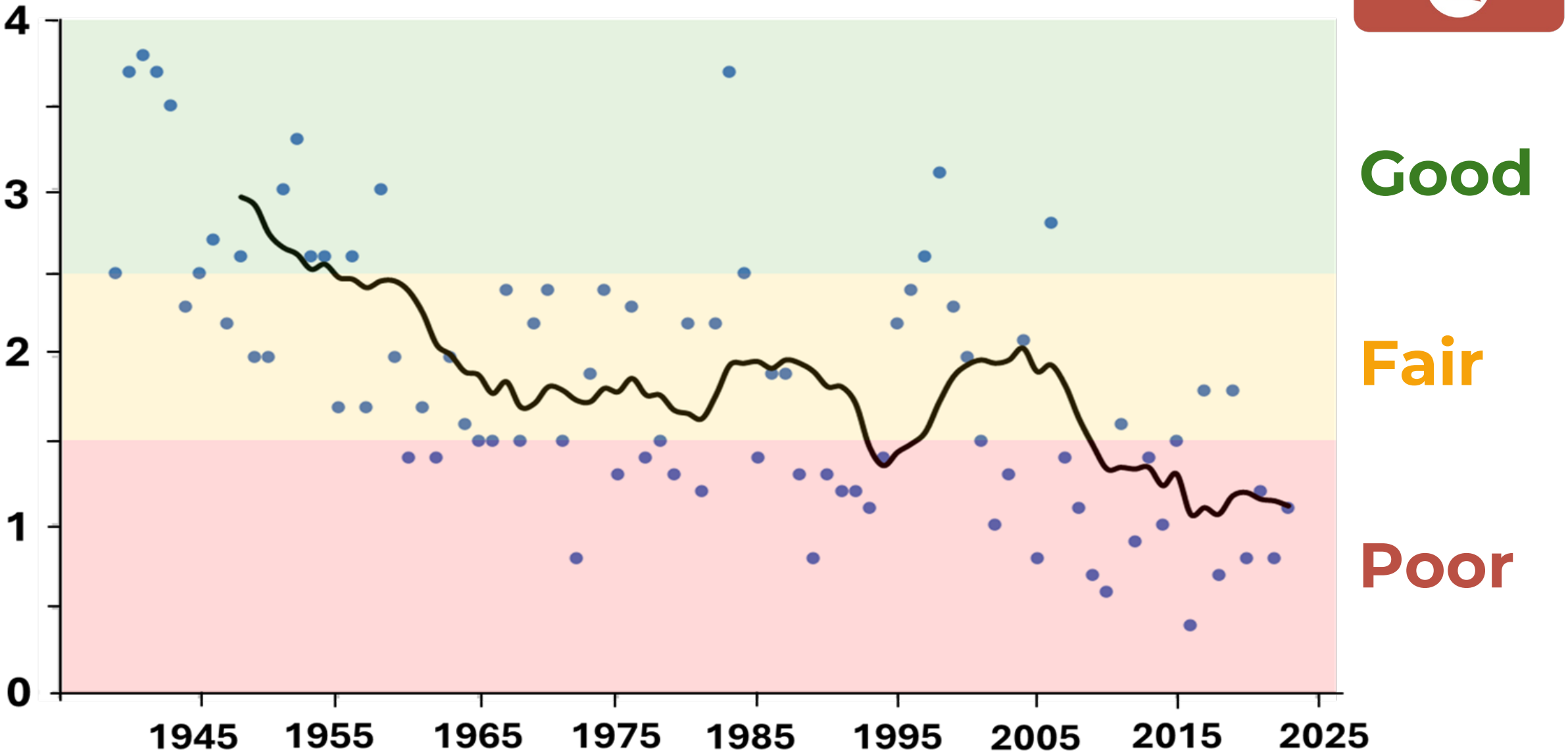
Freshwater Flow compares actual flows to unimpaired flows

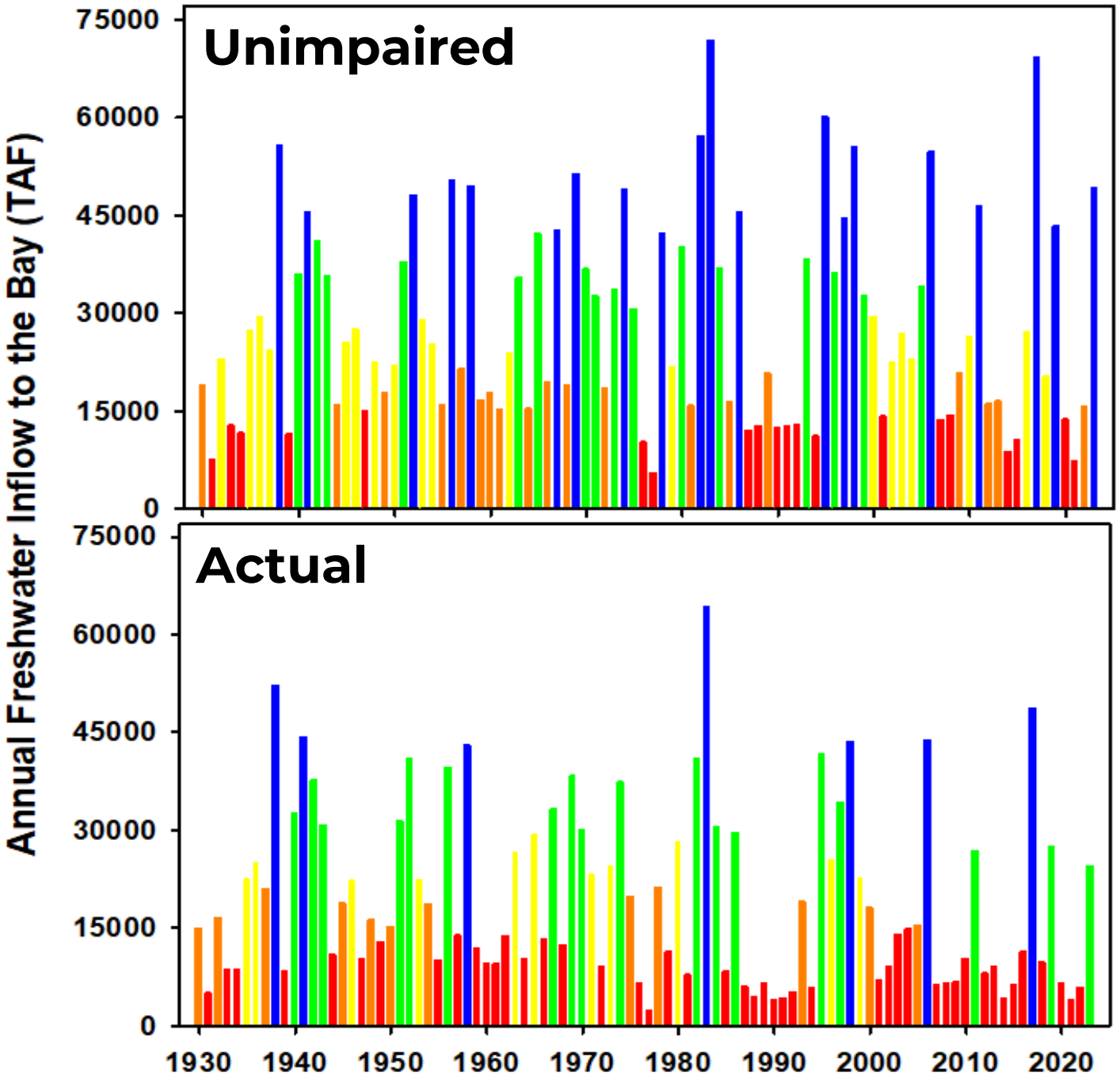
Beneficial Floods measures floodplain inundation and high Estuary inflows

Open Water measures Delta reverse flows and low salinity habitat

Freshwater Flow Index

ESTUARY





Dry Year Frequency

From 2000 to 2024

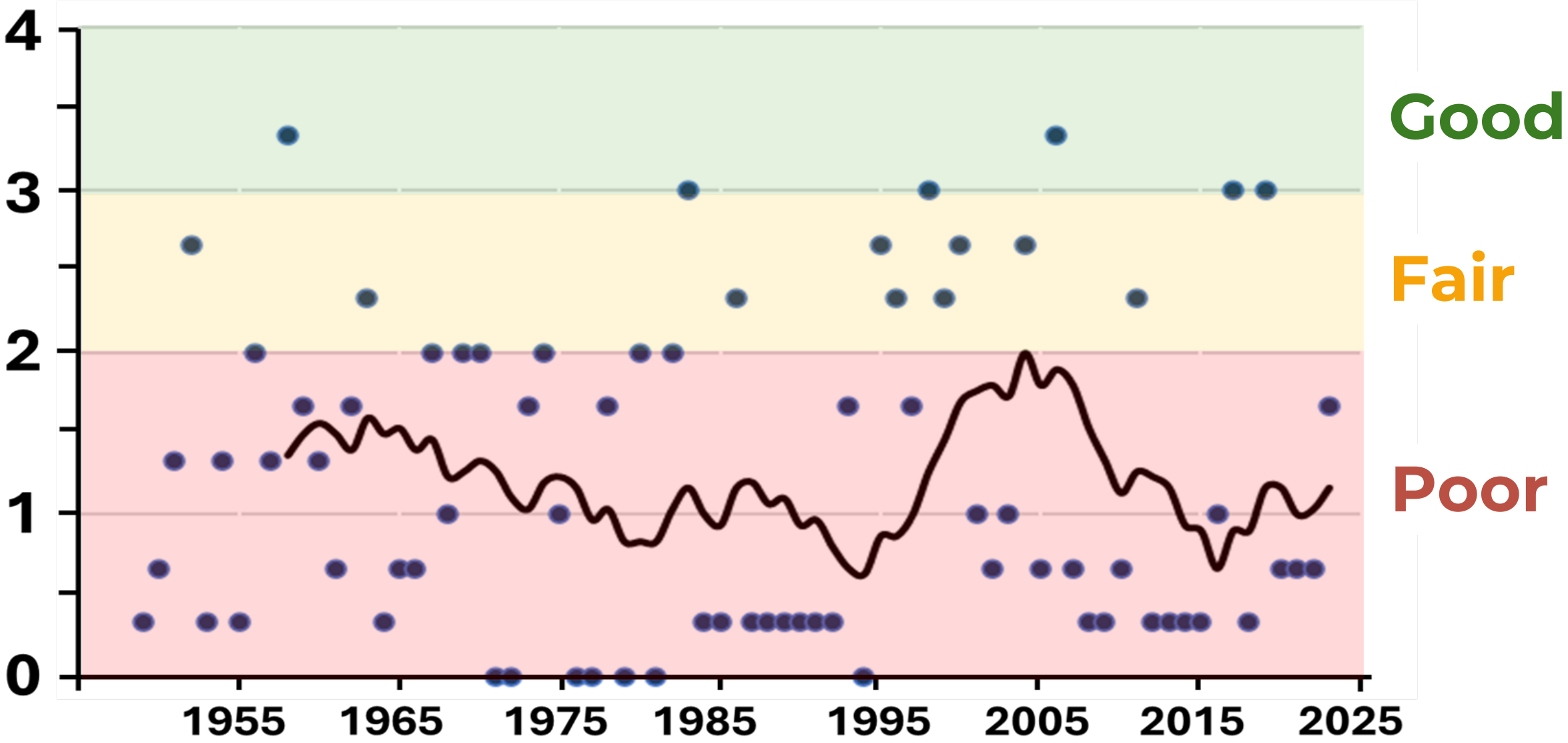
29% of years **Very Dry**

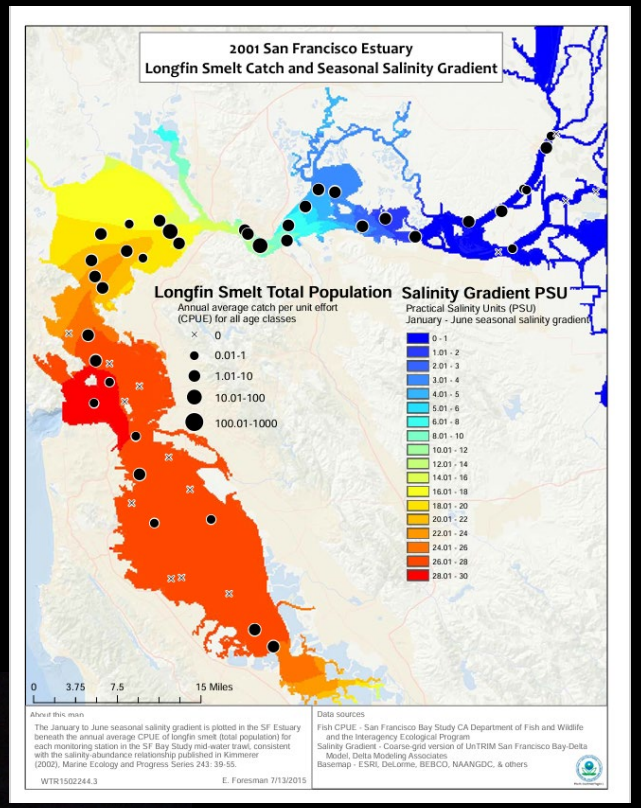
71% of years **Very Dry**

Figure 1: Location of Yolo Bypass

Beneficial Floods
Yolo Inundation

DELTA




2001 San Francisco Estuary
Longfin Smelt Catch and Seasonal Salinity Gradient
Longfin Smelt Total Population
Annual average catch per unit effort
(CPUE) for all age classes
0
0.01-1
1.01-10
10.01-100
100.01-1000
Salinity Gradient PSU
Practical Salinity Units (PSU)
January - June seasonal salinity gradient
0 - 1
1.01 - 2
2.01 - 3
3.01 - 4
4.01 - 5
5.01 - 6
6.01 - 8
8.01 - 10
10.01 - 12
12.01 - 14
14.01 - 16
16.01 - 18
18.01 - 20
20.01 - 22
22.01 - 24
24.01 - 26
26.01 - 28
28.01 - 30
0 3.75 7.5 15 Miles
About this map
The January to June seasonal salinity gradient is plotted in the SF Estuary beneath the annual average CPUE of longfin smelt (total population) for each monitoring station in the SF Bay Study mid-water trawl, consistent with the salinity-abundance relationship published in Kimmerer (2002), Marine Ecology and Progress Series 243: 39-55.
WTR1502244.3
E. Foresman 7/13/2015
Data sources
Fish CPUE - San Francisco Bay Study CA Department of Fish and Wildlife and the Interagency Ecological Program
Salinity Gradient - Coarse-grid version of UnTRIM San Francisco Bay-Delta Model, Delta Modeling Associates
Basemap - ESRI, DeLorme, BEBCO, NAANGDC, & others

Open Water
Low Salinity Habitat

BAY

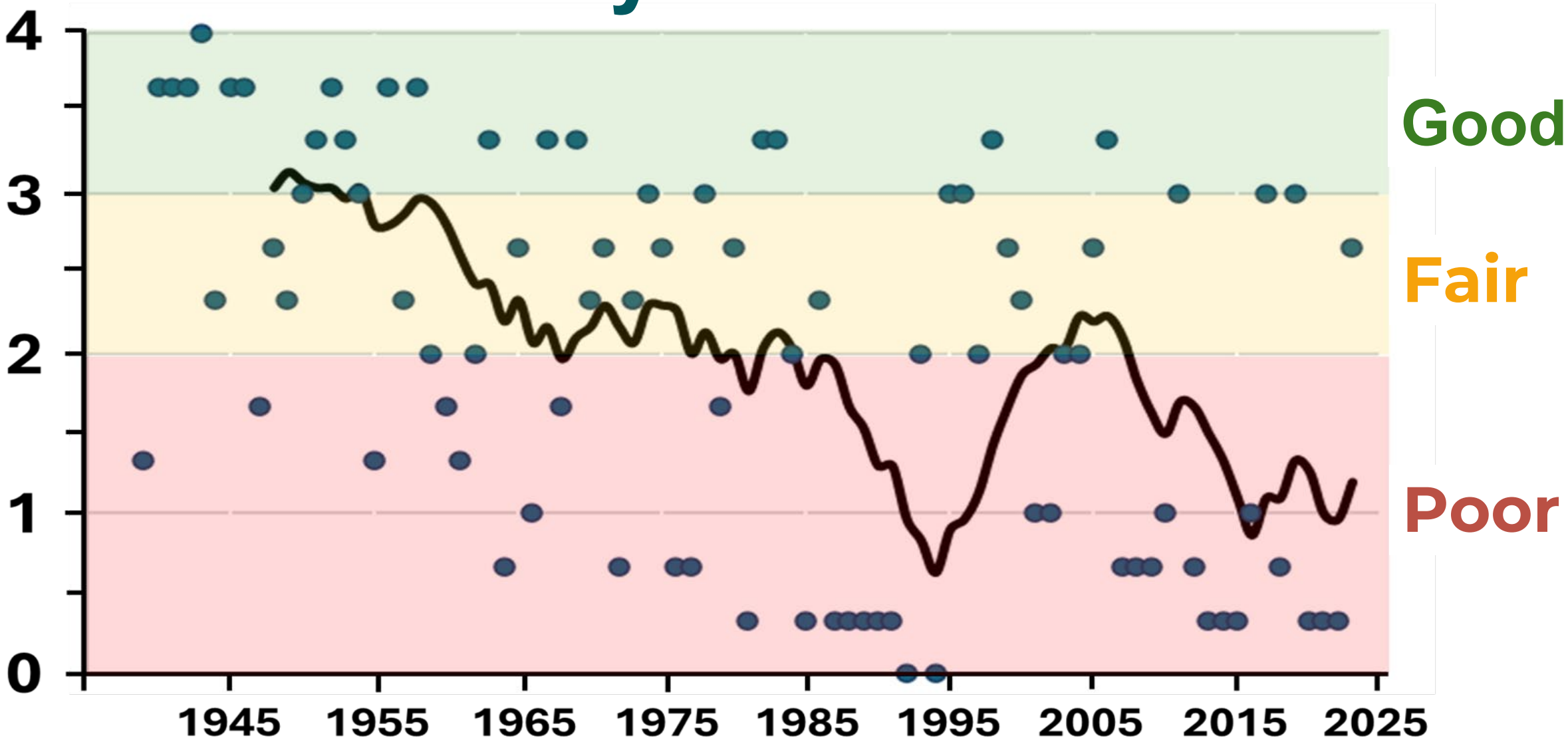


Photo Credit: Shira Belazel

Water

Photo Credit: Shira Belazel


Water
Habitats
Living Resources
Photo Credit: Shira Belazel

Photo Credit: Shira Belazel

Photo Credit: Shira Belazel

Water Quality

How is the Estuary doing?

Jay Davis, PhD
San Francisco Estuary Institute
jay@sfei.org

Photo: Shira Bezalel, SFEI


1965
FTA


2022

Good
No Change

BAY

Good
No Change

BAY

Fair
No Change

BAY DELTA

Good
No Change

BAY

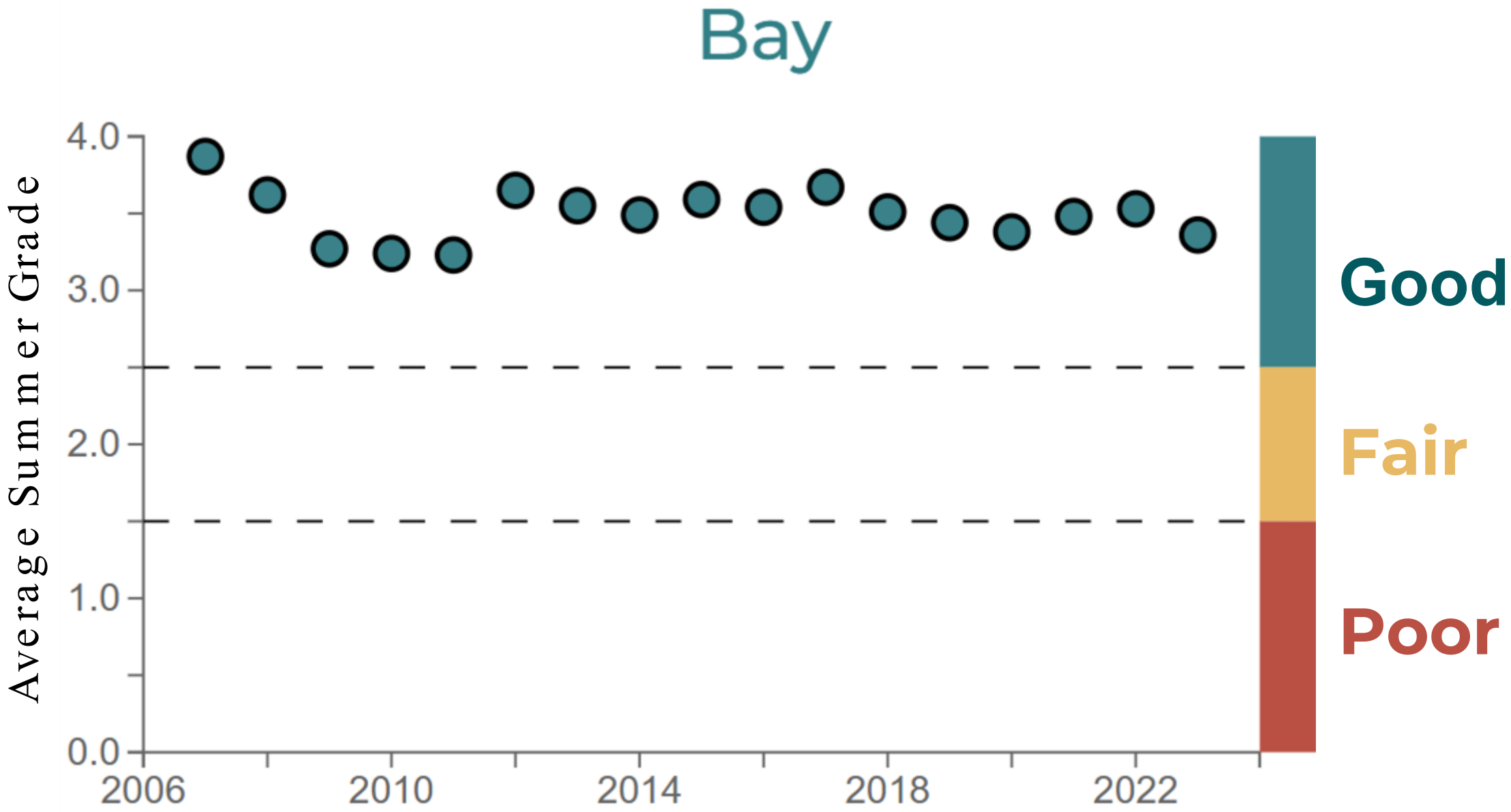
Fair
No Change

BAY DELTA

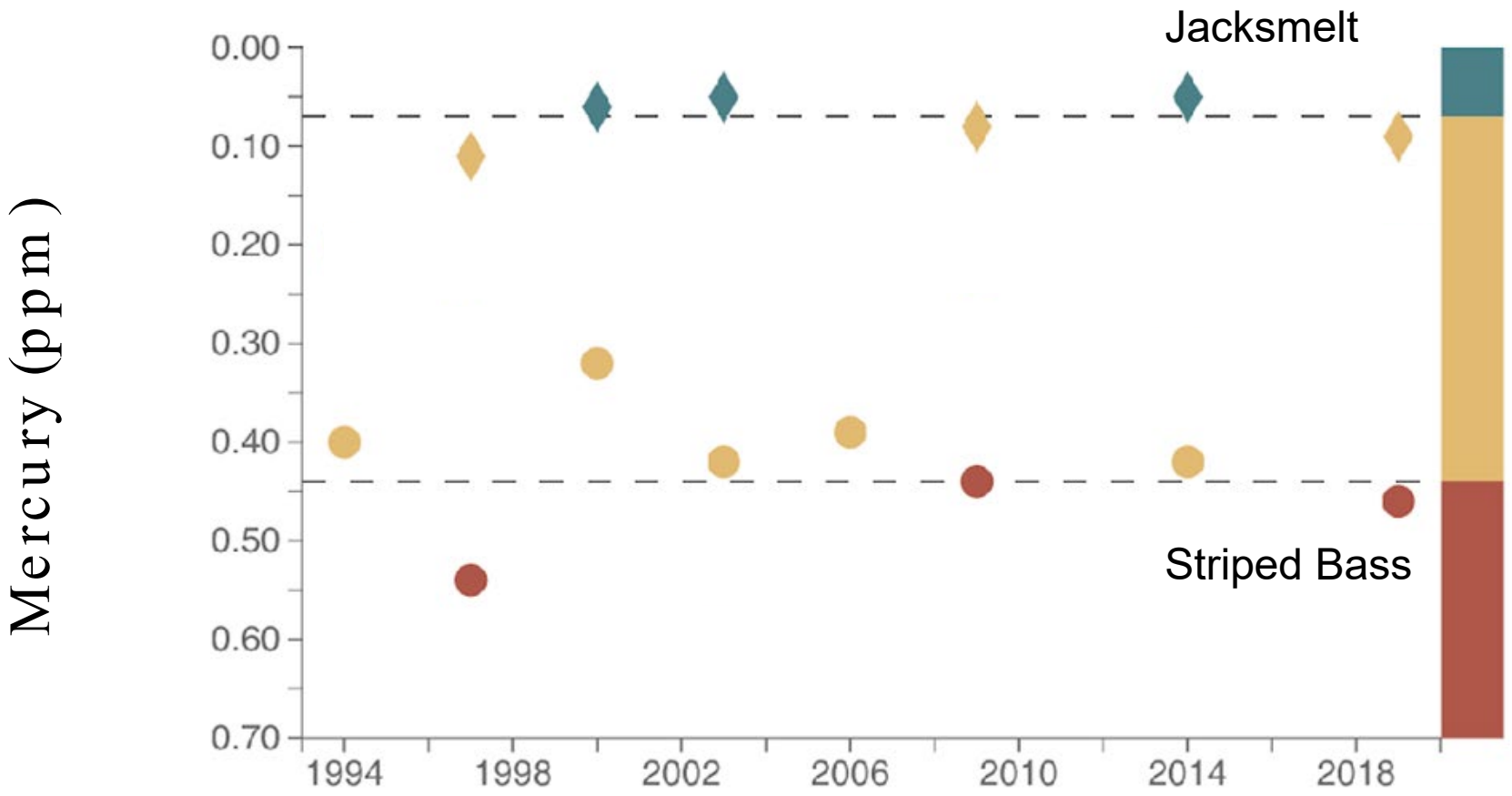
Fair
No Change

BAY

Safe for Swimming: Beach Bacteria



Safe for Eating: Mercury in Sport Fish

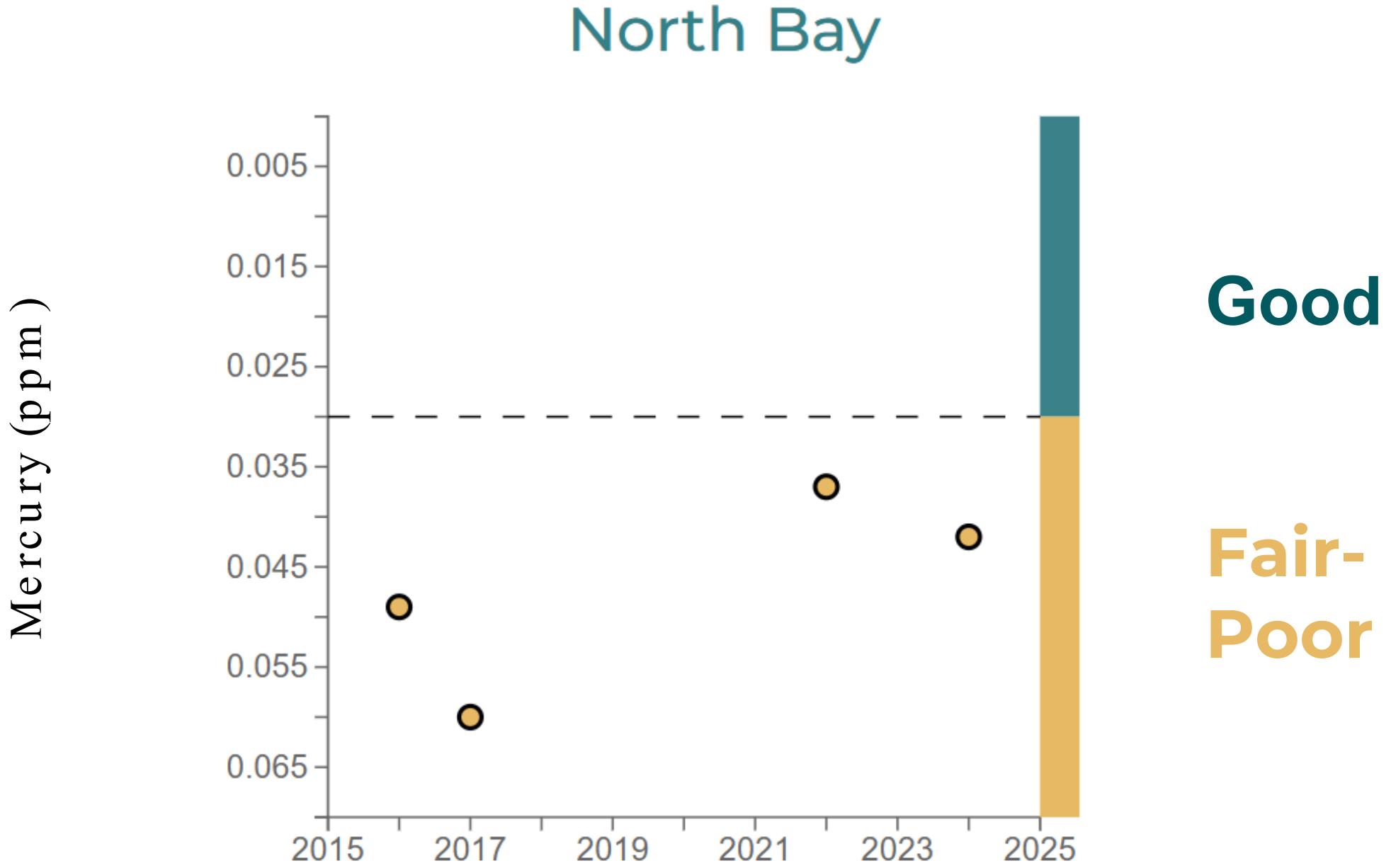


Good

Fair

Poor

Safe for Aquatic Life: Mercury in Prey Fish



A Lot More to the Story

- Nutrients
- Contaminants of Emerging Concern
- PFAS (“Forever Chemicals”)
- Pesticides

On the Bright Side

- Our region is innovative, proactive, collaborative…
- Management
- World-class monitoring
  - Bay Regional Monitoring Program
  - Nutrient Management Strategy
  - Delta Regional Monitoring Program
- Increased funding (at the moment)

San Francisco Chronicle
THE VOICE OF THE WEST
Founded in 1865 by Charles and M.H. de Young
A HEARST NEWSPAPER
William Nagel, Publisher and CEO

Emilio Garcia-Ruiz Editor in Chief
Demian Bulwa Director of News
Matthew Fleischer Editorial Page Editor
Nicole Frugé Director of Visuals
Michael Gray Director of Features and Daily Enterprise
Ron Kitagawa Director of Production
Jesse Lewis Director of Culture and Operations
Danielle Mollette-Parks Creative Director
Jess Marmor Shaw Director of Audience
Sean Jacobsen SVP, Advertising
Elaine Lo VP, Finance
Jeff Lawson SVP, Print Operations
Sean Kurysh VP, Human Resources

OPEN FORUM

A healthier S.F. Bay is within reach

By Andrew Gunther, Alexis Strauss Hacker and Jay Davis

It was major news in August when a hazardous algae bloom turned San Francisco Bay water a murky brown color and killed a reported 10,000 yellowfin goby, hundreds of striped bass and white sturgeon, and a small number of endangered green sturgeon.

That kind of attention may seem understandable today, but just a couple of generations ago, it's likely barely anyone would have noticed. Why? Because fish die-offs used to be far more common.

During the 1960s and early 1970s, huge fish die-offs were reported in San Francisco Bay almost every year, with over 100,000 fish dying in 1965 alone. Our bay had become a dumping ground for minimally treated sewage, industrial wastewater, polluted runoff and solid waste — unfit for aquatic life and unsafe for swimming. This was the state of the bay for decades. A 1941 report described it as "obnoxiously and notoriously foul and an affront to civic pride and common decency."

But California stepped up. In 1969, our Legislature passed the Porter-Cologne Act, giving the San Francisco Bay Regional Water Quality Control Board the power to protect and restore our region's waters. The federal government added momentum in 1972 through the Clean Water Act and, within just 15 years, the bay showed stunning improvement. After investments exceeding $3 billion in federal, state and local funds — including advanced wastewater treatment plants — bay oxygen levels increased while bacteria and toxic metal

Brontë Wittpenn/The Chronicle

Thousands of fish in Lake Merritt and throughout San Francisco Bay were killed by an algae bloom in August.

national acclaim and has helped make the bay one of the best-monitored waterbodies in the world.

A cleaner San Francisco Bay required not only the treatment of discharge by

During the 1960s and early 1970s, huge fish die-offs were reported in San Francisco Bay almost every year.

Soft Shores

Tracking natural infrastructure along the Estuary's shore

Cate Jaffe, MEM | SFEI

catej@sfei.org

Katie McKnight, MLA-EP | SFEI

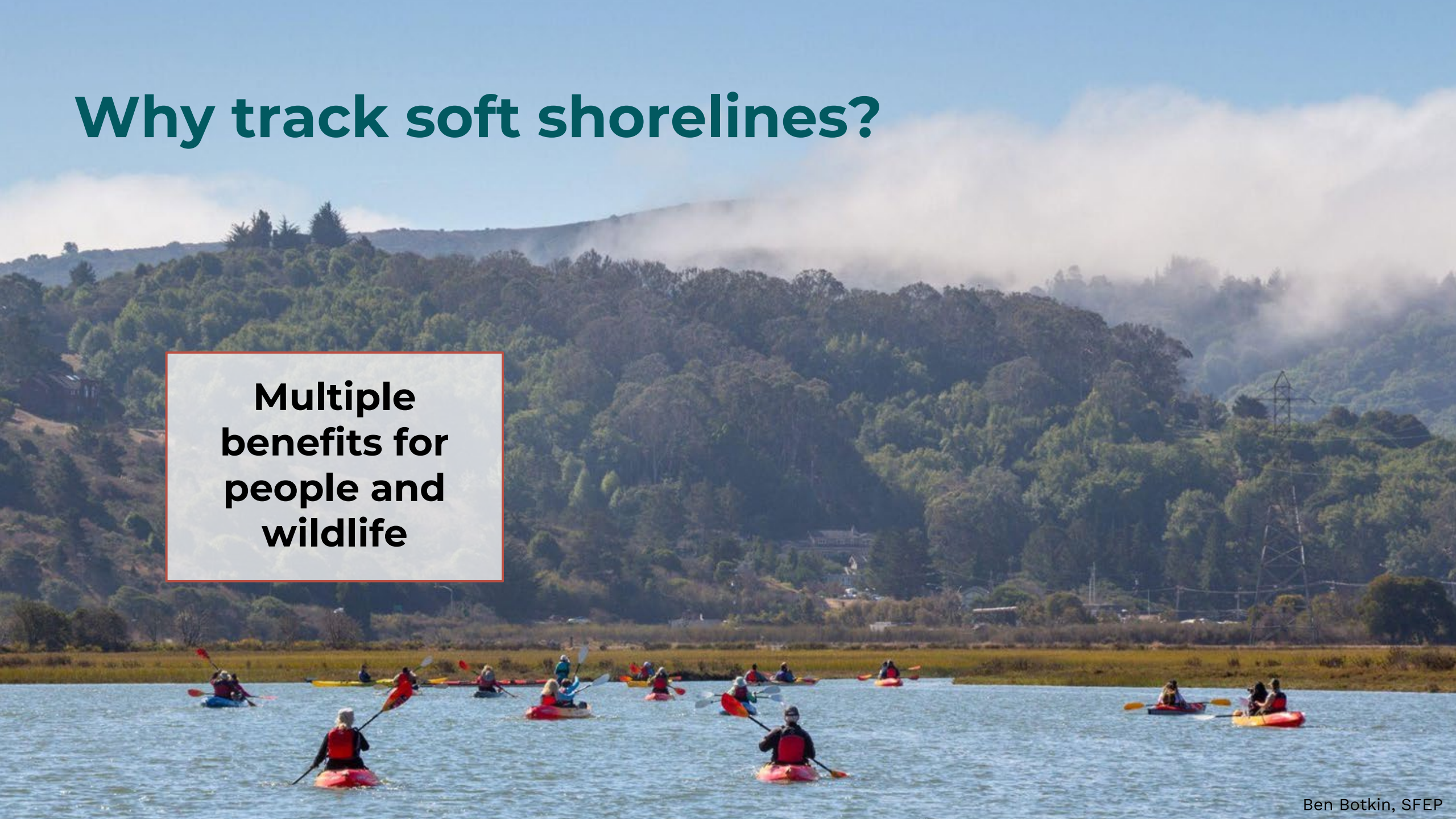
Photo: Shira Bezalel. Editing: Vanessa Lee, SFEI

Why track soft shorelines?

Ben Botkin, SFEP

Why track soft shorelines?

Multiple benefits for people and wildlife



Ben Botkin, SFEP

Why track soft shorelines?

Multiple benefits for people and wildlife

Adaptable and self-sustaining

Ben Botkin, SFEP

Why track soft shorelines?

Multiple benefits for people and wildlife

Adaptable and self-sustaining

Fills gaps in existing metrics and indicators

Ben Botkin, SFEP

What is a soft shore?


Ben Botkin, SFEP


DWR

Softer shores have undeveloped land or managed wetlands behind the shoreline and natural infrastructure – such as tidal marshes – in front


Mark Jones, MTC

Approach

1

classify & summarize land cover within 7,000+ segments

Approach

1

classify & summarize land cover within 7,000+ segments

2

rank shoreline segments continuously from “softest” to “hardest”

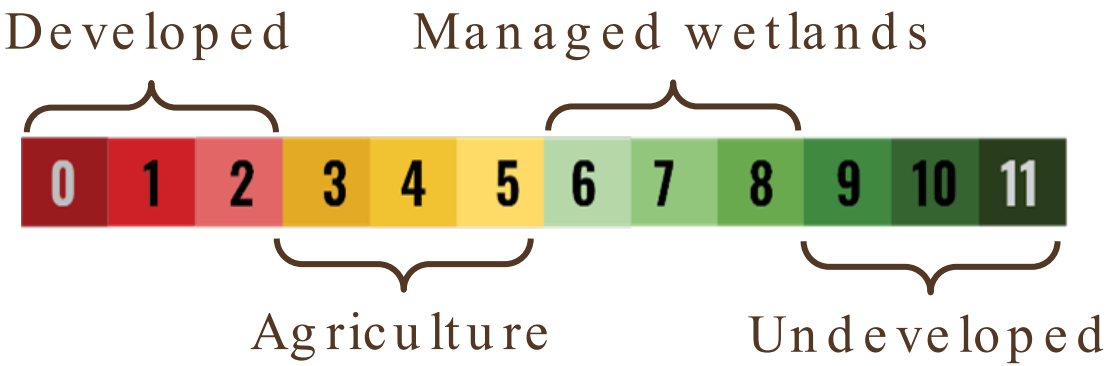
Approach

1

classify & summarize land cover within 7,000+ segments

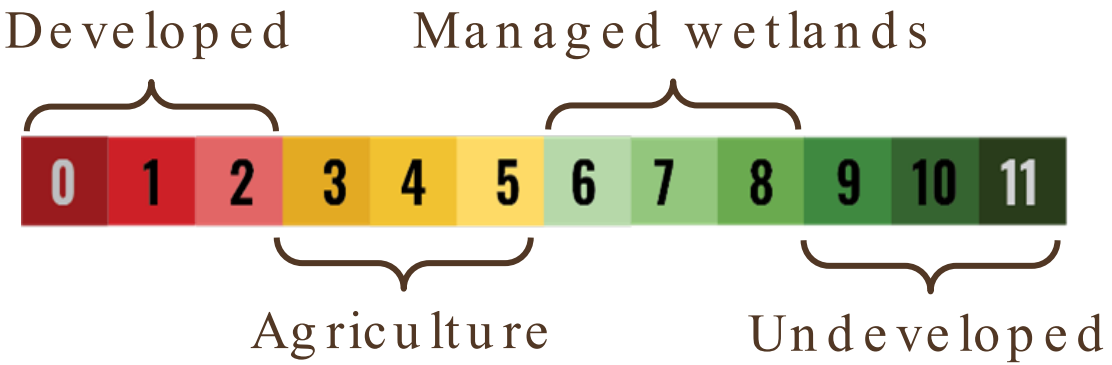
2

rank shoreline segments continuously from "softest" to "hardest"



Approach

1. classify & summarize land cover within 7,000+ segments
2. rank shoreline segments continuously from "softest" to "hardest"
3. calculate regional index

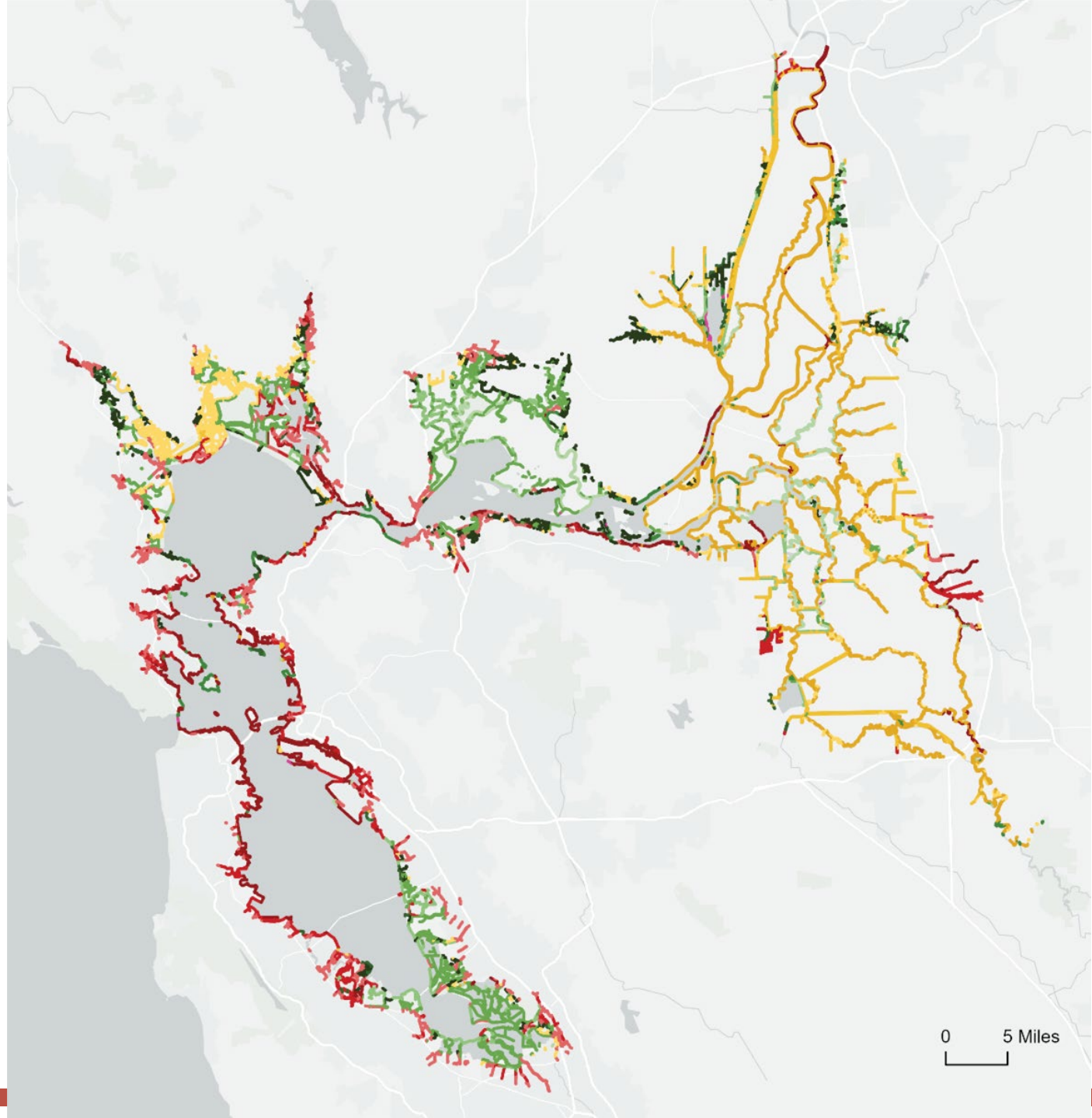


Results

Ranking the shoreline

The “softest” shorelines

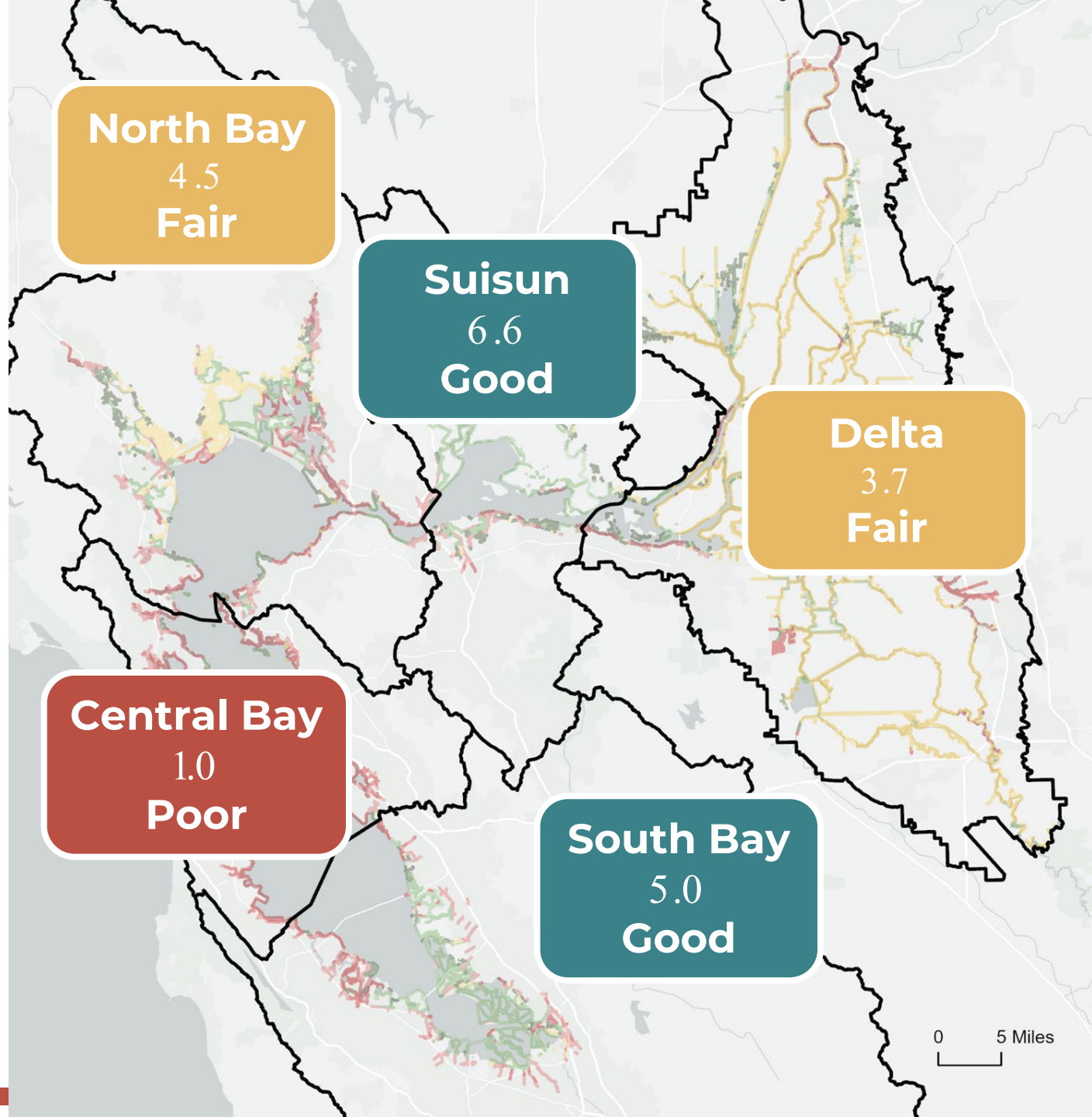
The “hardest” shorelines



Results

Final Scores

Shoreline rankings are used to calculate a single **Index** for each region



Future updates will.....

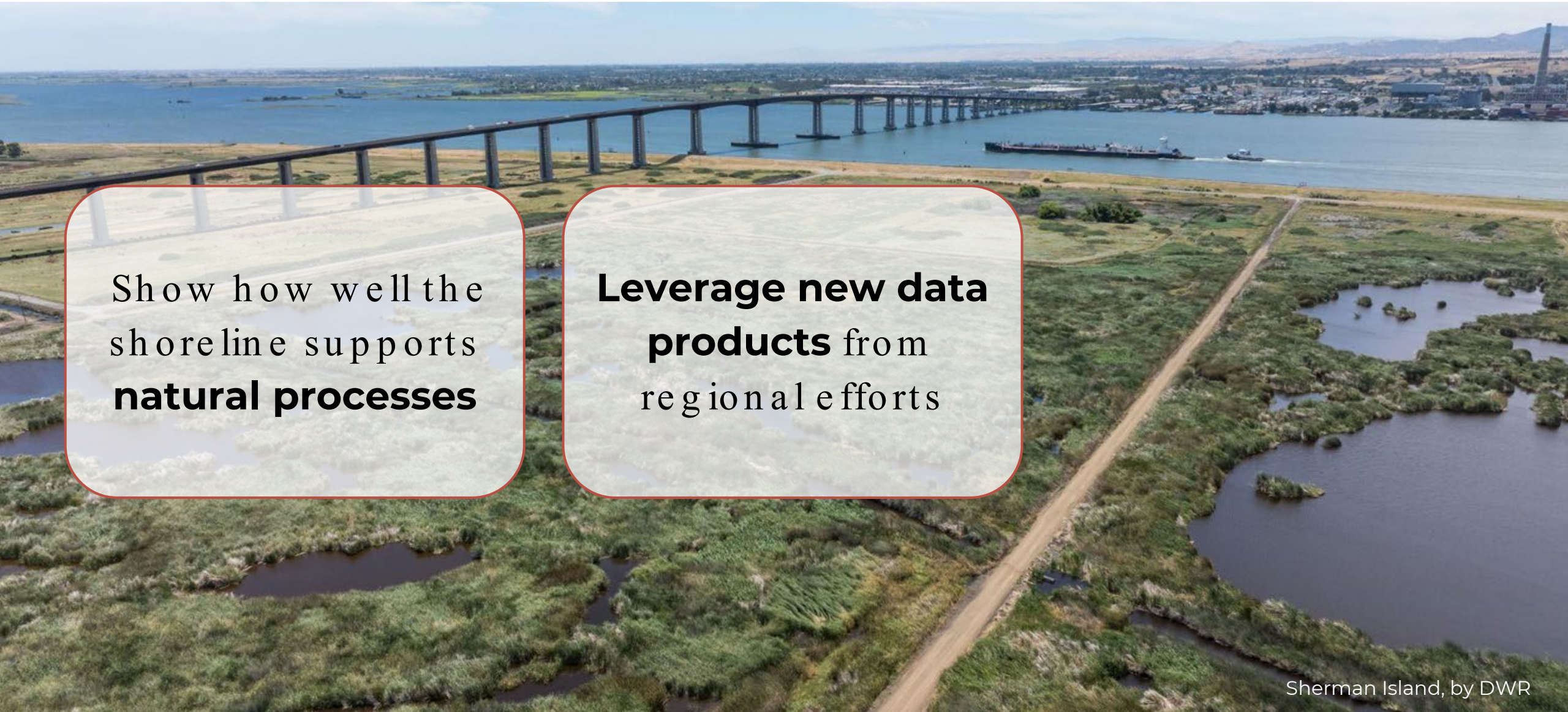
Sherman Island, by DWR

Future updates will.....

Show how well the shoreline supports **natural processes**

Sherman Island, by DWR

Future updates will.....

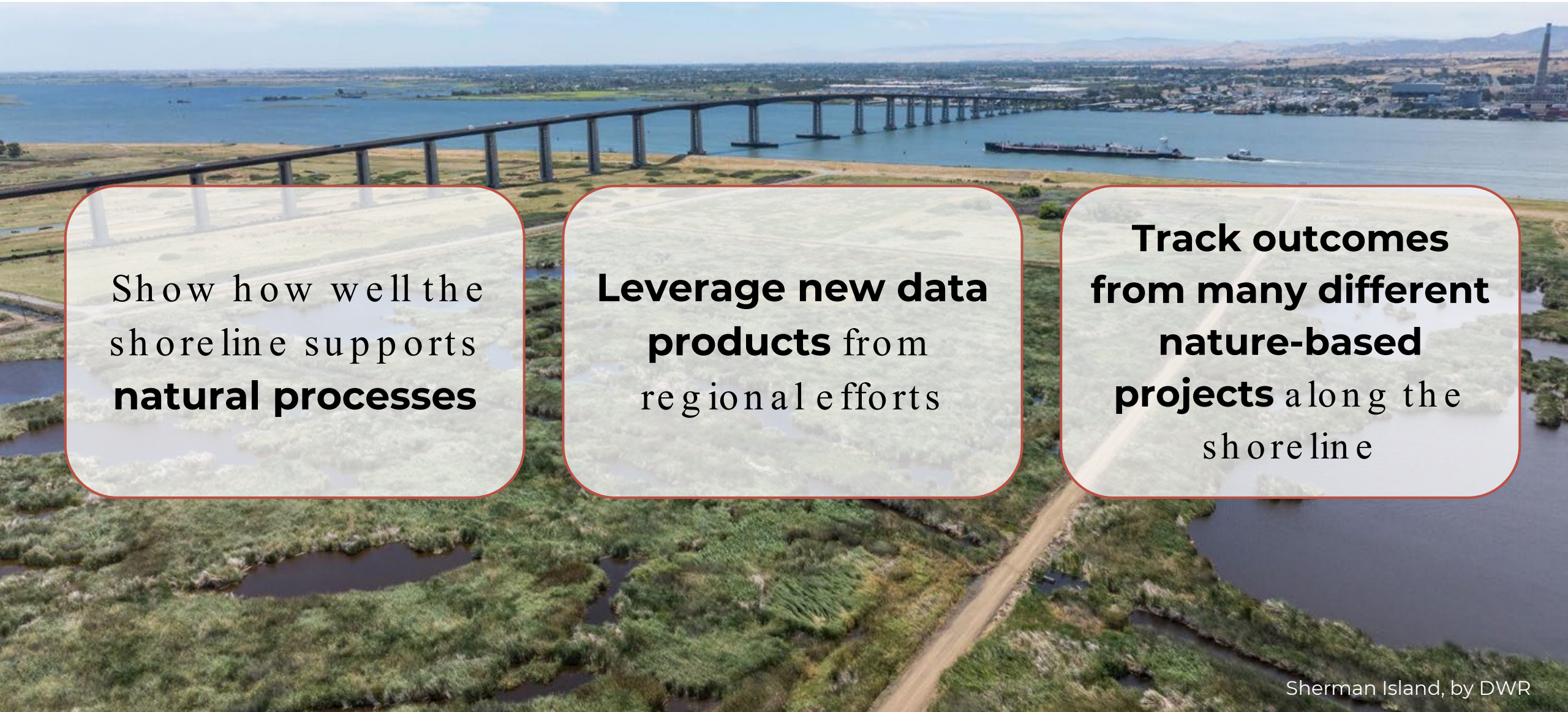


Show how well the shoreline supports **natural processes**

Leverage new data products from regional efforts

Sherman Island, by DWR

Future updates will.....



Show how well the shoreline supports **natural processes**

Leverage new data products from regional efforts

Track outcomes from many different nature-based projects along the shoreline

Sherman Island, by DWR

Bay and Delta Native Fish Communities

Stability in the Bay, declines in the Delta, and a hope for resilience & persistence

Dr. Levi S. Lewis[1,2]
lslewis@ucdavis.edu

Dr. James A. Hobbs[1]
jahobbs@ucdavis.edu

[1]UC Davis, [2]Accreting Analytics

Image Credit Jim Ervin OGFL

Native Fish Communities in the SFE

- **Habitats**
  - Pelagic, Demersal, Littoral, Wetland
- **Protected spp**
  - Delta Smelt, Longfin Smelt, Steelhead, Sturgeon
- **Trophic Level**
  - Forage fish (smelt, anchovies), Predators (salmon, sturgeon, sharks, halibut)
- **Life history**
  - Freshwater, Estuarine, Marine, Diadromous
- **Stressors**
  - Water diversions & exports, pollution, non-natives, fishing, trophic collapse, climate

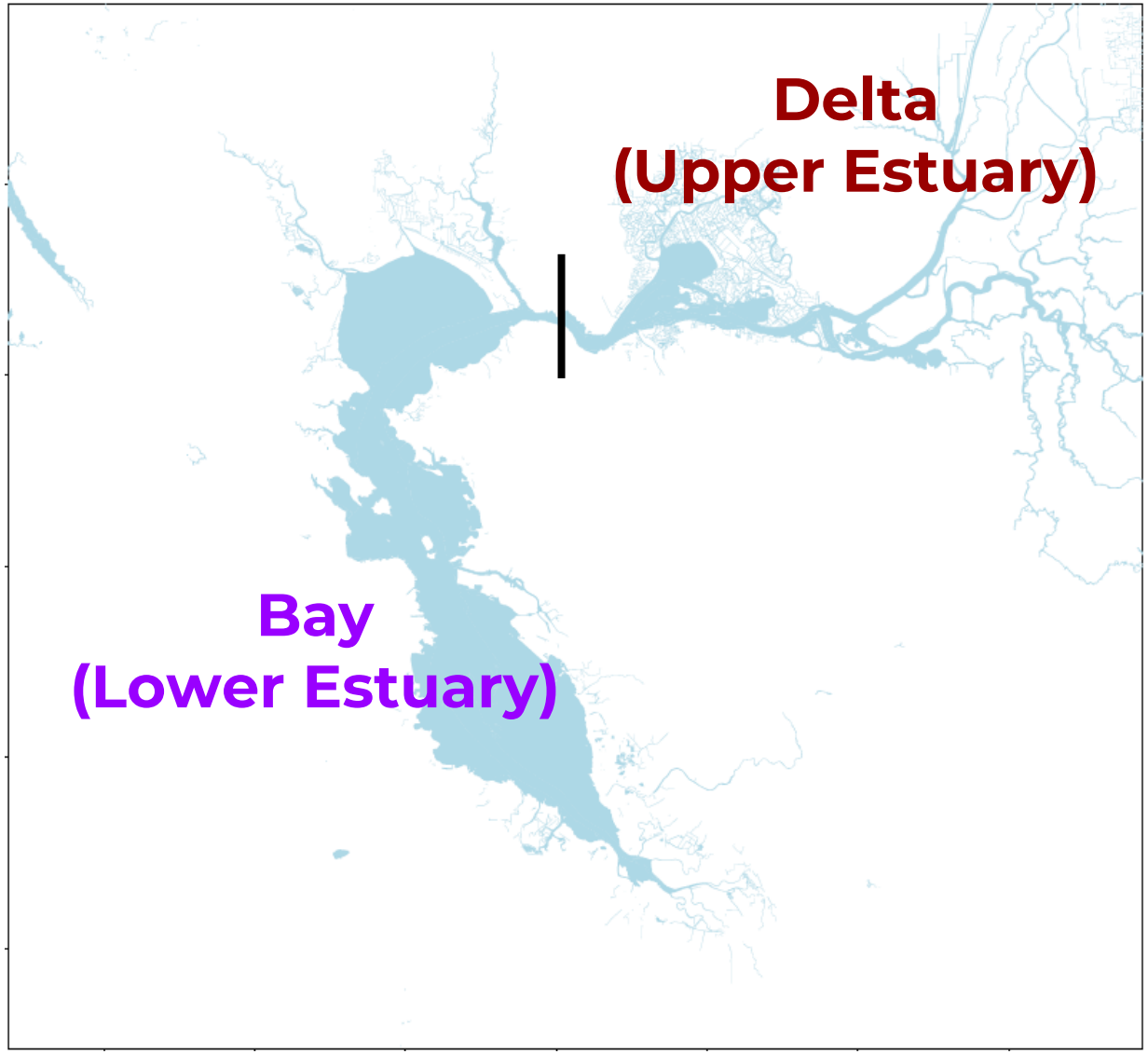
Fishes as indicators: *native fish communities reflect integrated ecological responses of aquatic fauna to multiple stressors; thus indicating the Estuary's ability to sustain native species that evolved to survive within its dynamic environment.*

SFE Regions

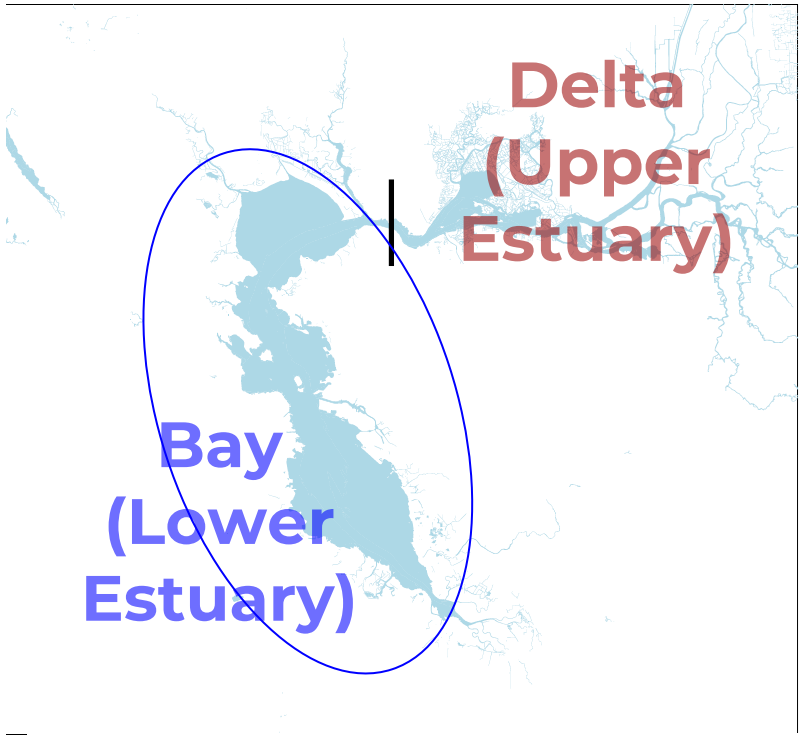
- **Delta (Upper Estuary)**
  - Sac-SJ R. Delta
  - Suisun Marsh,
  - Suisun Bay

- **Bay (Lower Estuary)**
  - San Pablo Bay
  - Central Bay
  - South Bay

- ***Indicator Scores***
  - *0 (very poor)* to *4 (excellent)*
  - *Analyses based on prior work (B. Bennett, C. Swanson, A. Weber -Stover, J. Rosenfield)*
  - *Regions separated in 2025 report*



Bay Fish Communities



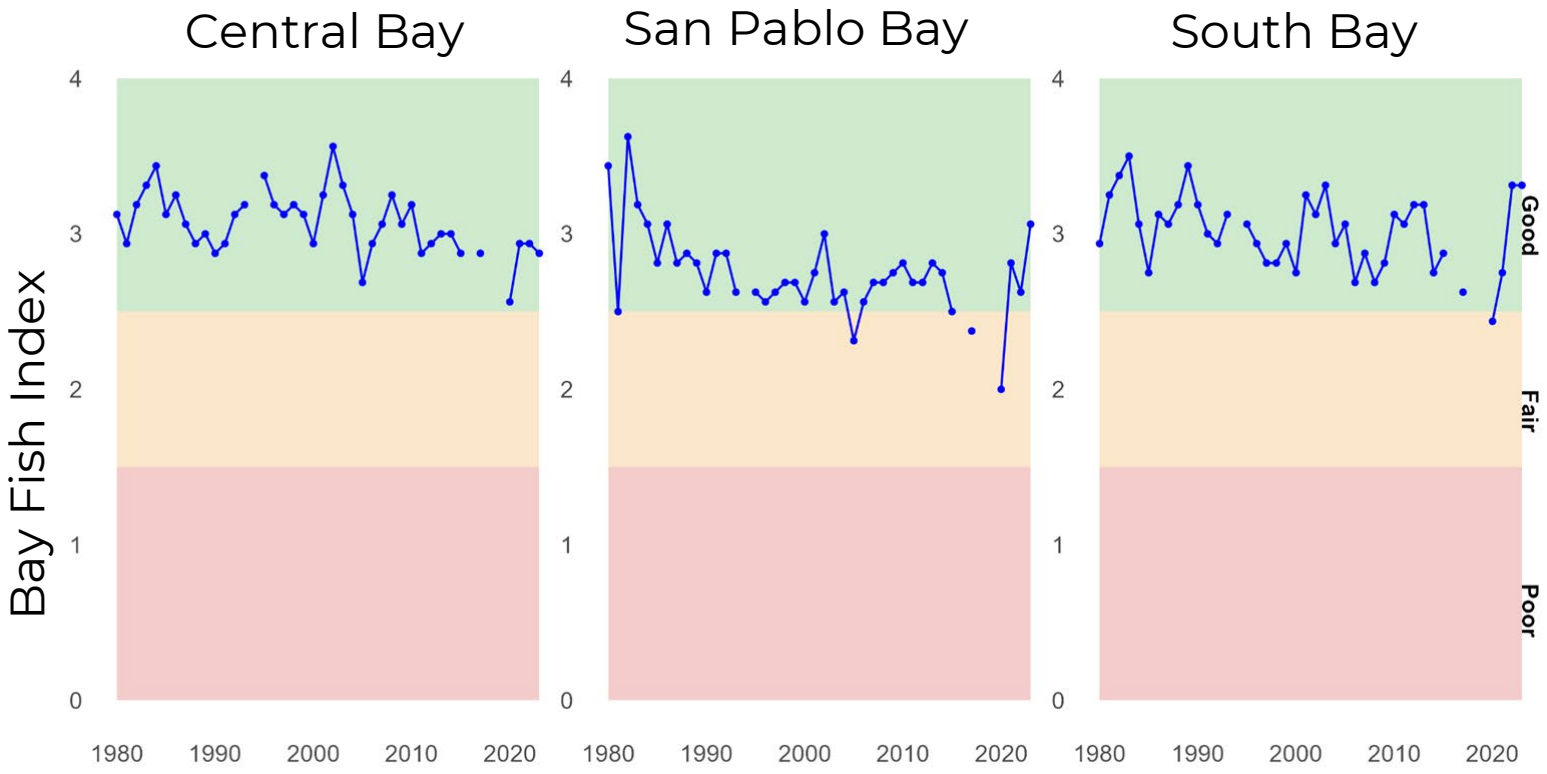
Longfin Smelt (*Spirinchus thaleichthys*)

Photo Credit: Levi Lewis

Surveys: SF Bay Study

Bay Fish Communities

Integrated Bay Fish Index (by region)



Metrics:

Native Abundance
Composition
Distribution

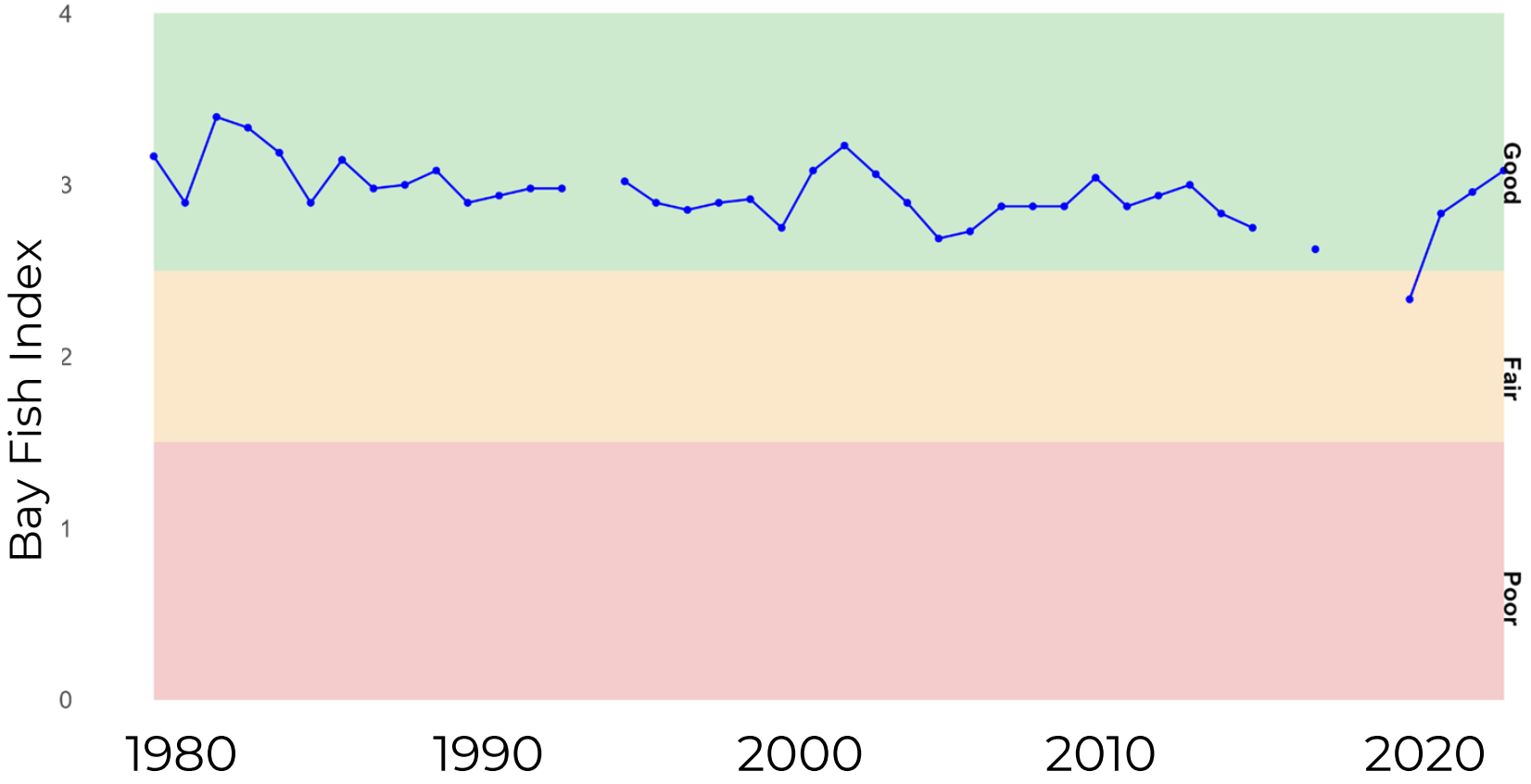
Regions:

San Pablo Bay
Central Bay
South Bay

- high native abundance
- native dominance
- broad distribution

Bay Fish Communities

Integrated Bay Fish Index



***Metrics**:*

Native Abundance
Composition
Distribution

***Regions**:*

San Pablo Bay
Central Bay
South Bay

- high native abundance
- native dominance
- broad distribution

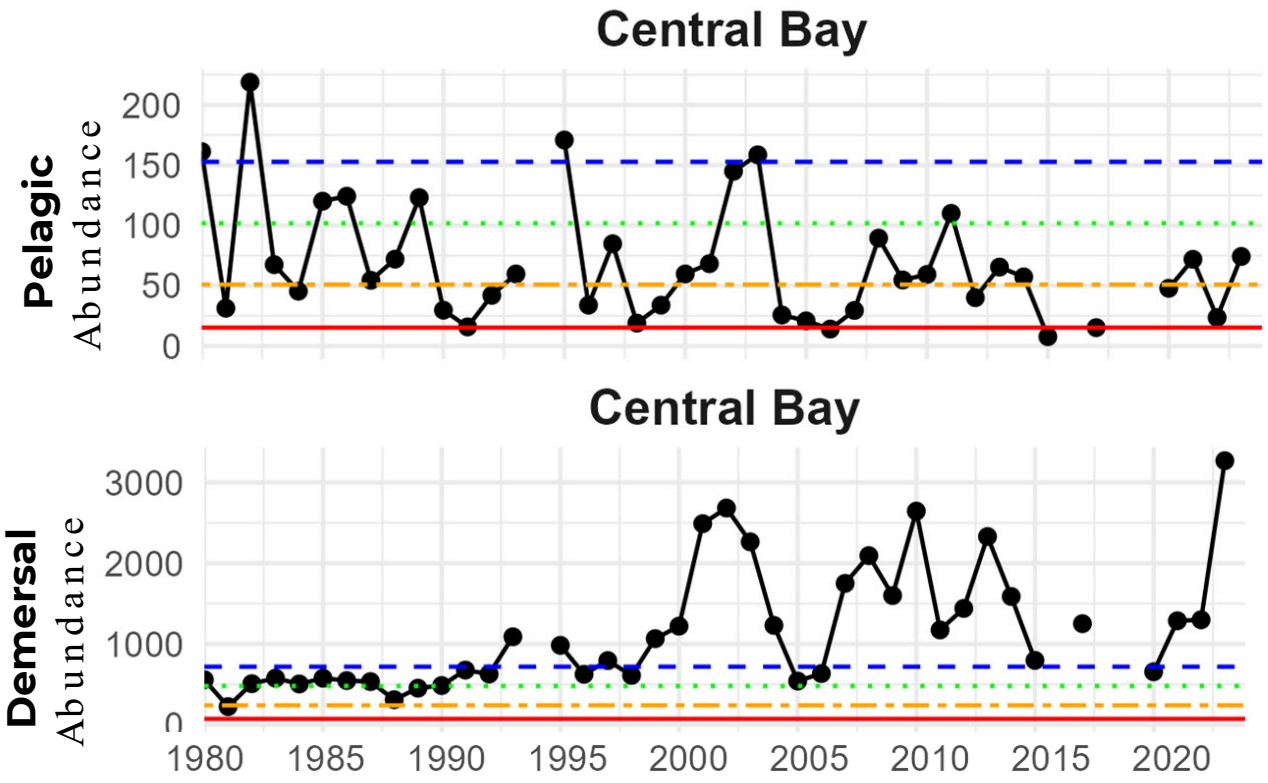
Bay Fish Communities

***Metrics**:*

Native Abundance
Composition
Distribution

***Regions**:*

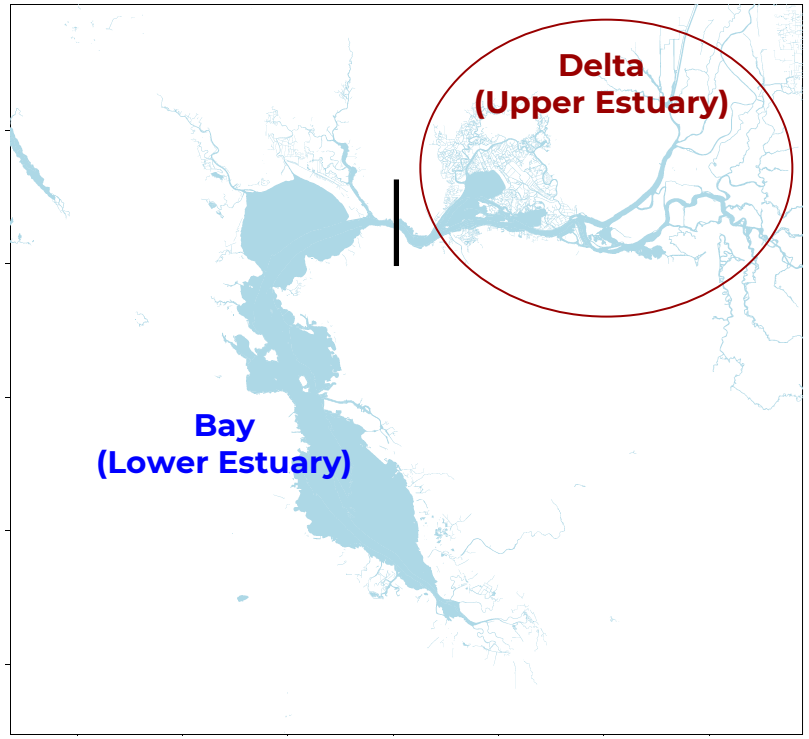
San Pablo Bay
Central Bay
South Bay



Interesting Observation

- Opposing long-term patterns in pelagic/demersal abundance scores
- May indicate different forcings in open-water and benthic habitats/communities

Delta Fish Communities

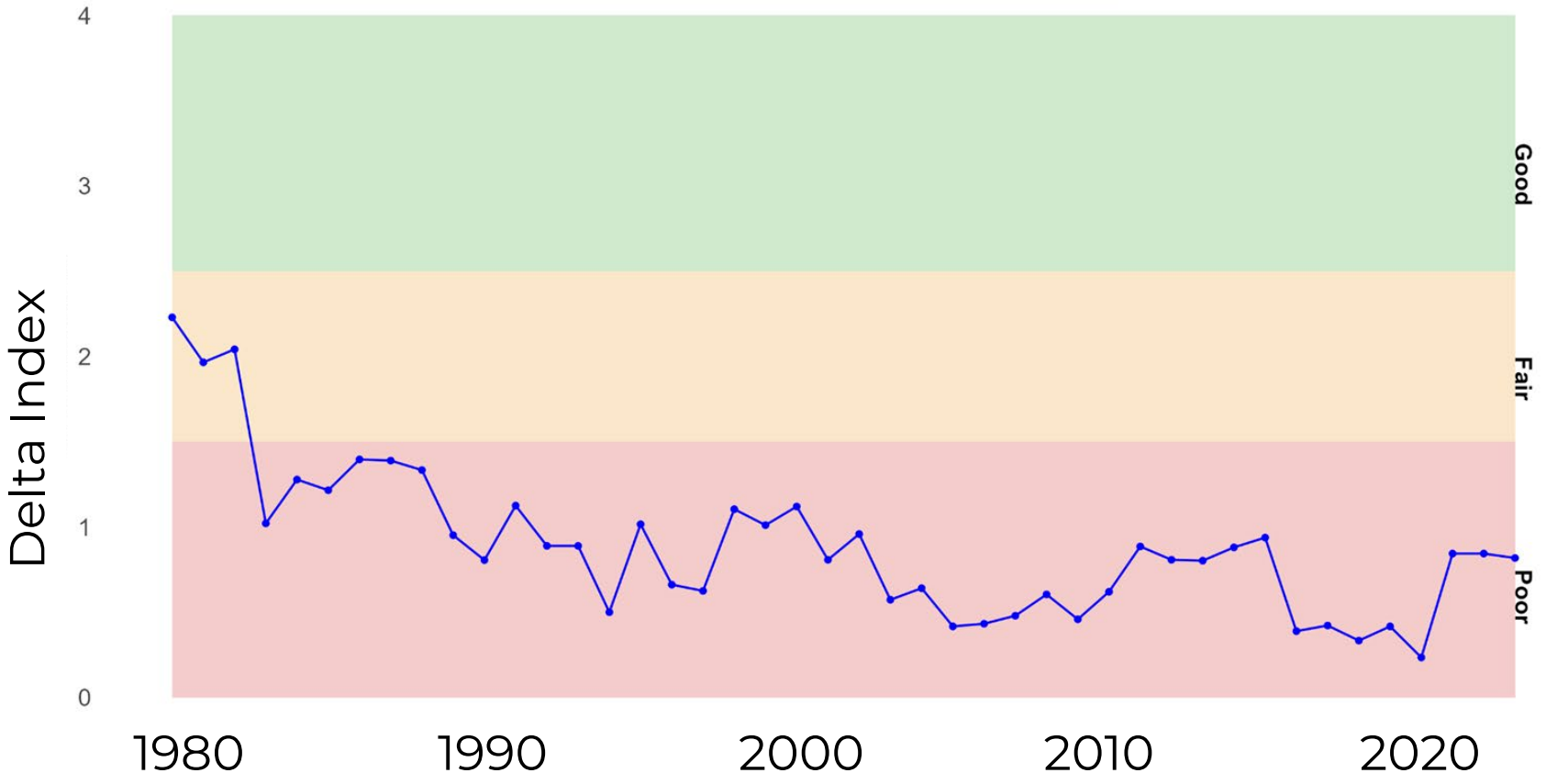


Delta Smelt (*Hypomesus transpacificus*)

Photo Credit: Levi Lewis

Surveys: FMWT, DJFMP, SMFS, *(SF Bay Study)*

Delta Fish Communities



***Metrics**:*

Native Abundance

Composition

***Zones**:*

Pelagic

Littoral

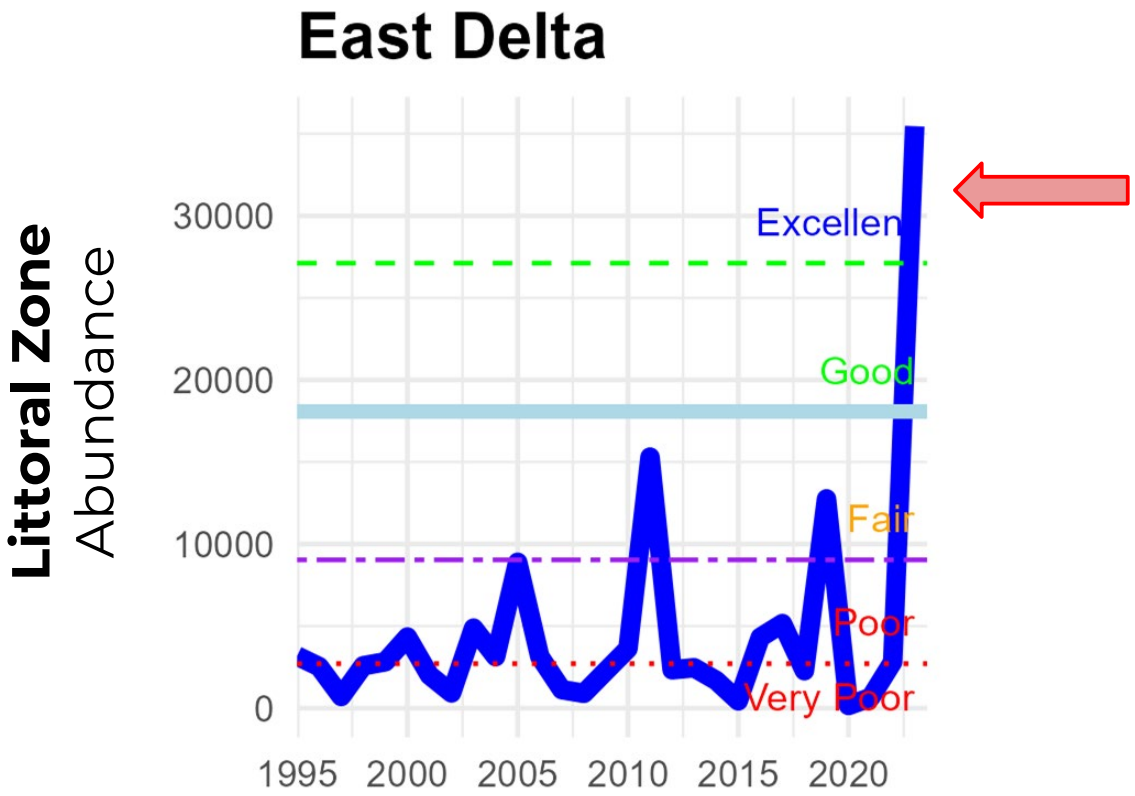
Wetland

- low native abundance
- non-native dominance

Delta Fish Communities

***Metrics**:*
Native Abundance
Composition

***Zones**:*
Pelagic
Littoral
Wetland



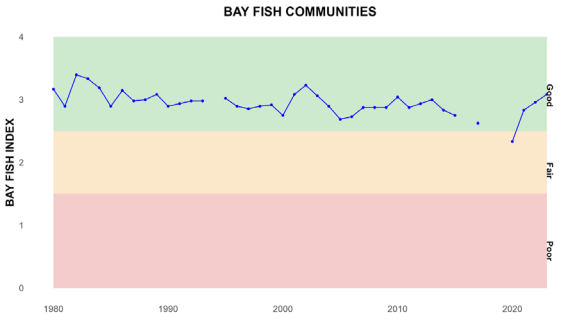
Interesting Observation

- Recent regional boom in cyprinids in littoral zone (beach seine) dataset
- Mean status is still poor
- Evidence of resilience?

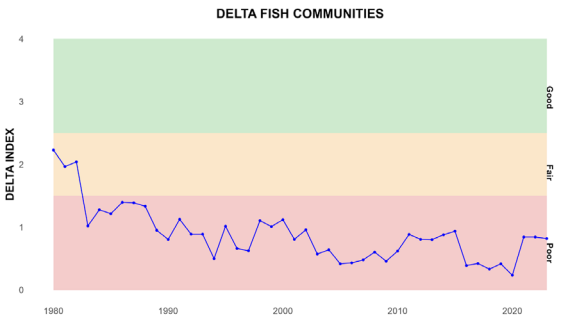
SFE Fish Communities

Conclusions

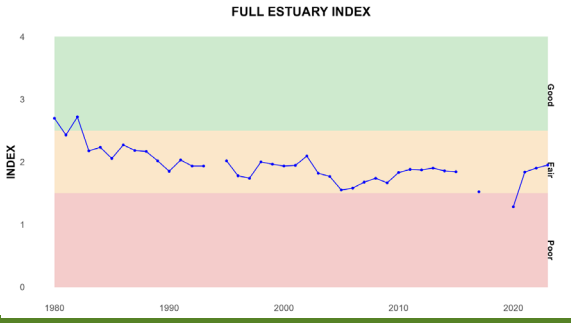
- **Bay Fish Communities**: high abundance, diversity, composition
  - Mix of estuarine and marine species
  - Similar among subregions (lowest in SPB)



- **Delta Fish Communities**: low abundance, diversity, composition
  - Mix of estuarine and freshwater species
  - Variable among subregions *(Delta -very poor, Suisun Marsh -poor)*
  - Slight increase in Delta following high outflow years *(cyprinids)*



- **SFE Fish Index:** fish communities in fair condition
  - lower in upper estuary
  - higher in lower estuary
  - some evidence of resilience (wet years)



SFE Fish Communities

Dungeness Crab
(*Metacarcinus magister)*

Photo Credit: Levi Lewis

Future Directions for Fish Indicators

- **Align indicator metrics** bt upper/lower Estuary
- Refine **regional & functional categories**
- Include **wetland data for lower Estuary**
- Include data on **larger-bodied fisheries targets**
- Include **native invertebrates** and **total fish/invert abundance**

SFEP & UCD are working on a scoping report *to develop new & improved indicator metrics for future updates.*

SF BAY STATE OF THE BIRDS

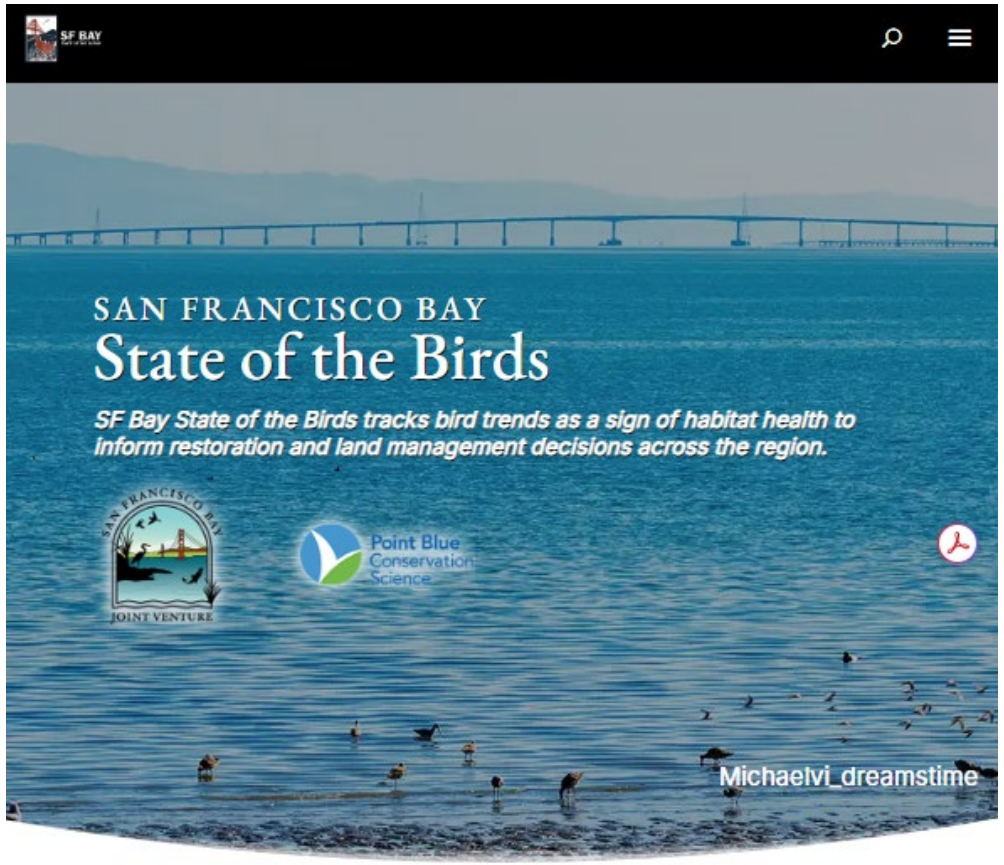
Julian Wood, San Francisco Bay Program Leader
Point Blue Conservation Science

October 28, 2025

SF BAY: HIGHLY DIVERSE BIRD COMMUNITY

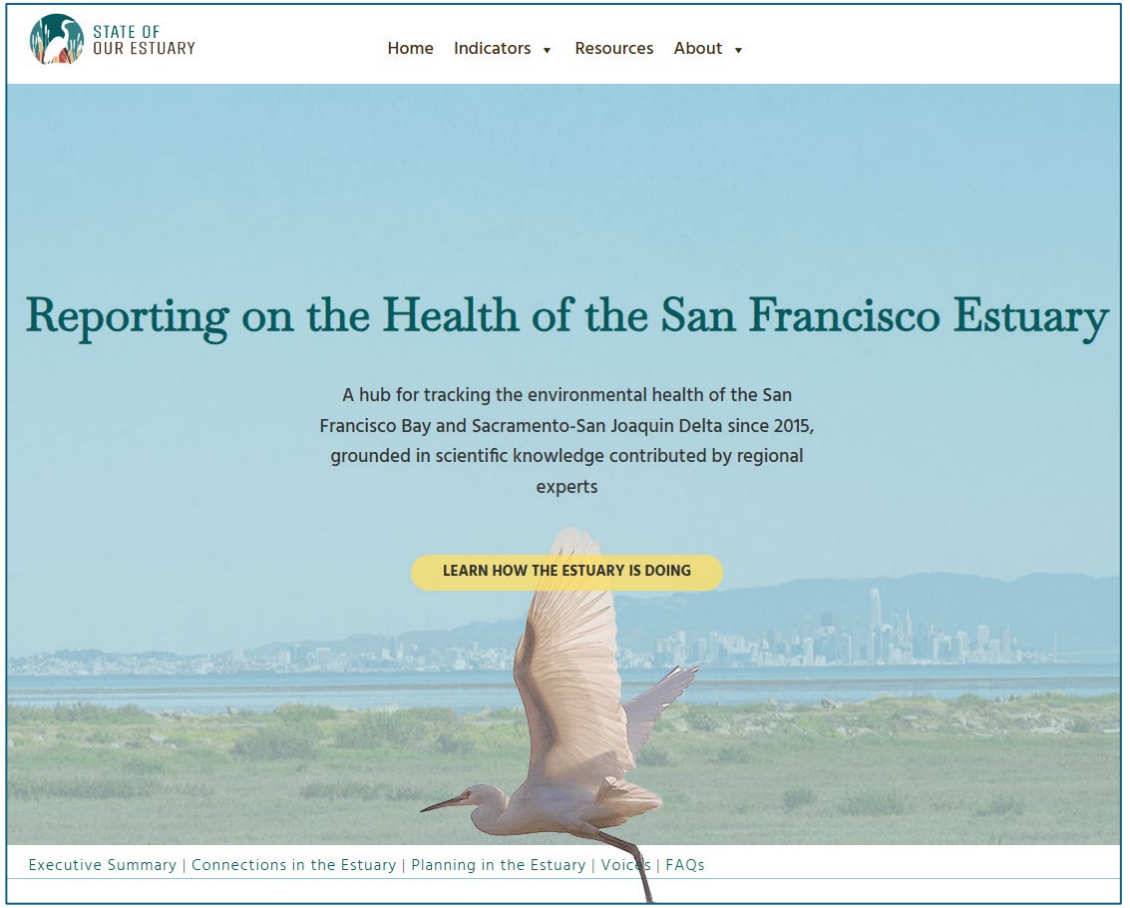
SF BAY
STATE OF THE BIRDS

SFBayStateoftheBirds.org



STATE OF OUR ESTUARY

OurEstuary.org



SF BAY STATE OF THE BIRDS PARTNERSHIP

Thank You to
Our Funder:

Point Blue Conservation Science

San Francisco Bay Joint Venture

Coastal Conservancy

Photo Credit: Vlad Butsky

A COLLABORATIVE EFFORT

San Francisco ESTUARY PARTNERSHIP

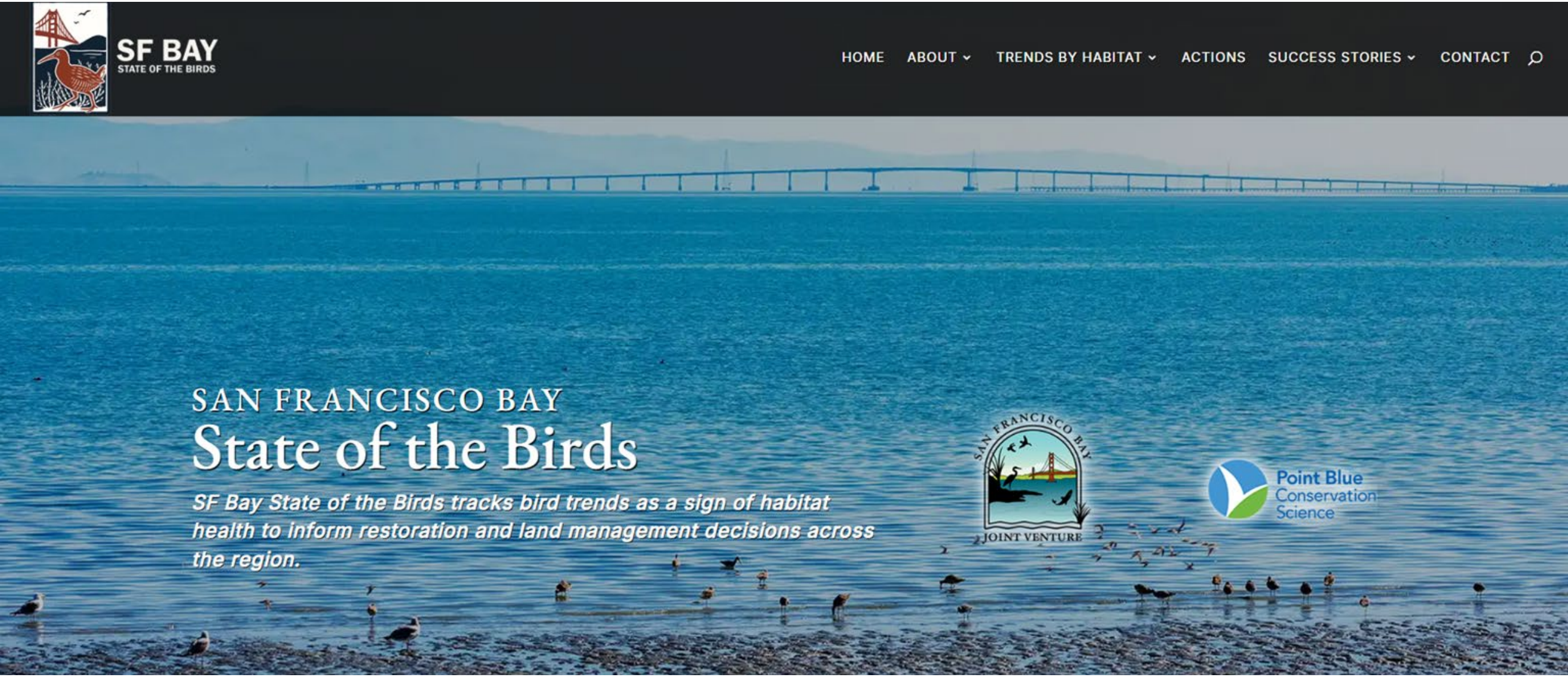
USGS science for a changing world

WRMP SF ESTUARY Wetlands Regional Monitoring Program

SAN FRANCISCO BAY BIRD OBSERVATORY

SFEI San Francisco Estuary Institute

Photo Credit: Beth Huning


SF BAY
STATE OF THE BIRDS
HOME
ABOUT
TRENDS BY HABITAT
ACTIONS
SUCCESS STORIES
CONTACT
SAN FRANCISCO BAY
State of the Birds
SF Bay State of the Birds tracks bird trends as a sign of habitat health to inform restoration and land management decisions across the region.
SAN FRANCISCO BAY
JOINT VENTURE
Point Blue
Conservation
Science

SF BAY
STATE OF THE BIRDS

How Bay Birds Are Doing

Tidal Marsh	Status
 **Tidal Marsh Birds** The multi-species indicator trend was positive, suggesting that tidal marshes support a diverse assemblage of bird species.	Increasing
 **Ridgway's Rail** The Ridgway's Rail population remains critically low and a more recent short-term decline is cause for concern. Continuing tidal marsh restoration will help increase their population.	Decreasing
Tidal Flat	
 **Shorebirds: Large, Medium, and Small** Wintering shorebirds decreased baywide, especially in the Central Bay where there is limited tidal flat habitat.	Decreasing
Subtidal	
 **Diving Ducks** Diving ducks that forage in subtidal habitats declined in the North and Central Bay and were relatively stable in the South Bay.	Mixed
Non-Tidal Wetlands and Waters	
 **Wintering Dabbling Ducks** Dabbling ducks are increasing overall and especially in the South Bay, indicating that non-tidal wetlands and waters are providing quality habitat.	Increasing
 **Breeding Dabbling Ducks in Suisun Marsh** The non-tidal wetlands and waters in Suisun are struggling to provide quality habitat for a key indicator species, breeding dabbling ducks.	Decreasing
 **Breeding Waterbirds in the South Bay** American avocet and black-necked stilt breeding has decreased in South Bay managed ponds, and was relatively stable for Forster's tern.	Mixed

STATE OF
OUR ESTUARY

Flourishing Wildlife			
Native Fish	Abundance, species diversity, species composition, and distribution of native fishes in the San Francisco Estuary	BAY DELTA	
Harbor Seals	Adult harbor seal abundance in the San Francisco Bay during the breeding season (under development)	BAY	
Ridgway's Rail	Ridgway's Rail population density in tidal marsh habitats of the San Francisco Bay (under development)	BAY	
Shorebirds	Winter densities of migratory shorebirds in the San Francisco Bay	BAY	
Tidal Marsh Birds	Breeding population density for three tidal marsh bird species in the San Francisco Bay	BAY	
Waterfowl	Winter abundance for dabbling and diving ducks in the San Francisco Bay	BAY	

SF BAY
STATE OF THE BIRDS

TIDAL MARSH

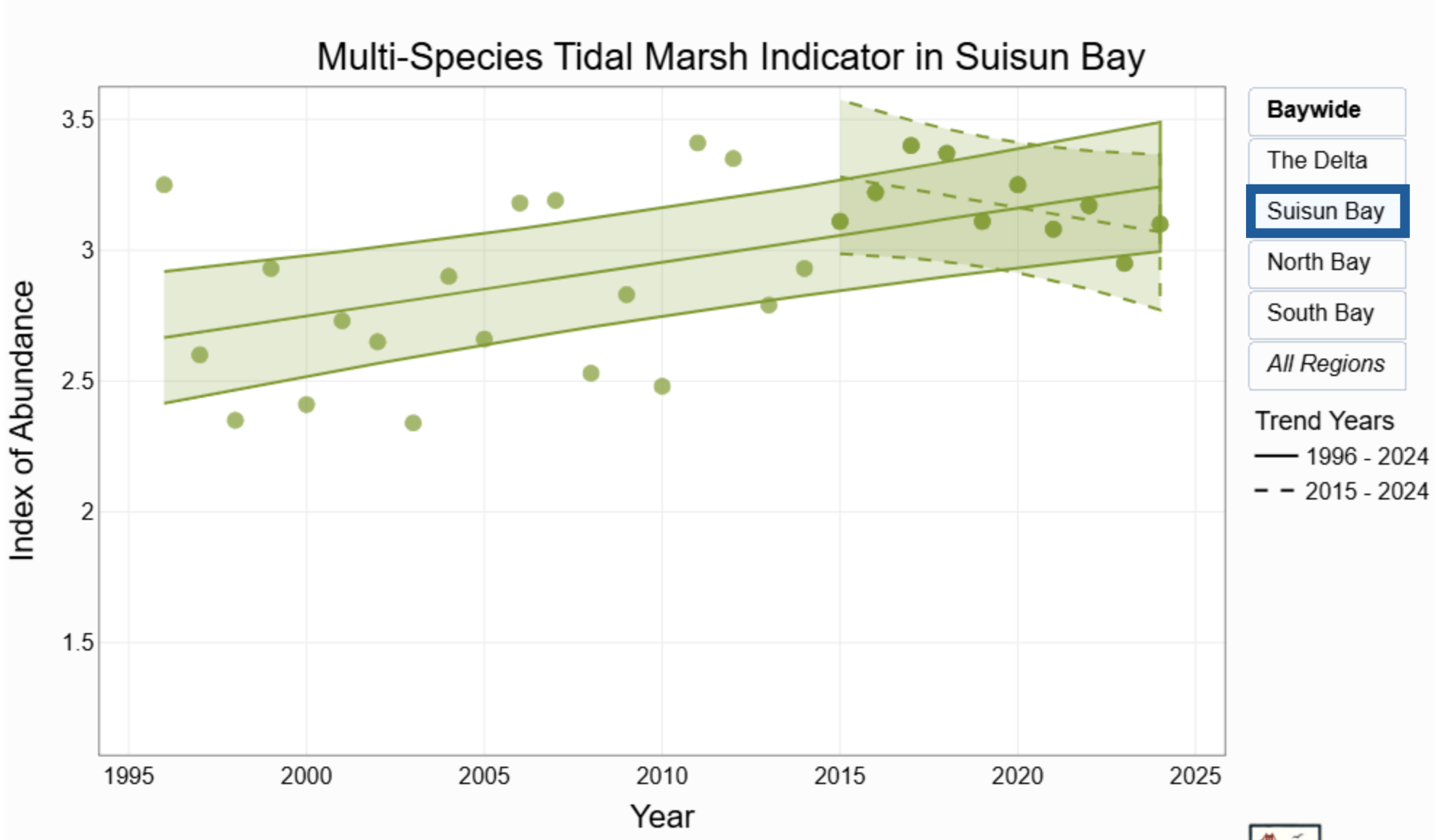
Artwork by: Christina Burnham

TIDAL MARSH

Tidal Marsh	Status
Tidal Marsh Birds The multi-species indicator trend was positive, suggesting that tidal marshes support a diverse assemblage of bird species.	Increasing
Ridgway's Rail The Ridgway's Rail population remains critically low and a more recent short-term decline is cause for concern. Continuing tidal marsh restoration will help increase their population.	Decreasing

Photo Credit Beth Huning

SF BAY
STATE OF THE BIRDS



Multi-Species Tidal Marsh Indicators in Suisun Bay

The multi-species trend was positive over the long-term in Suisun Marsh (2.1% increase annually) but may have declined over the last 10 years.

SF BAY

TIDAL FLATS

Artwork by: Christina Burnham

TIDAL FLATS

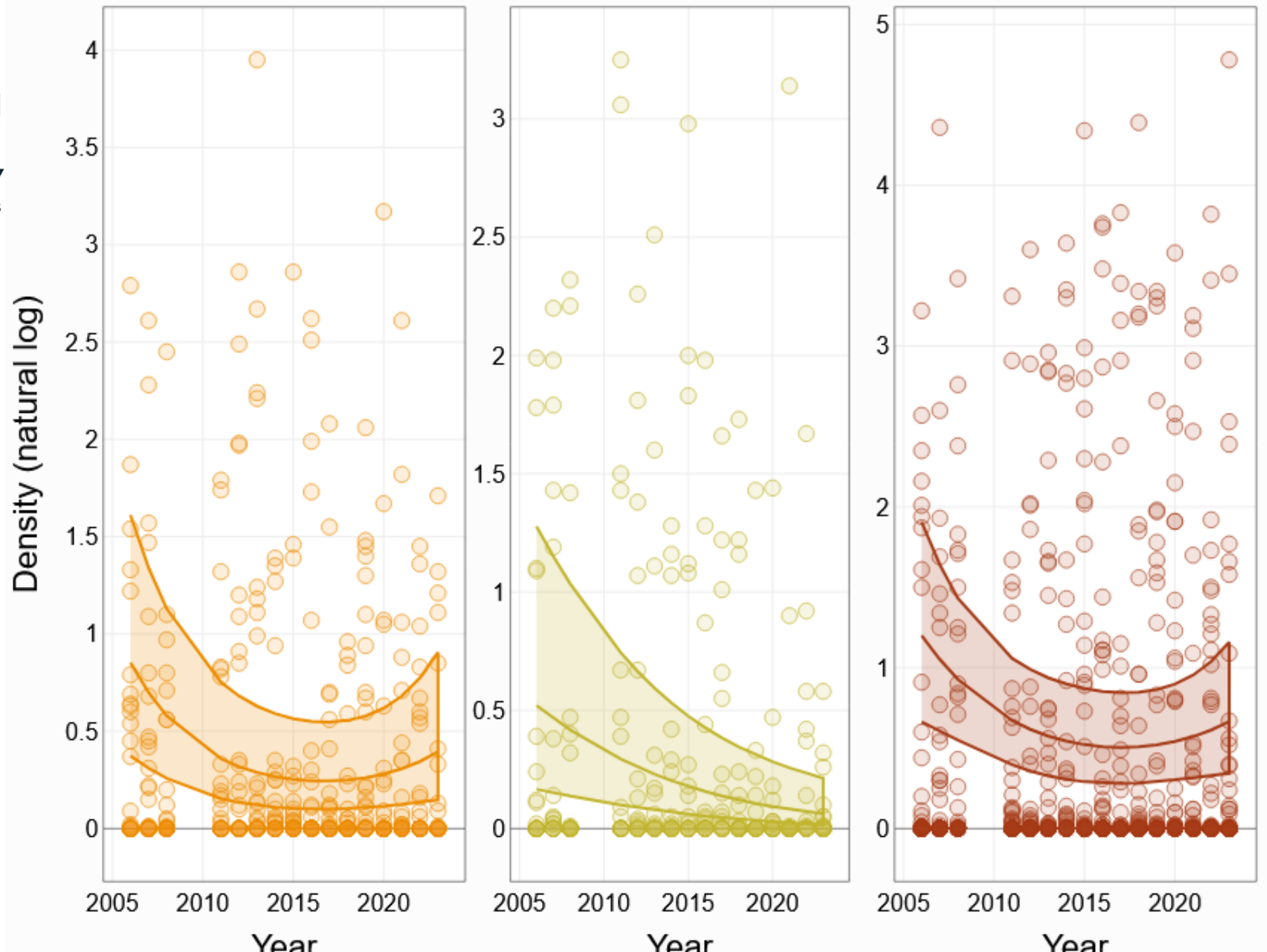
SF BAY
STATE OF THE BIRDS

Tidal Flat	Status
Shorebirds: Large, Medium, and Small Wintering shorebirds decreased baywide, especially in the Central Bay where there is limited tidal flat habitat.	Decreasing

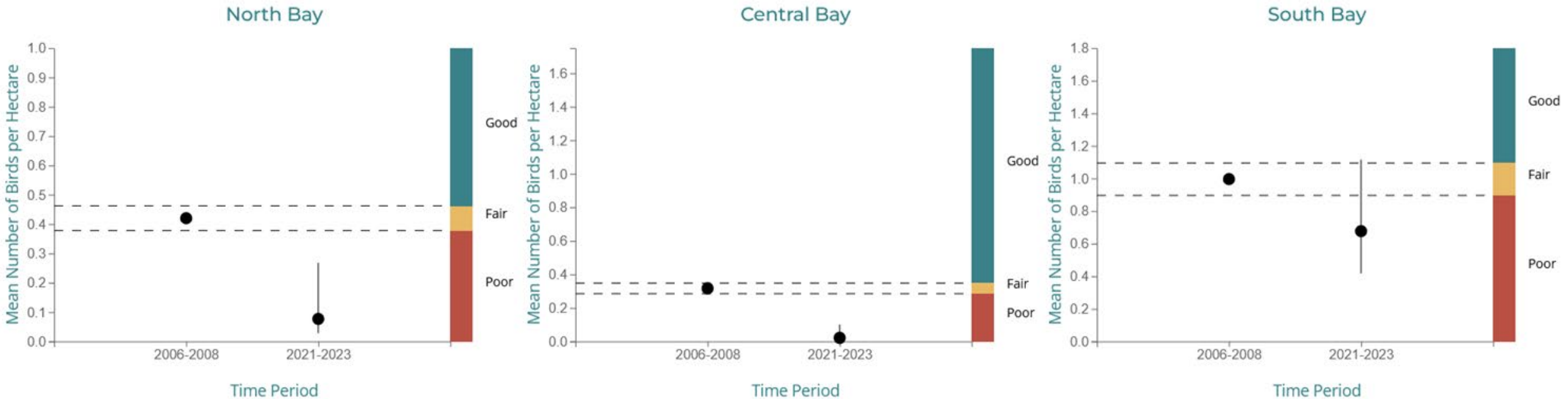
Photo Credit: Ingrid Taylar

SF BAY
STATE OF THE BIRDS

Medium Shorebirds in San Francisco Bay

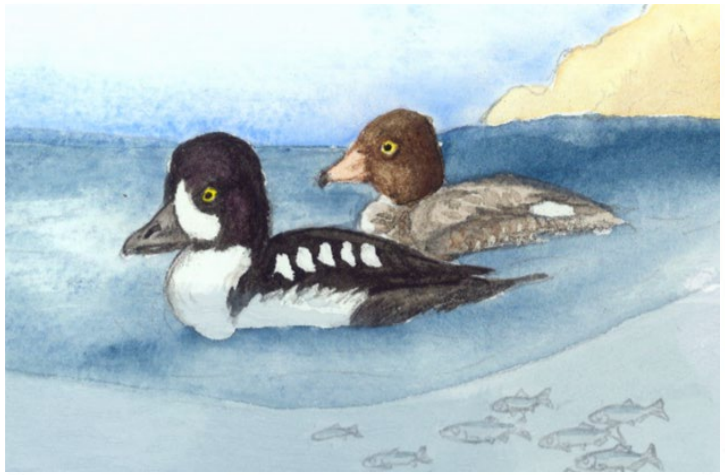


Medium Shorebirds



SF BAY
STATE OF THE BIRDS

SUBTIDAL



Barrow's Goldeneye

Barrow's Goldeneye winter in San Francisco Bay and prefer the quiet, protected, shallower waters more than other diving duck species found in the Bay, and are much harder to find than the similar-in-appearance Common Goldeneye. Learn More

Artwork by: Christina Burnham

SUBTIDAL*

Subtidal	Status
Diving Ducks Diving ducks that forage in subtidal habitats declined in the North and Central Bay and were relatively stable in the South Bay.	Mixed

*Preliminary results

Photo Credit: Michael Penn

SF BAY
STATE OF THE BIRDS

NON-TIDAL WETLANDS & WATERS

Artwork by: Christina Burnham

NON-TIDAL WETLANDS & WATERS*

Non-Tidal Wetlands and Waters	Status
Wintering Dabbling Ducks Dabbling ducks are increasing overall and especially in the South Bay, indicating that non-tidal wetlands and waters are providing quality habitat.	Increasing
Breeding Dabbling Ducks in Suisun Marsh The non-tidal wetlands and waters in Suisun are struggling to provide quality habitat for a key indicator species, breeding dabbling ducks.	Decreasing
Breeding Waterbirds in the South Bay American avocet and black-necked stilt breeding has decreased in South Bay managed ponds, and was relatively stable for Forster's tern.	Mixed

*Preliminary results

Photo Credit: Andrei Stanescu

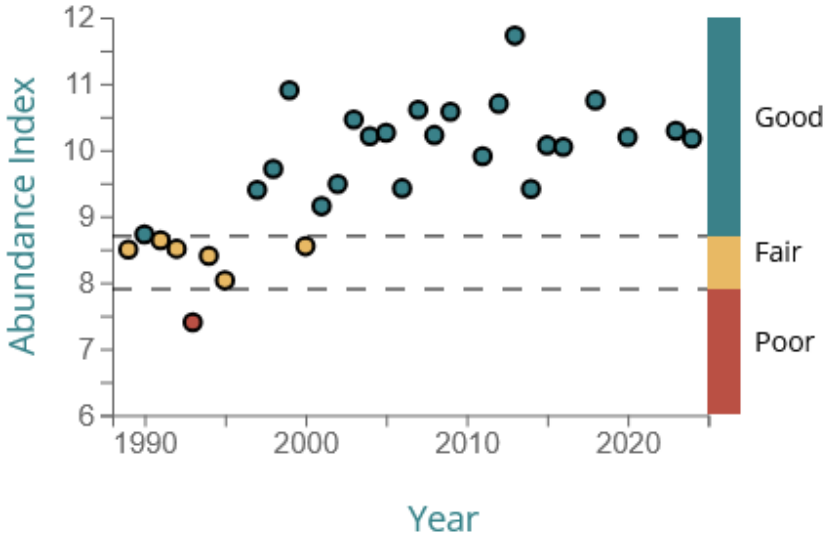
STATE OF OUR ESTUARY

Home Indicators Resources About

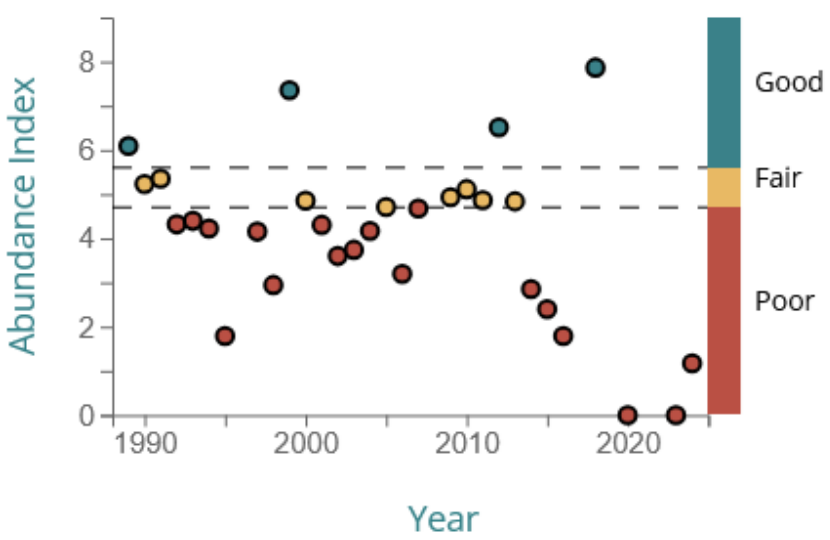
Why it Matters | Status & Trend | Full Read | Technical Appendix | Related Indicators

Dabbling Ducks

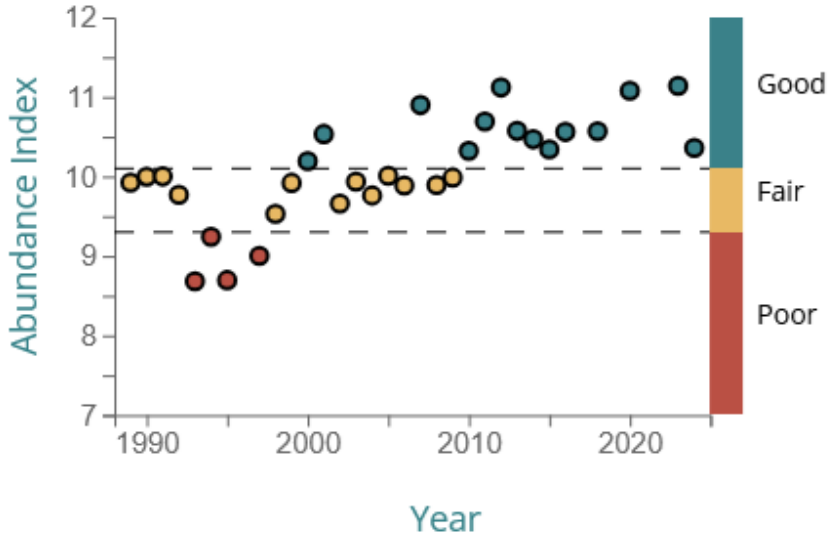
North Bay



Central Bay



South Bay



*Preliminary results

MAIN TAKE-AWAYS

- Restoration works
- Investments needed to help reverse species declines
- Managers need timely information to develop actions
  - Visit the Actions tab on the website

Photo Credit: Michael Vi

SFBayStateoftheBirds.org

Photo Credit: Andre Istanescu


Photo: Joey Kotfika

Thank You!

Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board. California's Clean Water State Revolving Fund is capitalized through a variety of funding sources, including grants from the United States Environmental Protection Agency and state bond proceeds. The contents of this document do not necessarily reflect the views and policies of the foregoing, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.
This material is based upon work supported by the Delta Stewardship Council's Delta Science Program, under Contract No. DSC23010.

ourestuary.org

STATE OF
OUR ESTUARY
Reporting on the Health of the San Francisco Estuary

stateofthebirds.org

SF BAY
STATE OF THE BIRDS