Monitoring for management: A modular, ecosystem function-based assessment framework for estuaries

EMPA
Monitoring Program

C. Whitcraft, J. Walker, E. Stein, K. O'Connor, R. Clark,, B. Hughes, J. Largier, D. Jacobs, and C. Toms

SCCWRP Established 1969

CCWG central coast wetlands group

Biological Sciences

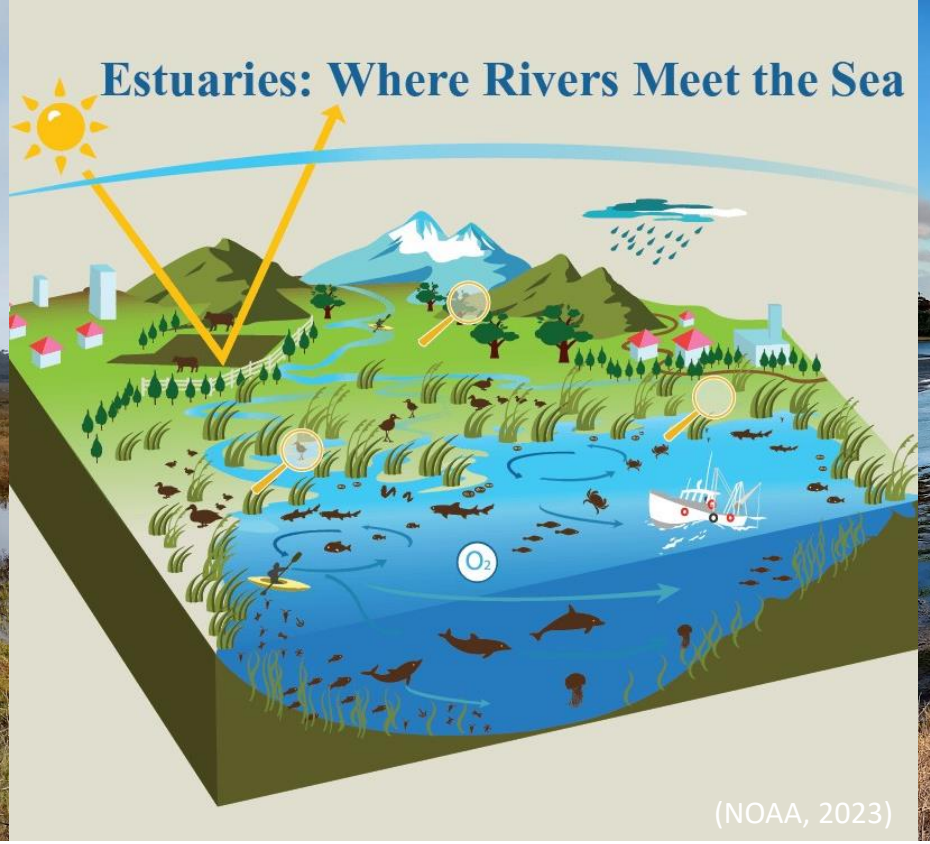
SONOMA STATE UNIVERSITY

UCDAVIS Coastal and Marine Sciences Institute

UCLA

CALIFORNIA WATER BOARDS San Francisco Bay · R2


Women In Science
Women In Science
Women In Science
Women In Science



(NOAA, 2023)

What is an Estuary?

- Contain important wetland habitat
  - Habitat to important and protected species
- Come in a variety of shapes and sizes

E. Stein


SOUTHERN CALIFORNIA
WETLANDS
RECOVERY
PROJECT
E. Stein


1MINUTE PLANTCAM JUL.14,11 09:49 AM

www.anemoon.org/

P. Barilla

Photo Robb Hamilton

Photo Robb Hamilton

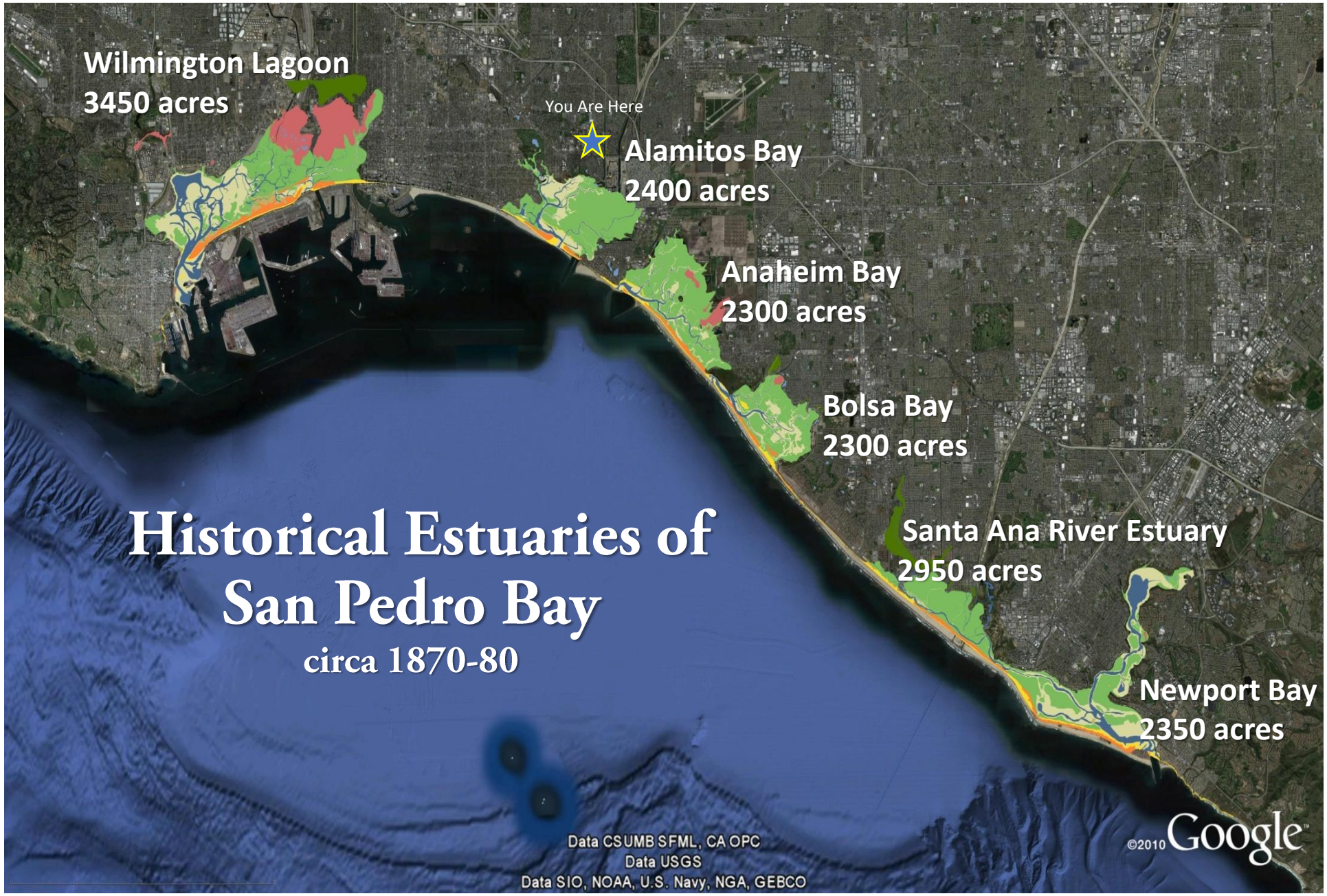
California Halibut,
Paralichthys californicus

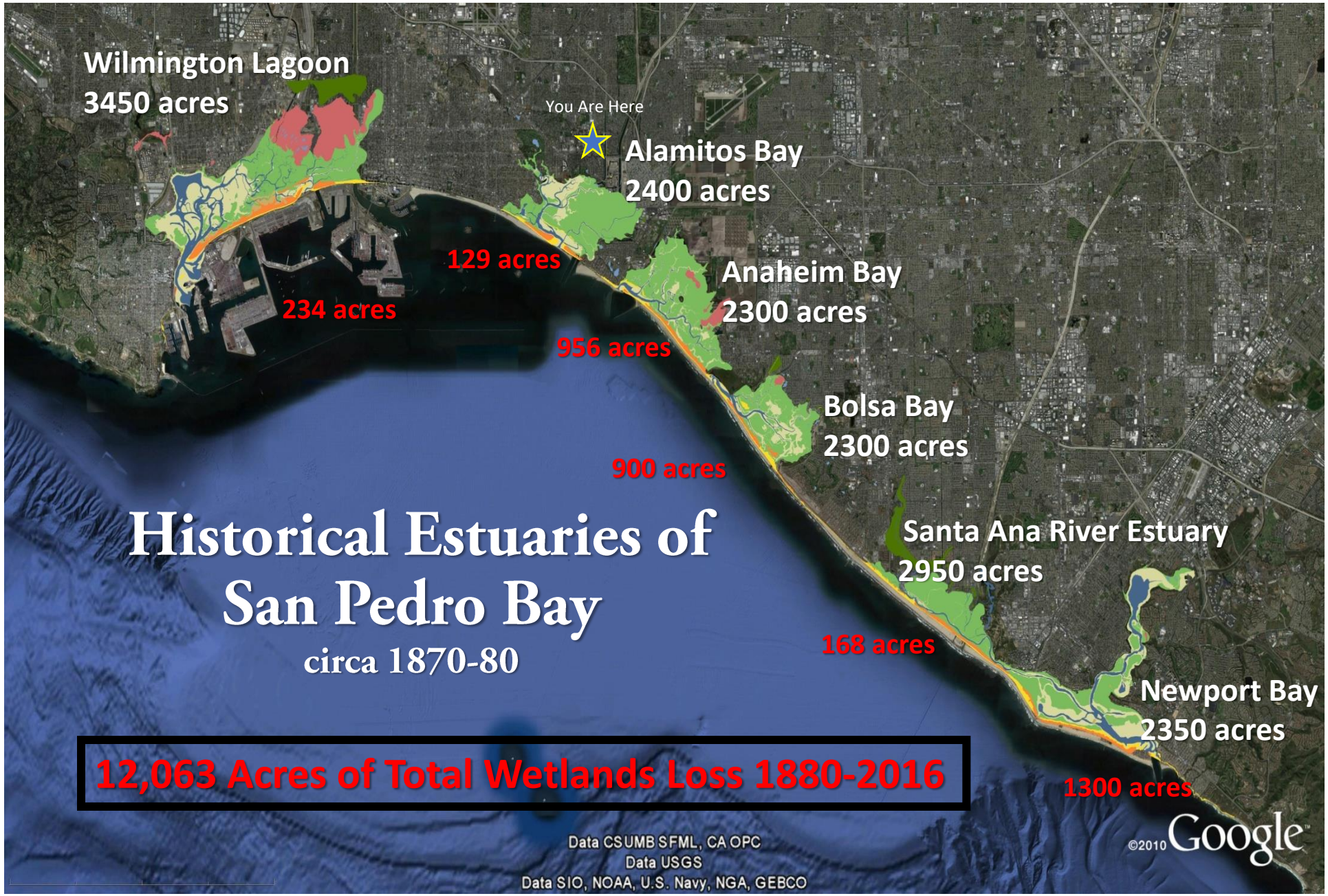
D.Witting

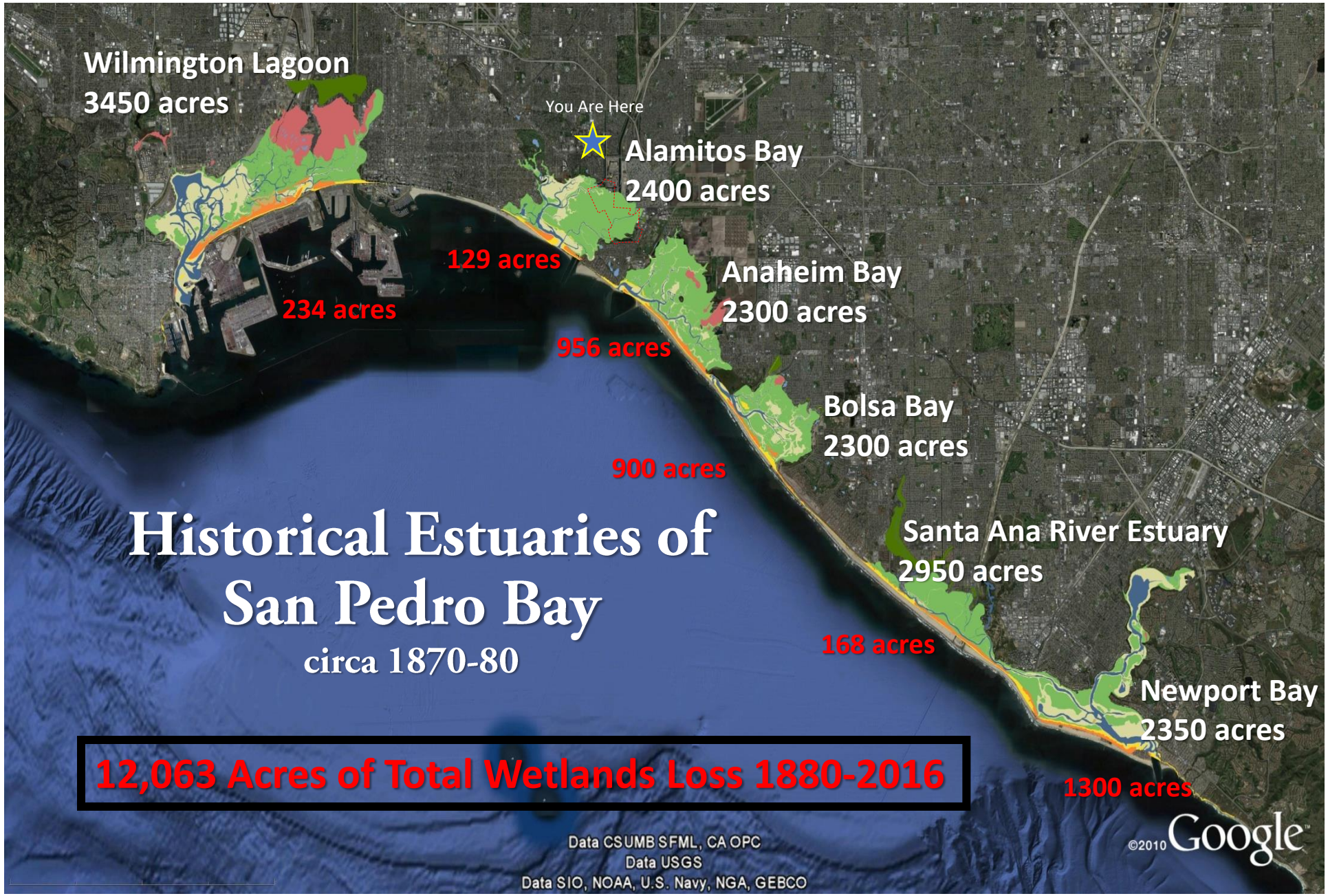
www.divebums.com

I’ll be honest Raymond. I really don’t give a darn about the wetlands.


SCIENCE TRANSFORMED HIM INTO A MONSTER.
LOVE CHANGED HIM EVEN MORE!
SWAMP THING
THE COMIC BOOK LEGEND LIVES!
"SWAMP THING" A MELNIKER-USLAN Production of a WES CRAVEN Film
LOUIS JOURDAN
ADRIENNE BARBEAU
Based upon characters appearing in magazines published by DC Comics, Inc. Produced by BENJAMIN MELNIKER and MICHAEL E. USLAN
Written and Directed by WES CRAVEN
EP

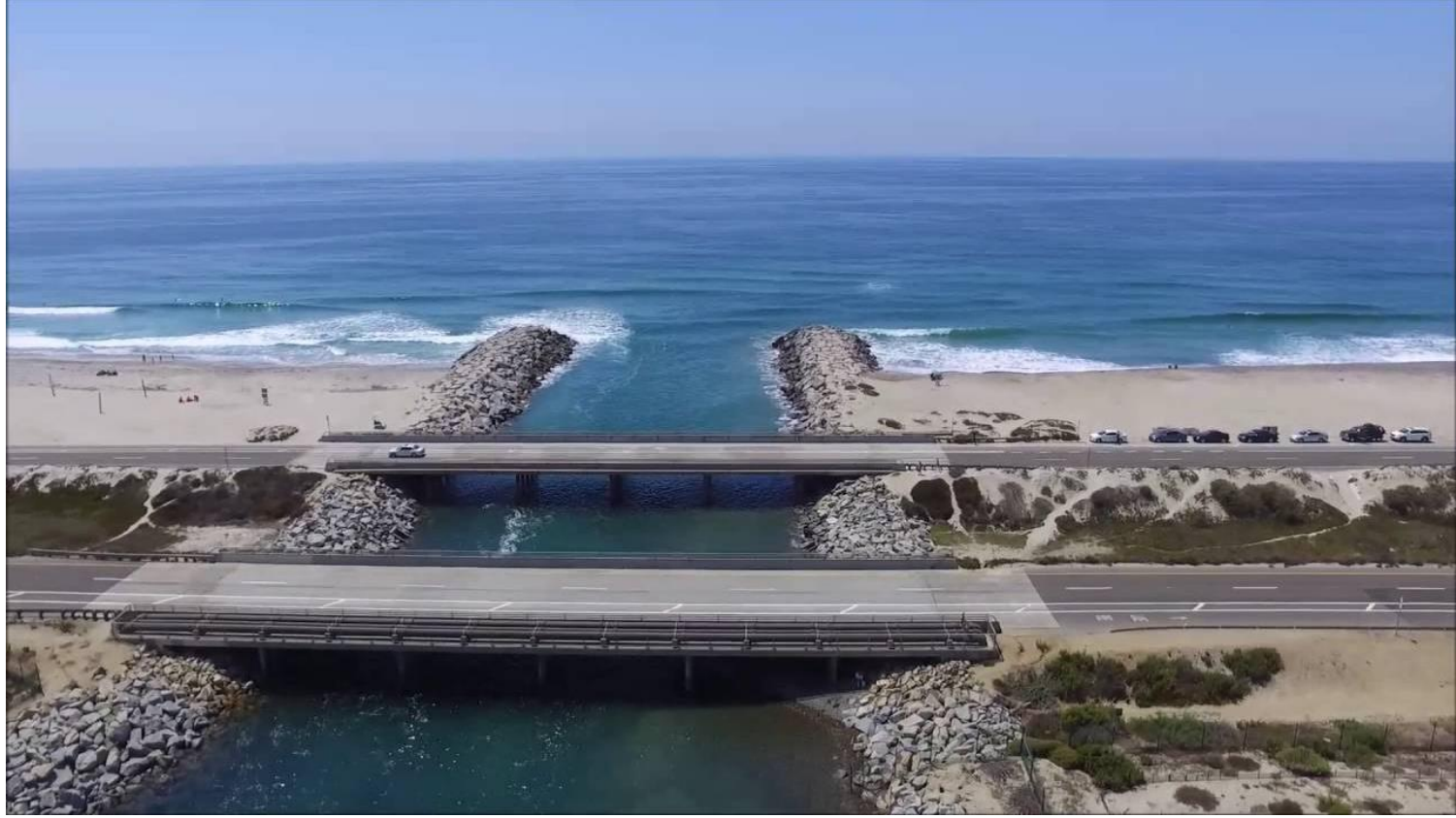

Wilmington Lagoon
3450 acres
You Are Here
Alamitos Bay
2400 acres
Anaheim Bay
2300 acres
Bolsa Bay
2300 acres
Santa Ana River Estuary
2950 acres
Newport Bay
2350 acres
Historical Estuaries of
San Pedro Bay
circa 1870-80
Data CSUMB SFML, CA OPC
Data USGS
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2010 Google


Wilmington Lagoon
3450 acres
You Are Here
Alamitos Bay
2400 acres
129 acres
Anaheim Bay
2300 acres
234 acres
956 acres
Bolsa Bay
2300 acres
900 acres
Historical Estuaries of
San Pedro Bay
circa 1870-80
Santa Ana River Estuary
2950 acres
168 acres
Newport Bay
2350 acres
12,063 Acres of Total Wetlands Loss 1880-2016
1300 acres
Data CSUMB SFML, CA OPC
Data USGS
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2010 Google


Wilmington Lagoon
3450 acres
You Are Here
Alamitos Bay
2400 acres
129 acres
Anaheim Bay
2300 acres
234 acres
956 acres
Bolsa Bay
2300 acres
900 acres
Historical Estuaries of
San Pedro Bay
circa 1870-80
Santa Ana River Estuary
2950 acres
168 acres
Newport Bay
2350 acres
12,063 Acres of Total Wetlands Loss 1880-2016
1300 acres
Data CSUMB SFML, CA OPC
Data USGS
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2010 Google

History of Southern California Estuaries

- Historically small and shallow systems
- Many bar-built systems
- Urbanization has led to changes in hydrology



History of Southern California Estuaries

- Historically small and shallow systems
- Many bar-built systems
- Urbanization has led to changes in hydrology

Coastal wetland management relies on consistent monitoring and assessment.

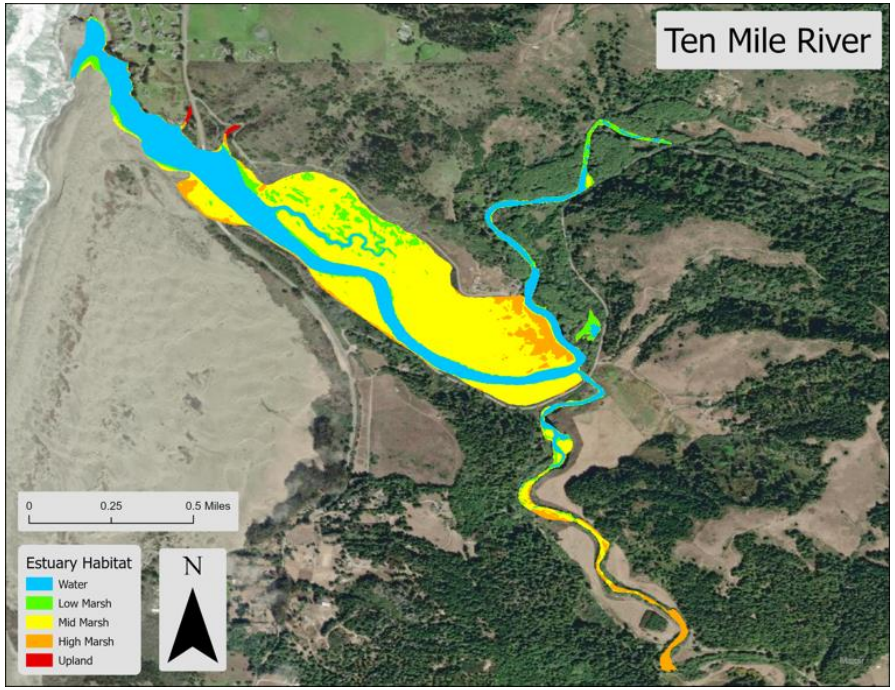


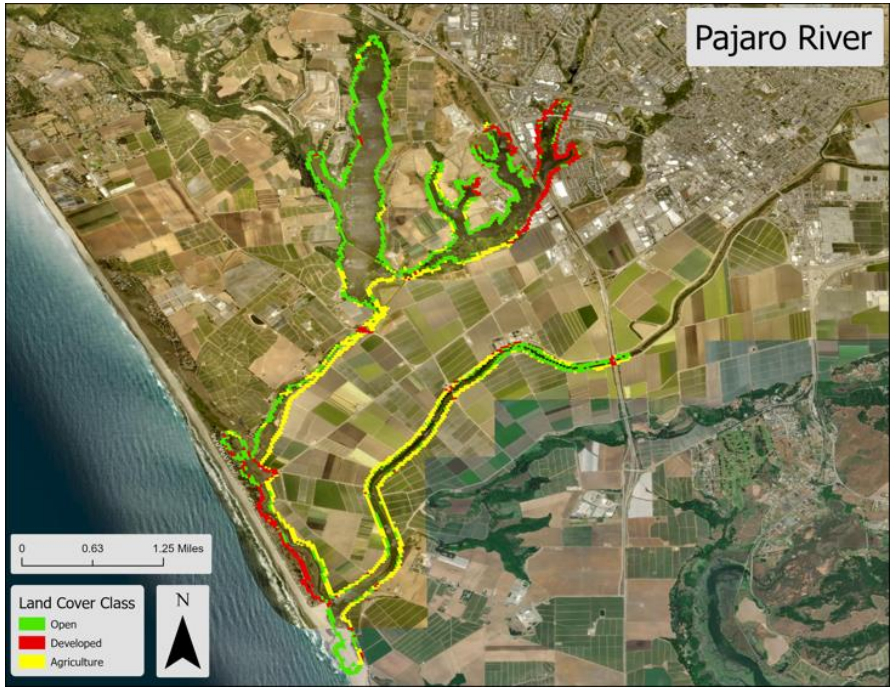


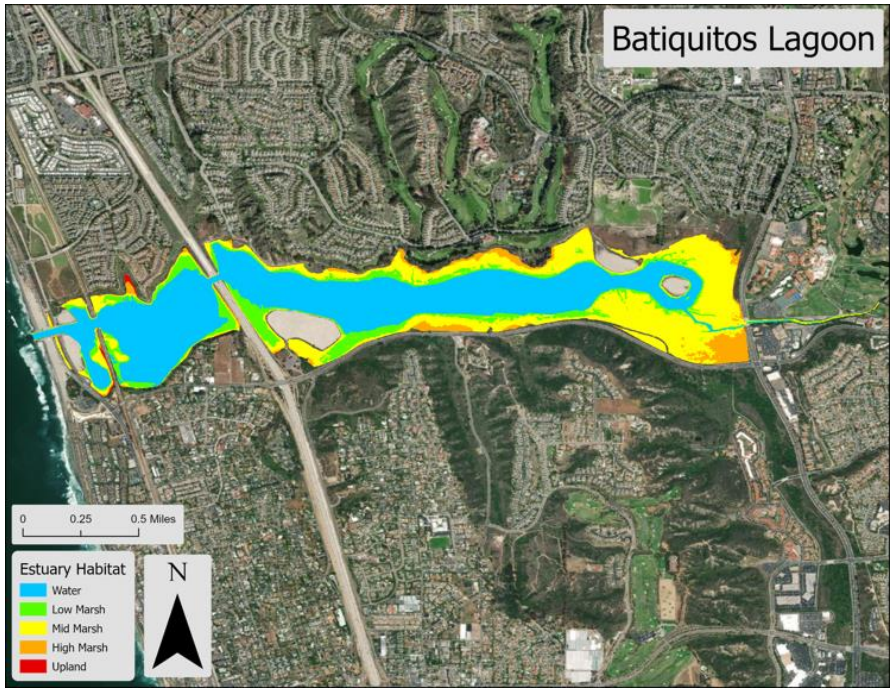


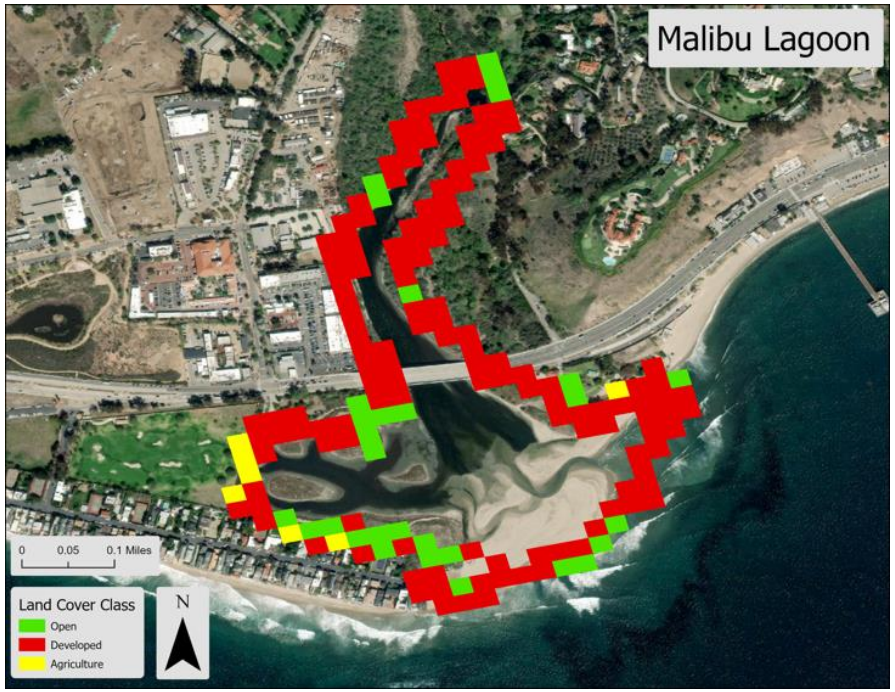
There are several key challenges to large scale monitoring.

1. Spatial:
   - Comparison across heterogeneous environments (e.g., large open embayments vs intermittently closed systems)
2. Management:
   - Differing management needs (Regulatory vs. voluntary condition monitoring)
3. Methodological:
   - Variety of monitoring programs (disparate monitoring methods)
4. Data:
   - Data storage and sharing (data hiding)









Spatial Challenges

- Systems vary
  - Large latitudinal gradient
  - Size
  - Development
  - Habitat composition
  - Inlet status
  - Protection
- How do we standardize sampling in areas that are so different?

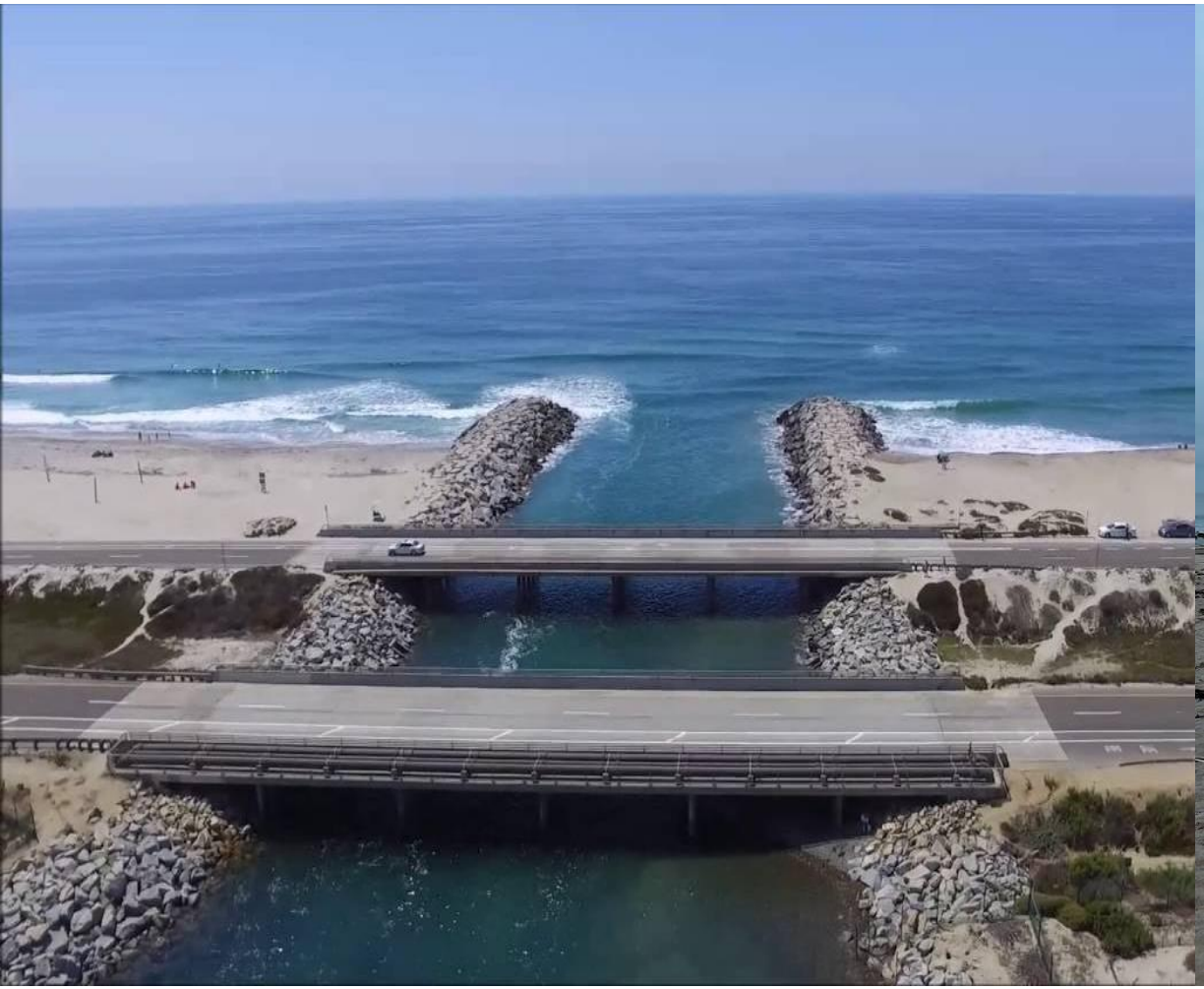
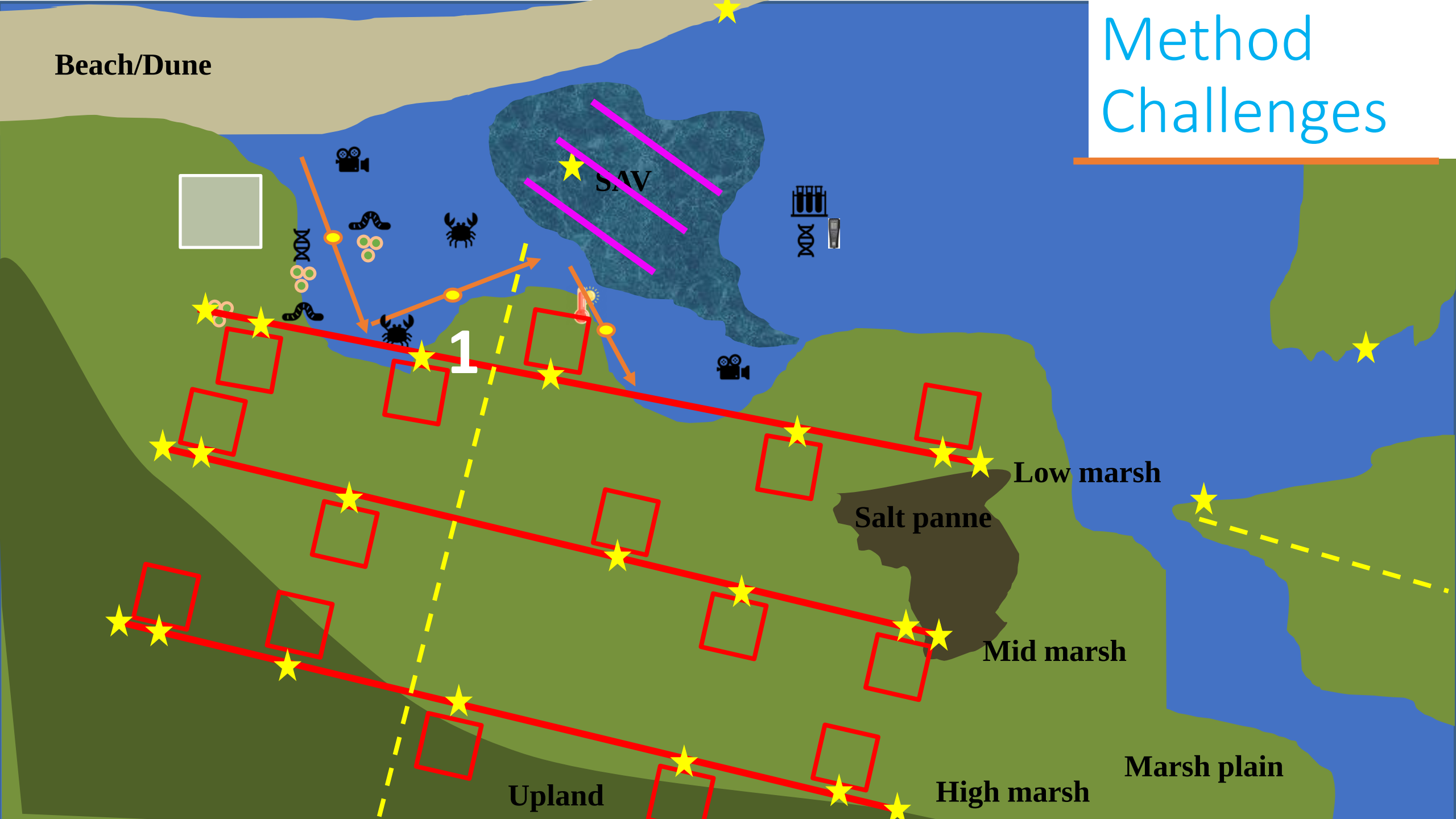


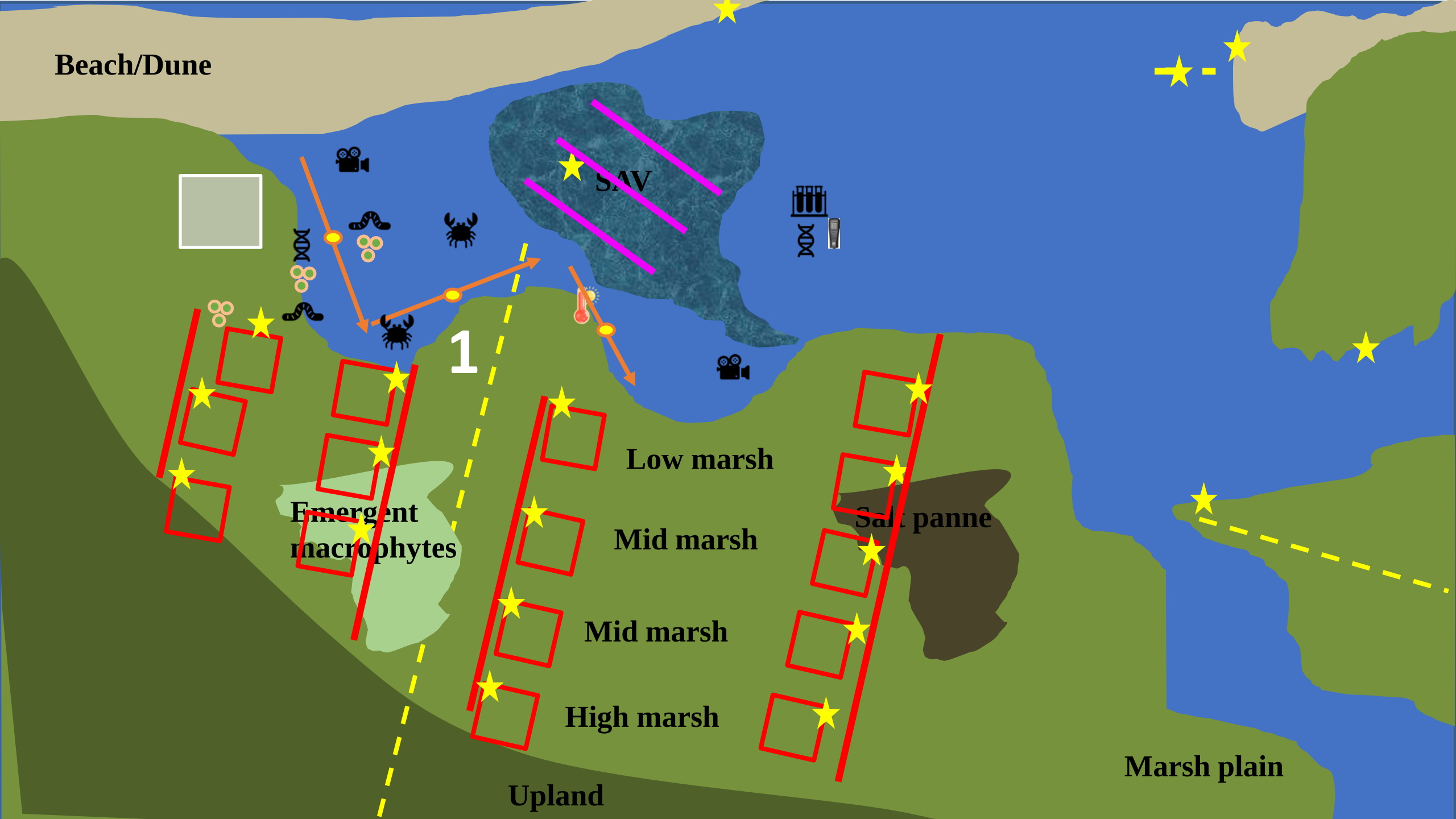
Photo: A. Maben

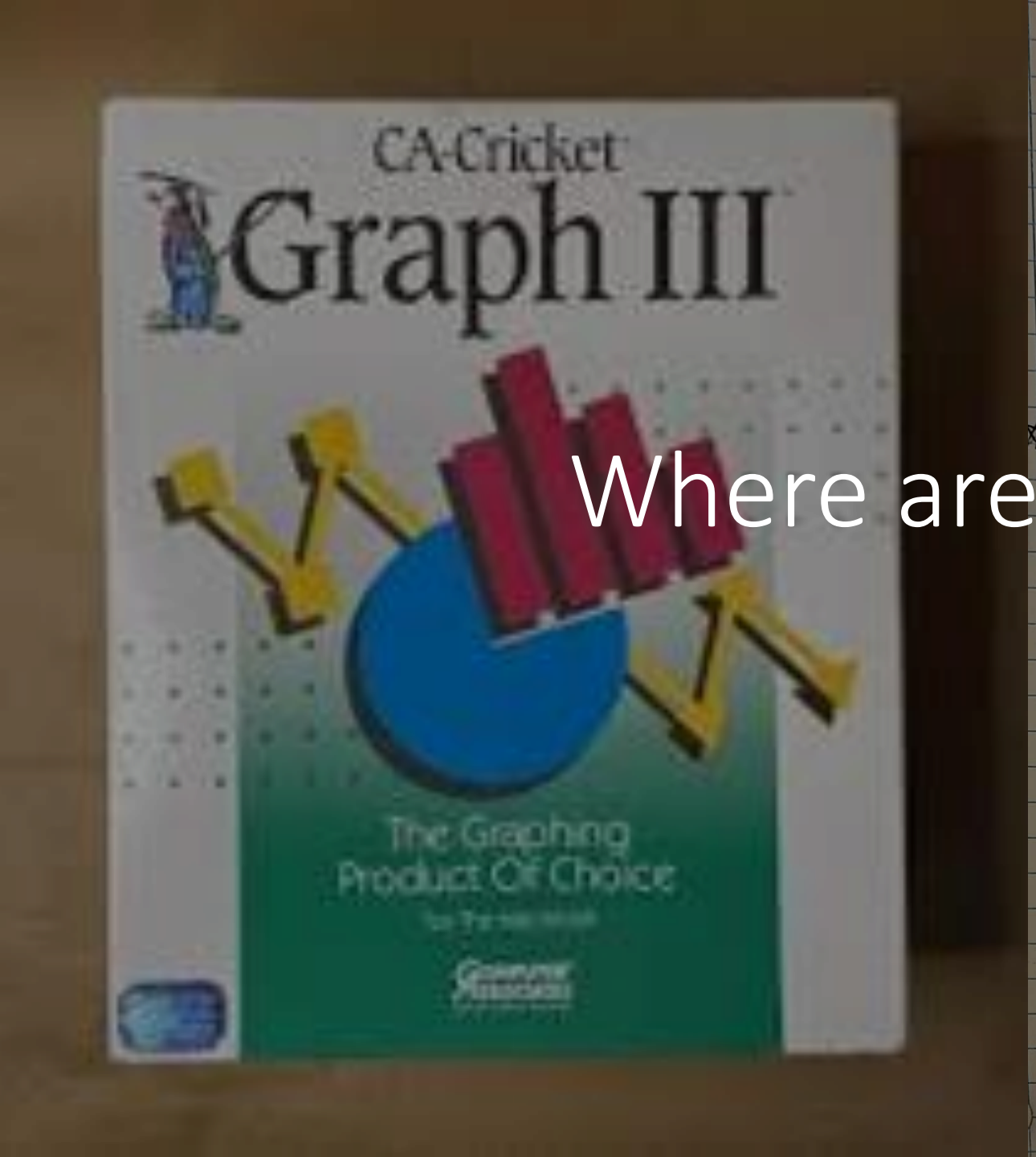
Management Challenges

- Goals vary
  - Through time
  - Species versus function
  - Among agencies and landowners
  - Can be in conflict

Method Challenges




Beach/Dune
SAV
1
Low marsh
Mid marsh
Mid marsh
High marsh
Emergent
macrophytes
Salt panne
Upland
Marsh plain



Where are the data?

name	crucible #	Empty wt(g)	Dry wt	Combusted Wt	Empty Foil	Wet	Dry Foil
M-S3-INT	17	20.2560	27.4837	26.4581	0.93	65.46	
M-S2-MAR	22*	22.1808	35.6197 (11.3720)	35.1802 (11.1478)	0.97	68.65	
M-S2-SUB	24	19.4221	28.1367	26.8132	0.85	69.29	
M-S2-INT	39	21.5817	36.7454	34.9359	0.93	71.46	
M-S3-SUB	21	20.3096	23.7504	23.0474	1.04	65.09	
M-S1-MAR	25*	20.9706	24.6478 (1.5752)	23.6784 (07.2378)	0.99	67.02	
M-S1-INC	16	23.4151	40.6355	39.2628	1.01	68.57	
M-S3-MAR	23+	20.4716	24.7606 (12.0270)	24.1969 (11.4810)	0.97	66.20	
M-S1-SUB	19	19.6544	34.3470	38.5059	0.91	~~68.67~~ 69.58	

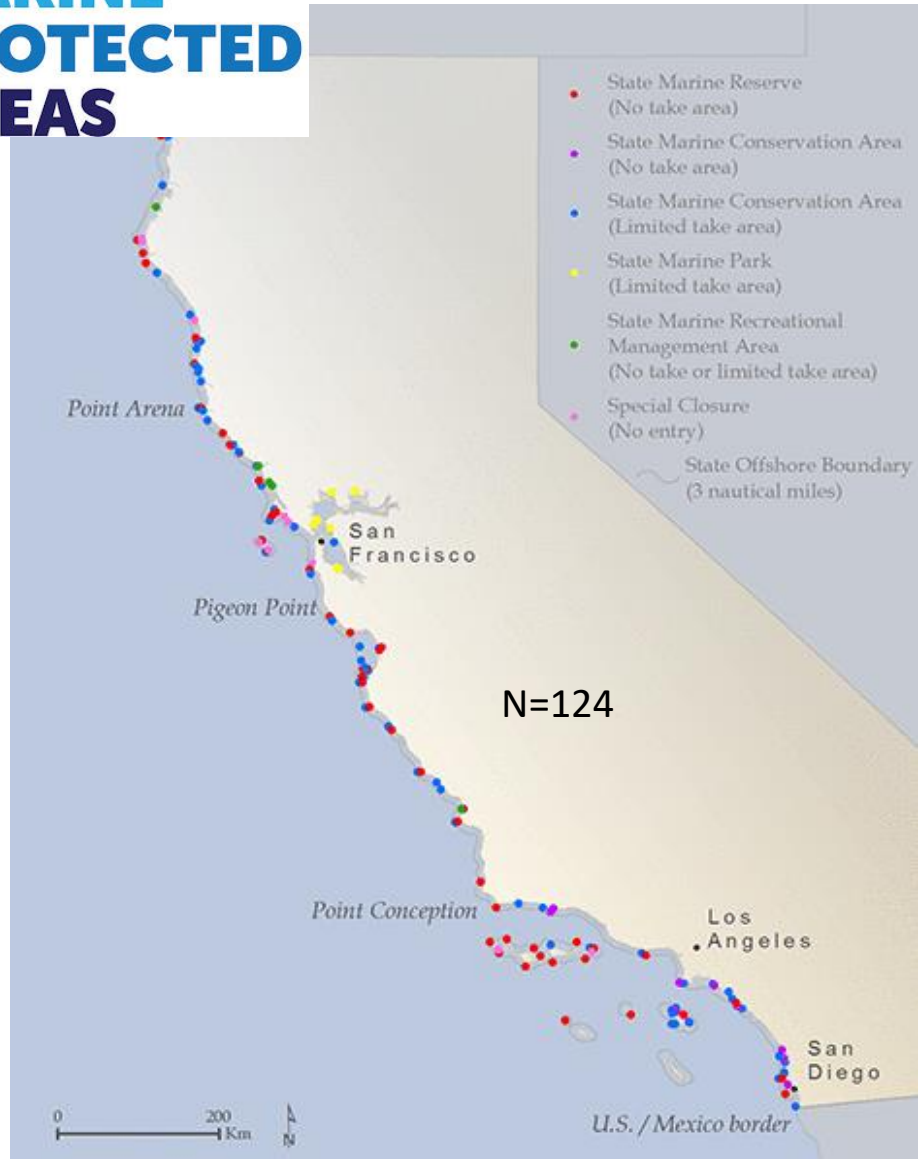
52.88 53.939

+ ~~44.70~~g <2mm (sand) [total w/foil ~~50.75~~g]
1.30g >2mm rocks, 9.42g >2mm plant material
crucible >2mm = #10 [small], crucible <2mm = #23

* 1.89g >2mm rocks
11.59g >2mm plant material
47.21g <2mm sand [total w/foil 48.68]
crucible <2mm = #25 / crucible >2mm = #48 (small crucible)

* crucible <2mm = #22 / crucible >2mm = #19 (small crucible)
56.19g <2mm (sand), [total w/foil 57.16g]
10.96g >2mm rocks, .12g >2mm plant material

CALIFORNIA MARINE PROTECTED AREAS



23 of the 124 MPAs are estuarine MPAs

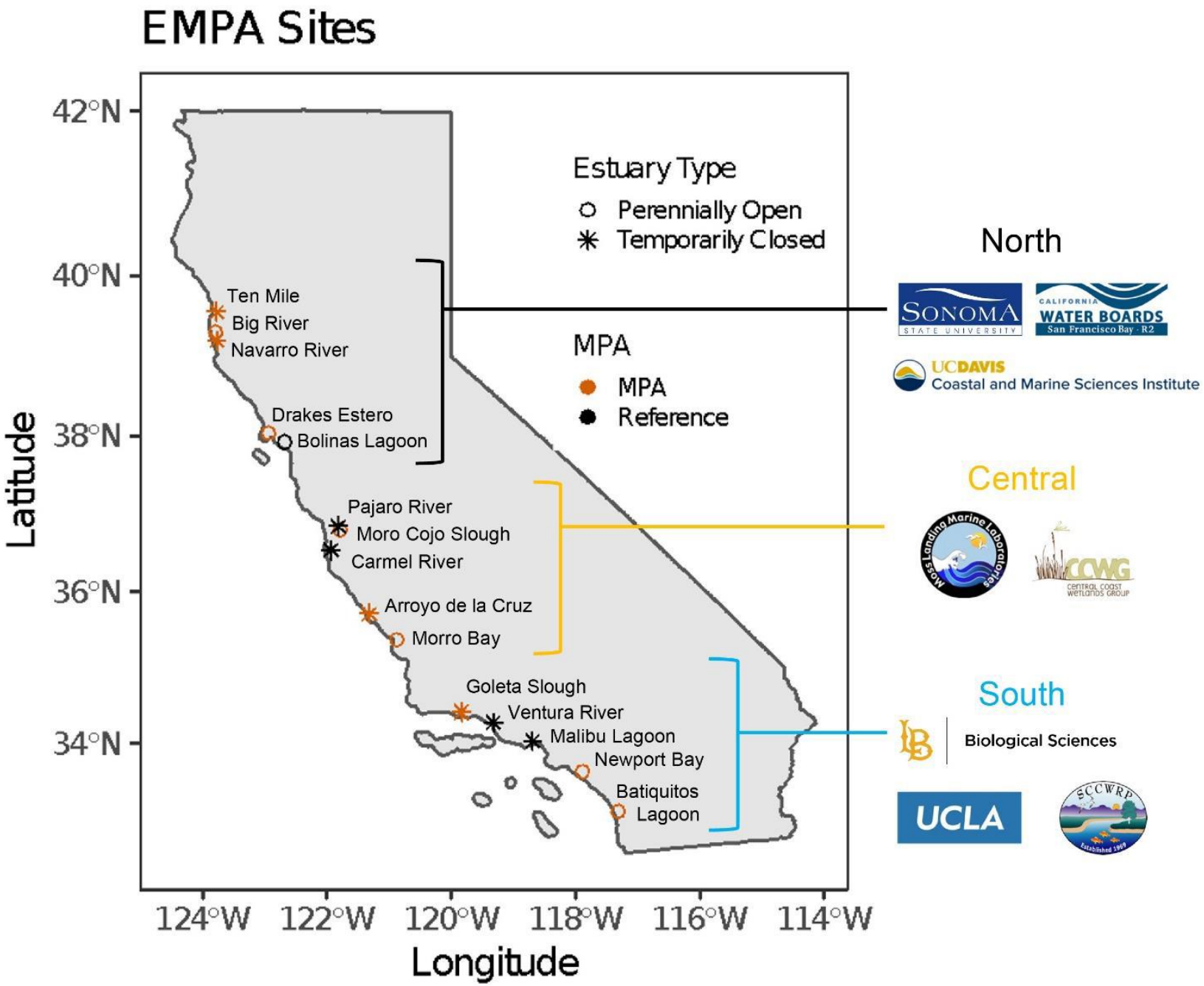
State lacks a way to assess the condition and effectiveness of estuarine MPA designation

Estuarine MPA Monitoring Program

EMPA
Monitoring Program

Project Goal:

Develop a monitoring and assessment framework for evaluating the condition of **coastal estuaries and lagoons** and relating their condition to the conditions in adjacent reference estuaries and offshore marine MPAs. The framework includes recommendations for **site selection, indicators, protocols, and data management** and provides the initial structure for a coordinated estuary monitoring network.


EMPA Sites
Estuary Type
Perennially Open
Temporarily Closed
MPA
MPA
Reference
Ten Mile
Big River
Navarro River
Drakes Estero
Bolinas Lagoon
Pajaro River
Moro Cojo Slough
Carmel River
Arroyo de la Cruz
Morro Bay
Goleta Slough
Ventura River
Malibu Lagoon
Newport Bay
Batiquitos Lagoon
42°N
40°N
38°N
36°N
34°N
Latitude
124°W
122°W
120°W
118°W
116°W
114°W
Longitude
North
Central
South
Biological Sciences
UCLA

To assess condition, we need assessment frameworks based on four principles.

EMPA
Monitoring Program

1. **Flexibility**: Assessing condition using a modular, function-based approach
2. **Comparability**: Synthesize across geographic areas and system
3. **Interpretability**: Comprehensive and consistent sampling
4. **Practicality**: Feasible sampling campaign and management centric

OCEAN PROTECTION COUNCIL
SONOMA STATE UNIVERSITY
Biological Sciences
Moss Landing Marine Laboratories
CCWG Central Coast Wetlands Group
SCCWRP Established 1969
UCLA
UCDAVIS Coastal and Marine Sciences Institute
CALIFORNIA WATER BOARDS San Francisco Bay · R2

The framework assesses estuarine condition using an ecosystem function-based approach.

- The underlying principle is that all estuaries should provide a variety of ecological functions at some ideal rate in the absence of anthropogenic disturbance and alteration.

Nekton Habitat	Primary Production
Protected Species Support	Secondary Production
Nutrient Cycling	Sea level rise amelioration and resilience
Bird habitat	Shellfish support
Nursery habitat	Support of vascular plant communities
Wildlife support	

The framework assesses estuarine condition using an ecosystem function-based approach.

- Multiple indicators can be used to assess a given ecological function.
- Prioritize indicators for inclusion based on:
  1. Key ecological functions
  2. Designated goals of the assessment framework
  3. Incorporation of indicators currently/previously being used in other programs

Estuary		Indicators		
		Water quality	Water nutrient concentration	General community composition (eDNA)
Functions	Nekton Habitat	■	■	
	Primary Production			■
	Secondary Production			
	Protected Species Support	■		■

Green squares represent the indicators that can be used to evaluate function

Estuaries		Indicators												
		Water quality	Water nutrient concentration	General community composition (eDNA)	Sediment characteristics	Benthic infauna abundance/diversity	SAV/macroalgae distribution	Fish abundance/ diversity	Crab abundance/ diversity	Marsh vegetation distribution/ diversity/ invasives	Marshplain elevation	Sediment accretion rates	Mouth dynamics	General habitat condition
Ecosystem Functions	Nekton Habitat													
	Primary Production													
	Secondary Production													
	Protected Species Support													
	Nutrient Cycling													
	SLR Amelioration													
	Bird Habitat													
	Shellfish Support													
	Nursery Habitat													
	Support Vascular Plants													
	Wildlife Support													

Estuaries		Indicators												
		Water quality	Water nutrient concentration	General community composition (eDNA)	Sediment characteristics	Benthic infauna abundance/diversity	SAV/macroalgae distribution	Fish abundance/ diversity	Crab abundance/ diversity	Marsh vegetation distribution/ diversity/ invasives	Marshplain elevation	Sediment accretion rates	Mouth dynamics	General habitat condition
Ecosystem Functions	Nekton Habitat	■	■											
	Primary Production				■									
	Secondary Production													
	Protected Species Support	■												
	Nutrient Cycling		■		■									
	SLR Amelioration													
	Bird Habitat													
	Shellfish Support	■	■		■									
	Nursery Habitat													
	Support Vascular Plants	■			■									
	Wildlife Support	■	■											

Estuaries		Indicators												
		Water quality	Water nutrient concentration	General community composition (eDNA)	Sediment characteristics	Benthic infauna abundance/diversity	SAV/macroalgae distribution	Fish abundance/ diversity	Crab abundance/ diversity	Marsh vegetation distribution/ diversity/ invasives	Marshplain elevation	Sediment accretion rates	Mouth dynamics	General habitat condition
Ecosystem Functions	Nekton Habitat	■	■				■	■	■					
	Primary Production			■	■		■			■				
	Secondary Production					■	■			■				
	Protected Species Support	■		■			■	■	■	■				
	Nutrient Cycling		■		■	■	■			■				
	SLR Amelioration						■			■				
	Bird Habitat					■	■	■	■	■				
	Shellfish Support	■	■	■	■	■	■							
	Nursery Habitat					■	■	■	■					
	Support Vascular Plants	■			■		■			■				
	Wildlife Support	■	■	■			■			■				

Estuaries		Indicators												
		Water quality	Water nutrient concentration	General community composition (eDNA)	Sediment characteristics	Benthic infauna abundance/diversity	SAV/macroalgae distribution	Fish abundance/ diversity	Crab abundance/ diversity	Marsh vegetation distribution/ diversity/ invasives	Marshplain elevation	Sediment accretion rates	Mouth dynamics	General habitat condition
Ecosystem Functions	Nekton Habitat	■	■				■	■	■					
	Primary Production			■	■		■			■	■	■		■
	Secondary Production					■	■			■				
	Protected Species Support	■		■			■	■	■	■	■		■	■
	Nutrient Cycling		■		■	■	■			■		■	■	
	SLR Amelioration						■			■	■	■		■
	Bird Habitat					■	■	■	■	■	■		■	■
	Shellfish Support	■	■	■	■	■	■							
	Nursery Habitat					■	■	■	■				■	
	Support Vascular Plants	■			■		■			■	■	■		■
	Wildlife Support	■	■	■			■			■	■			■

Estuaries		Indicators													
		Water quality (DO, temp, salinity, Chl a, etc.)	Sediment nutrient concentration (TOC/TN)	General community composition (eDNA)	Sediment characteristics (grainsize)	Benthic infauna community (small and large)	SAV distribution	Fish community	Mobile Invertebrate community	Marsh plain vegetation community	Marshplain elevation and inundation	Sediment accretion	Macroalgae distribution	General habitat condition (CRAM)	Level 1 (see next table)
Ecosystem Functions	Primary Production	■	■				■			■			■		
	Secondary Production	■	■	■		■	■			■					■
	Nutrient Cycling	■	■		■	■	■			■		■	■		
	Nekton Habitat Provision	■		■		■	■	■	■				■	■	■
	Nursery Habitat Provision	■				■	■	■	■	■	■				■
	Bird Habitat Provision			■		■	■	■	■	■	■		■	■	■
	Shellfish Support	■		■	■	■	■						■		
	Support Vascular Plants									■	■	■		■	■
	SLR Amelioration									■	■	■		■	■

Monitoring Protocols

- **Abiotic Factors:**
  - In-situ water parameters
  - Basic water chemistry and nutrients
  - Sediment cores
- **Biotic Factors:**
  - Fish surveys, BRUV
  - Crab surveys
  - Benthic invertebrates
- **Estuary Habitat Surveys:**
  - Estuary Habitat Condition (CRAM)
  - Marsh Plain Vegetation and Topo Surveys
  - SAV Surveys
  - Community Composition Assessments (eDNA):
  - SLR Vulnerability and Marsh Plain Accretion Rate Estimates
- **Watershed Processes and Stressors:**
  - Landscape Stressors
  - Historical Habitat Change Analysis (where available)

SOP	Indicator	Collection Method
1/2	Water quality: PH, temperature, DO, salinity Water Elevation	Continuous data sensors YSI
3	Water nutrient concentration	Water grabs - nitrate, nitrite, Total N
4	General community composition (eDNA)	Water grabs - eDNA Sediment grabs
5	Sediment grainsize analysis	Sediment cores
6	Benthic infauna abundance, diversity, biomass	Sediment cores
7	SAV and Macroalgae surveys	Transects
8/9	Fish abundance and diversity	BRUVs Fish seines
10	Invertebrate (crabs), diversity, and biomass	Traps
11	Vegetation cover, distribution, and diversity	Transects
12	Topographic complexity	RTK surveys
13	Sediment accretion	Feldspar plots
	General habitat condition	CRAM

Management centric, function-based scoring criteria to evaluate condition.

Management centric, function-based scoring criteria to evaluate condition.

Standardization of condition assessment process by assigning each ecosystem function a suite of condition statements linked to individual indicators.

Ecosystem function: Vascular plant support

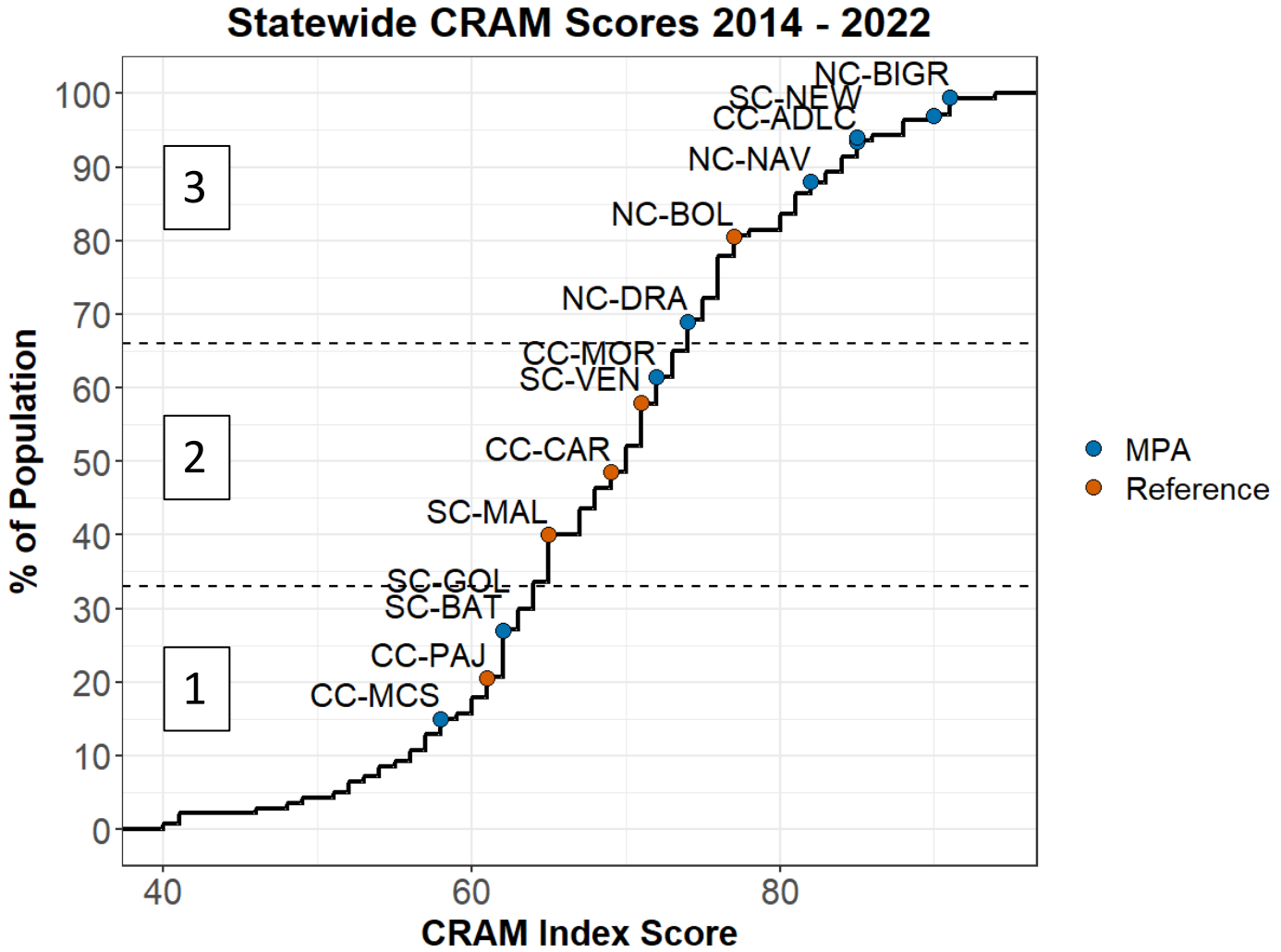
A high performing estuary has…

1. High California Rapid Assessment Method (CRAM) scores (Index, Physical, and Biotic attributes)
2. High percentage of native plant species
3. Dense vegetation cover in higher marsh elevation habitats (mid and high marsh)
4. Varied marsh plain topography (levels of rugosity)
5. Sediment supply to the marsh plain supports vascular plants
6. Appropriate amount of marsh plain inundation from main channel
7. Low presence of floating algae in the main channel

1. High California Rapid Assessment Method Scores for Index, Biotic and Physical Attributes

General
Habitat
Condition

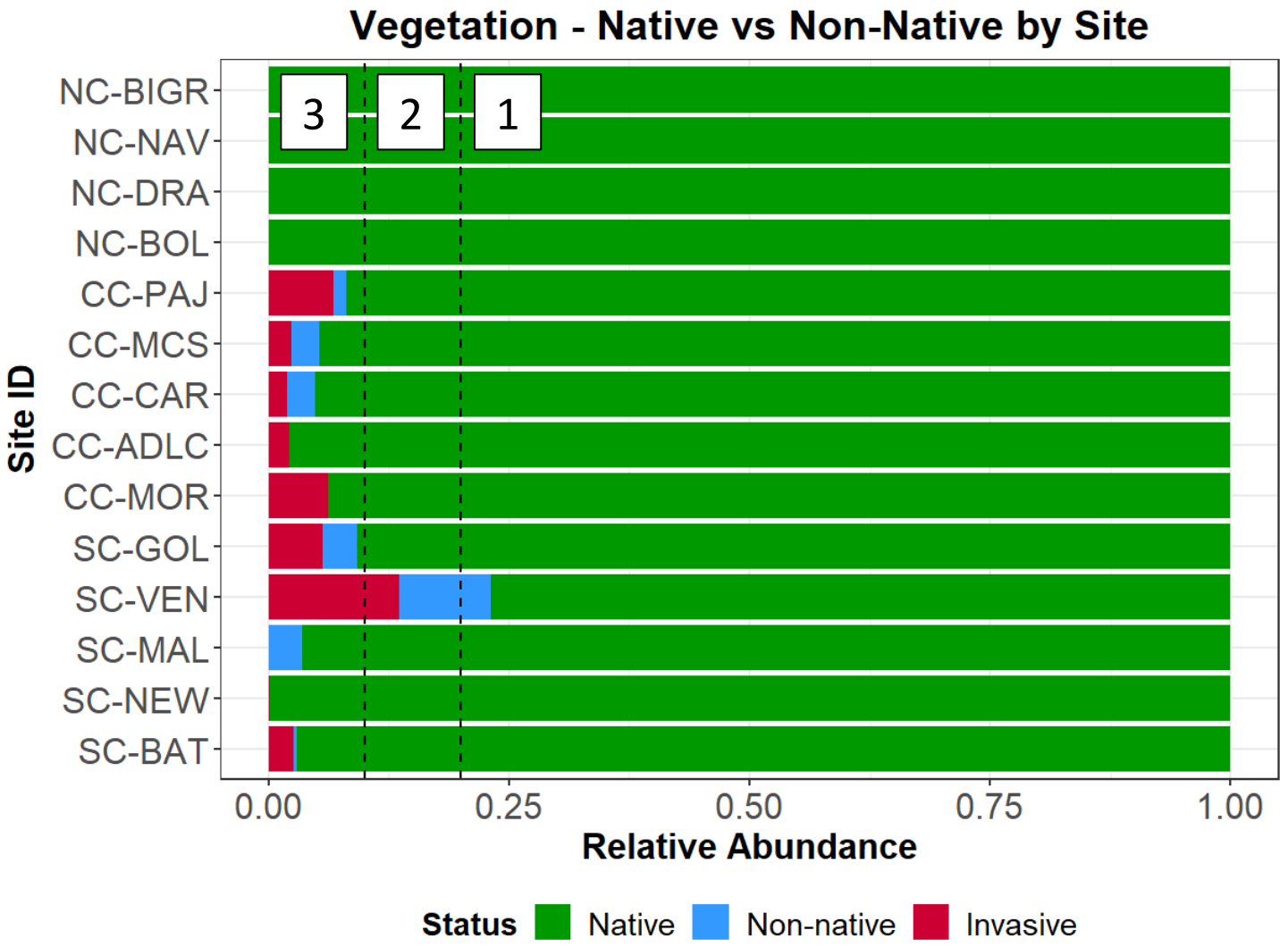
- 3 submetrics
- CRAM **Index score**, biotic, and physical attribute scores
- For scoring, divided statewide data into tertiles. If estuary scored within
  - Top 67-100% it received a 3
  - Middle 33-66% received a 2
  - Bottom 0-33% received a 1



2. High percentage of native plant species

Marsh vegetation distribution/ diversity/ invasives

- 3 submetrics
- **Cover of native plants**, cover of invasives, and the severity of the invasive plants present
- Using standards found in literature (O'Loughlin et al. 2021) set cutoff for scoring at 10 & 20% non-native and invasive combined cover
  - Below 10% received a 3
  - 10-20% received a 2
  - Above 20% received a 1

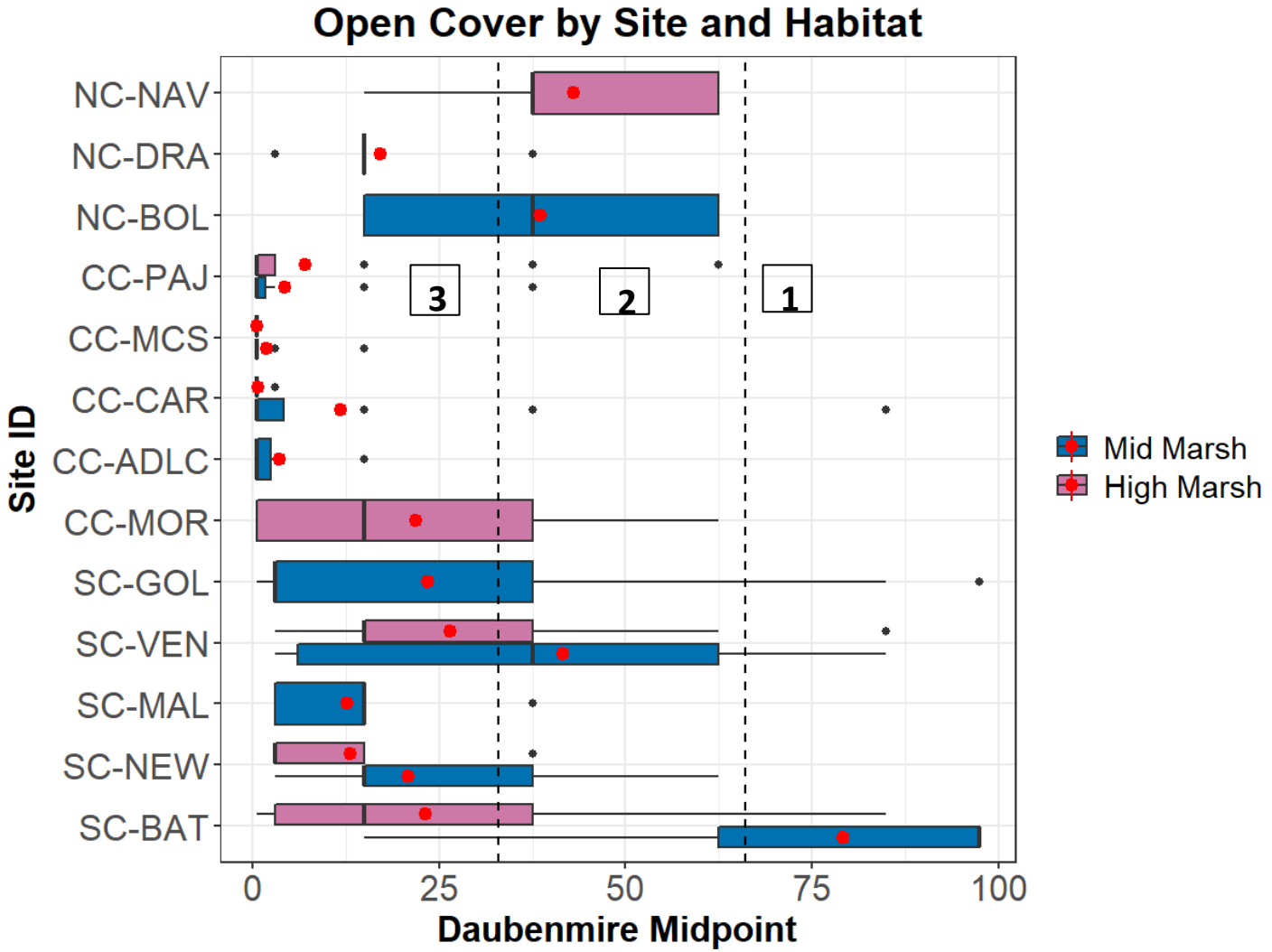


3. Dense vegetation cover in higher marsh elevation habitats (mid and high marsh)

Marsh vegetation distribution/ diversity/ invasives

- 3 submetrics
- **Low amount of open cover in mid and high marsh zones,** high plant diversity score, and a wide range of plant heights in each habitat zone
- Plotted open cover of mid and high marsh habitat and found mean open cover of each
- The cover was split into thirds:

  - 0-33% = 3
  - 34-66% = 2
  - 67-100% = 1

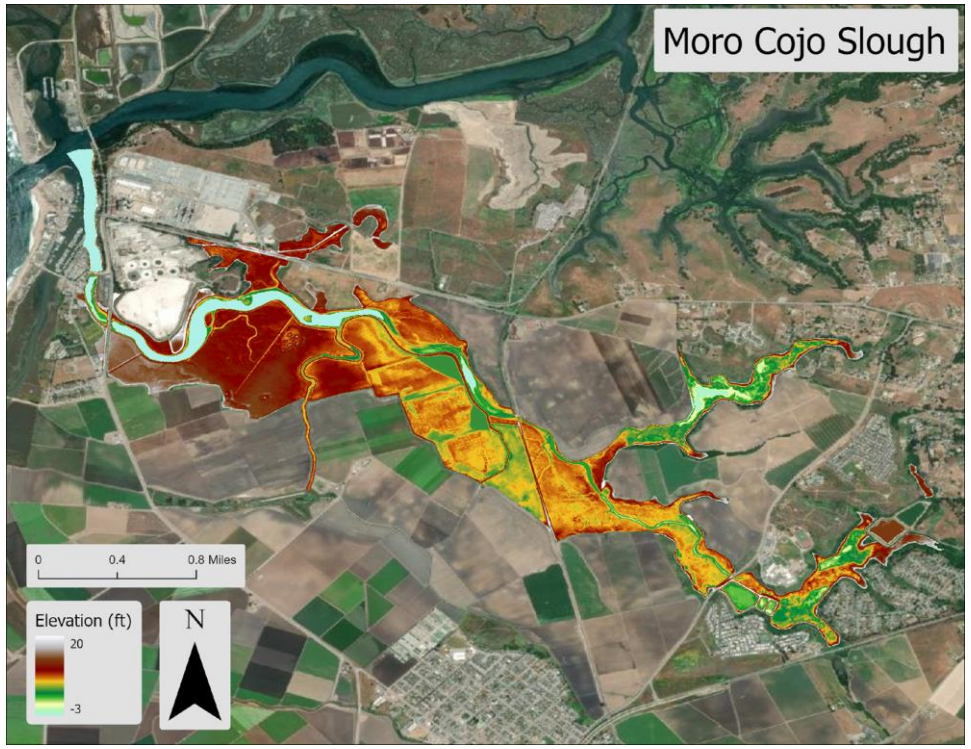


4. Varied marsh plain topography (levels of rugosity)

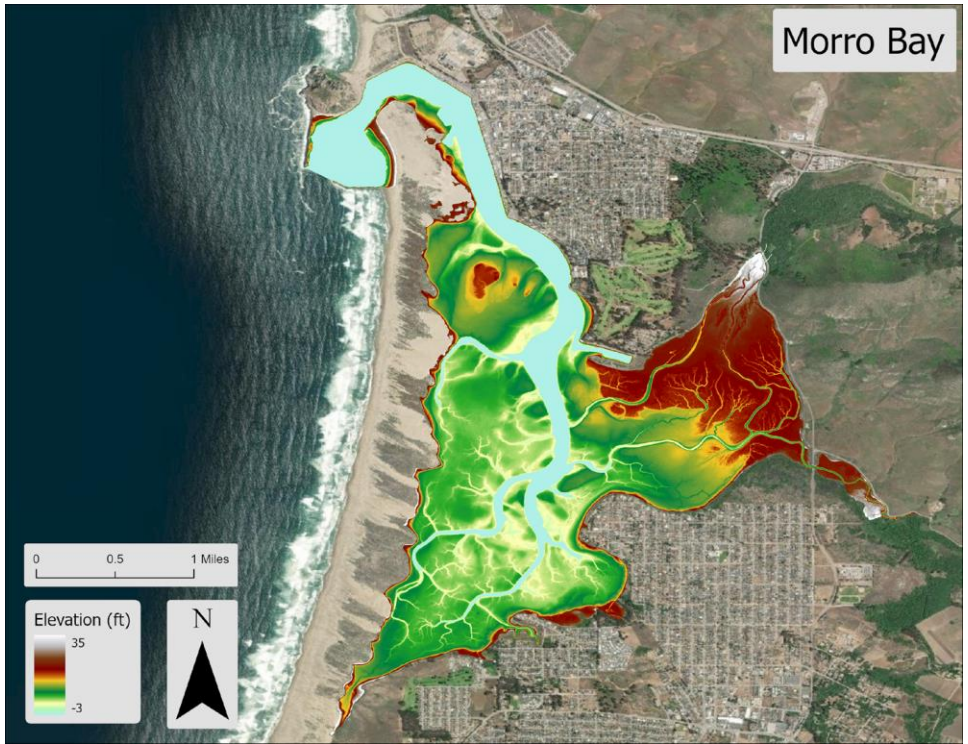
Marsh plain elevation

- Used Terrain Ruggedness Index tool in the ArcHydro toolbox to calculate ruggedness index of each estuary
- Using the max value we divided the scores into thirds
  - Largest values = 3
  - Middle values = 2
  - Low values = 1

Score =1



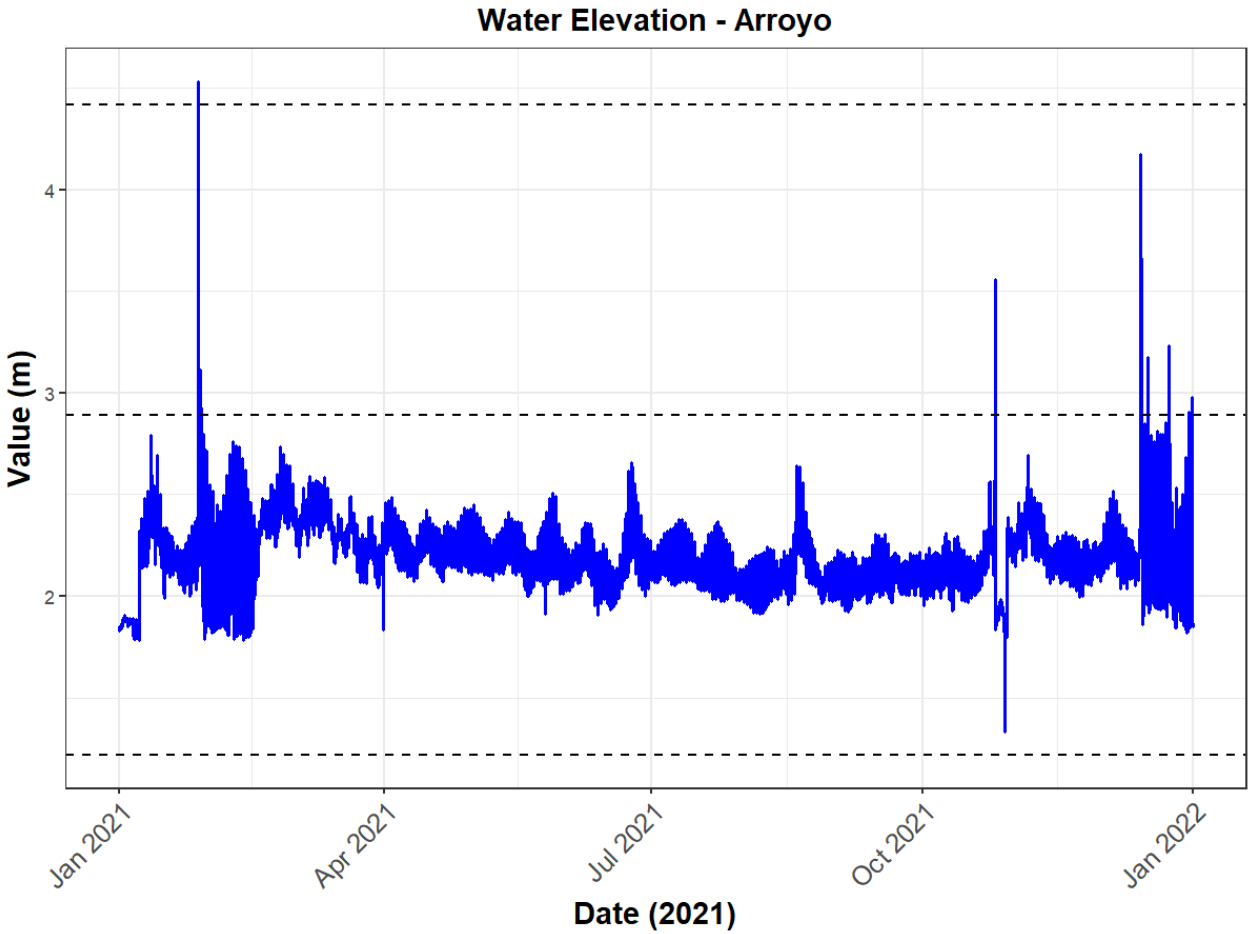
Score =2



5. Appropriate amount of marsh plain inundation from main channel

Marsh plain elevation-mouth dynamics

- Water elevation recorded for the year
- Using the binned elevation values from GIS analysis, determined average low, mid, and high marsh plain elevation
- Determine how frequently the water was inundating each marsh zone and for how long
- Did not have water elevation for all estuaries, not scored



NOT SCORED

6. Sediment supply to the marsh plain supports vascular plants

Sediment accretion rates

NOT SCORED

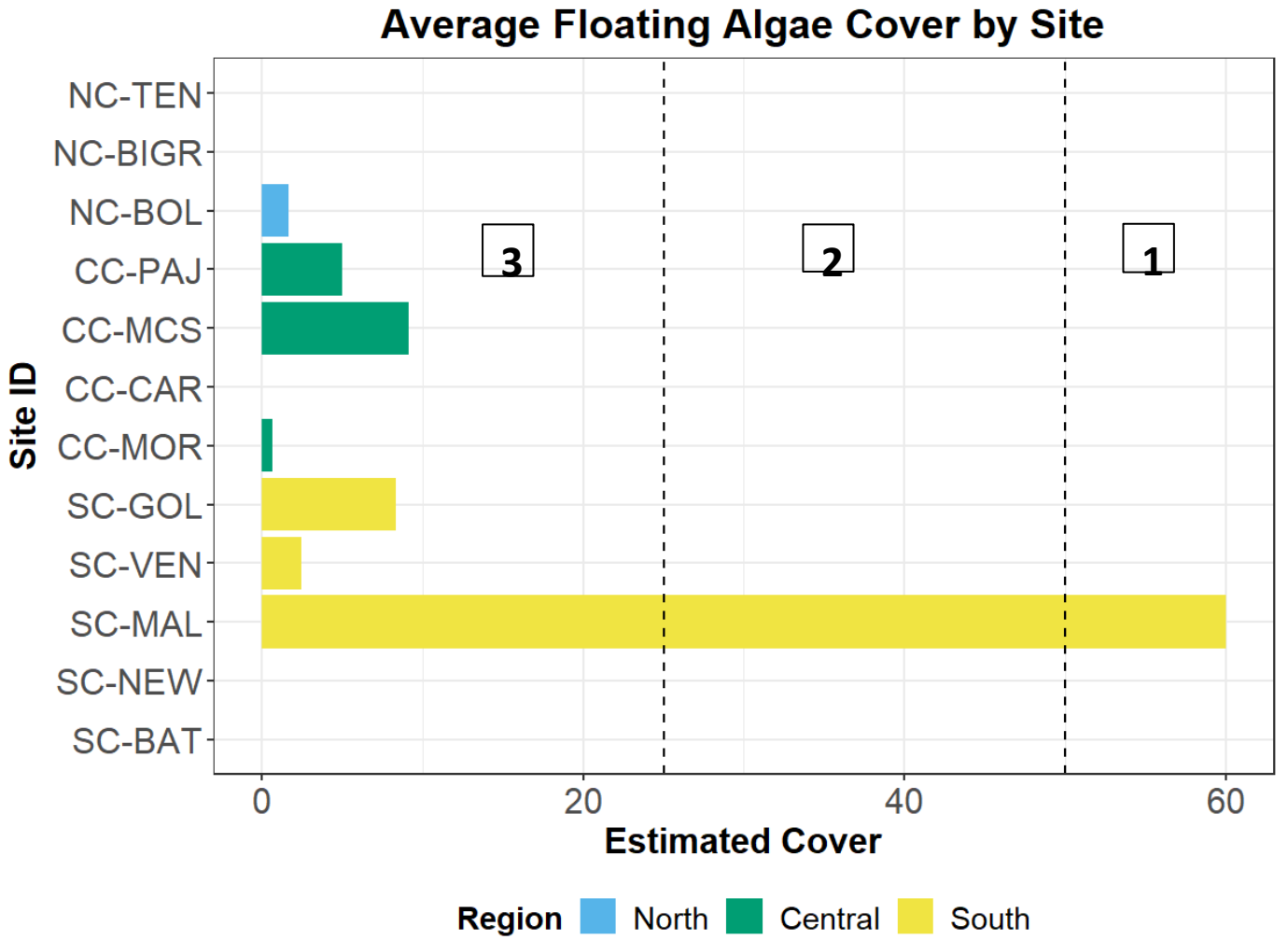
- Marsh plain accretion rates as an estimate of sediment supply to support marsh plain health.
- Accretion rates require several years between marker deployment and first sampling, an analysis has not been performed.

7. Low presence of floating algae in the main channel

SAV/macroalgae distribution

Very preliminary!

- Plotted average percent cover of floating algae at each estuary
- 0-25% = 3
- 26-50% = 2
- 51-100% = 1

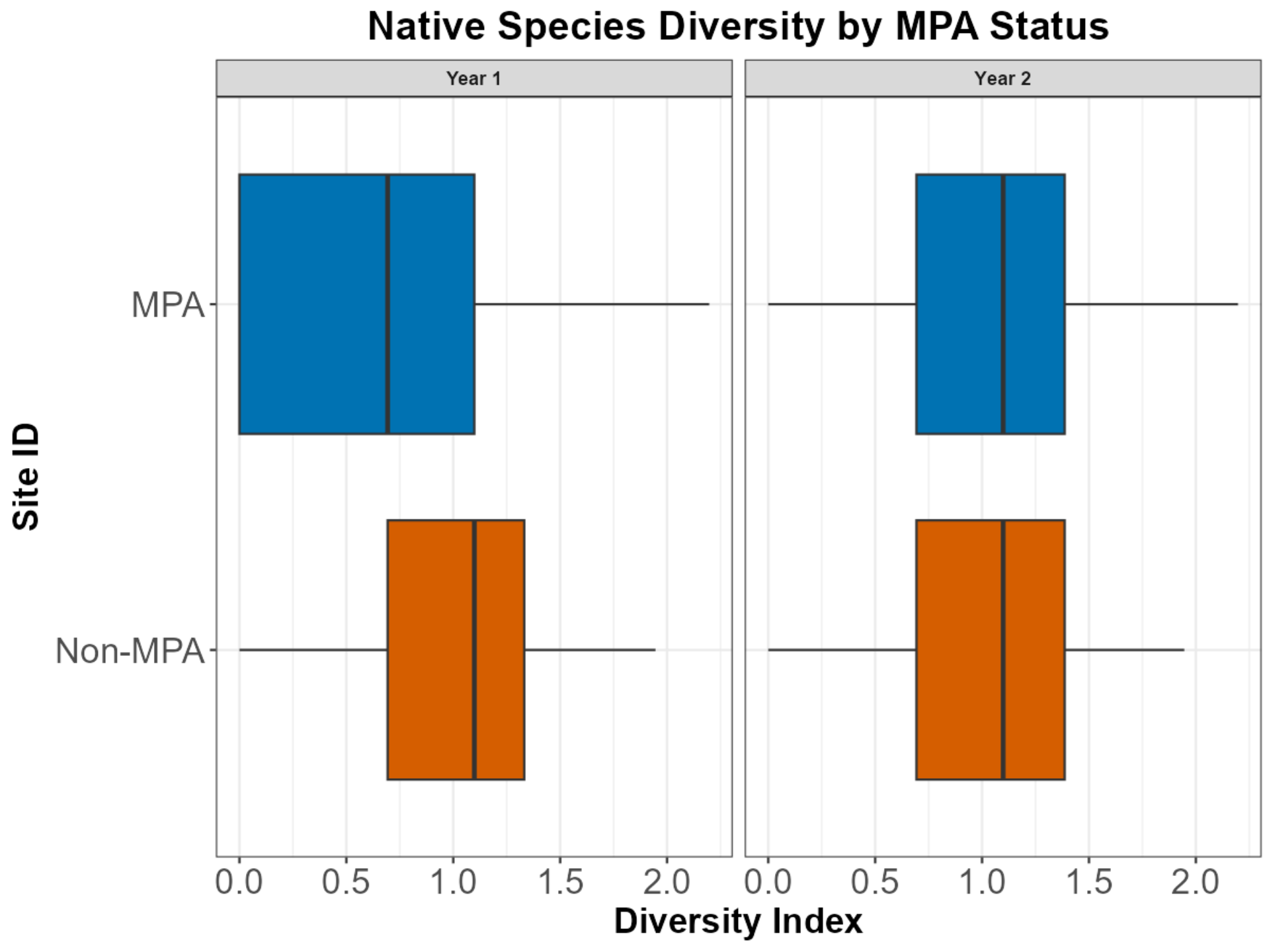


Example Function:
Support of Vascular Plant Communities

Site Name	General habitat condition	Marsh vegetation distribution & diversity		Marsh plain elevation		Sediment accretion rates	SAV/ macroalgae distribution	Final Score
	High CRAM Index, physical, and biotic attribute scores	*Native plant cover*	*Vegetation Cover*	*Varied marsh plain topography*	*Appropriate amount of inundation*	*Sediment supply*	*Low presence of floating algae*	
Ten Mile River	3.00	3.00	NA	3.00	NA	NA	3.00	3.00
Big River	3.00	3.00	1.50	3.00	NA	NA	3.00	2.70
Navarro River	3.00	3.00	1.33	3.00	NA	NA	NA	2.58
Drakes Estero	3.00	3.00	1.67	3.00	NA	NA	NA	2.67
Bolinas Lagoon	3.00	3.00	1.67	2.00	NA	NA	3.00	2.53
Pajaro River	1.33	1.67	2.00	2.00	NA	NA	3.00	2.00
Moro Cojo Slough	1.33	2.67	2.00	1.00	NA	NA	3.00	2.00
Carmel River	2.67	2.67	3.00	3.00	NA	NA	3.00	2.87
Arroyo de la Cruz	2.67	2.67	2.33	2.00	NA	NA	NA	2.42
Morro Bay	2.67	2.33	2.00	2.00	NA	NA	3.00	2.40
Goleta Slough	2.00	2.00	1.67	2.00	NA	NA	3.00	2.13
Ventura River	2.67	1.67	2.17	2.00	NA	NA	3.00	2.30
Malibu Lagoon	2.00	3.00	2.33	2.00	NA	NA	2.00	2.27
Newport Bay	3.00	2.67	2.33	3.00	NA	NA	3.00	2.80
Batiquitos Lagoon	1.67	2.67	1.33	2.00	NA	NA	3.00	2.13

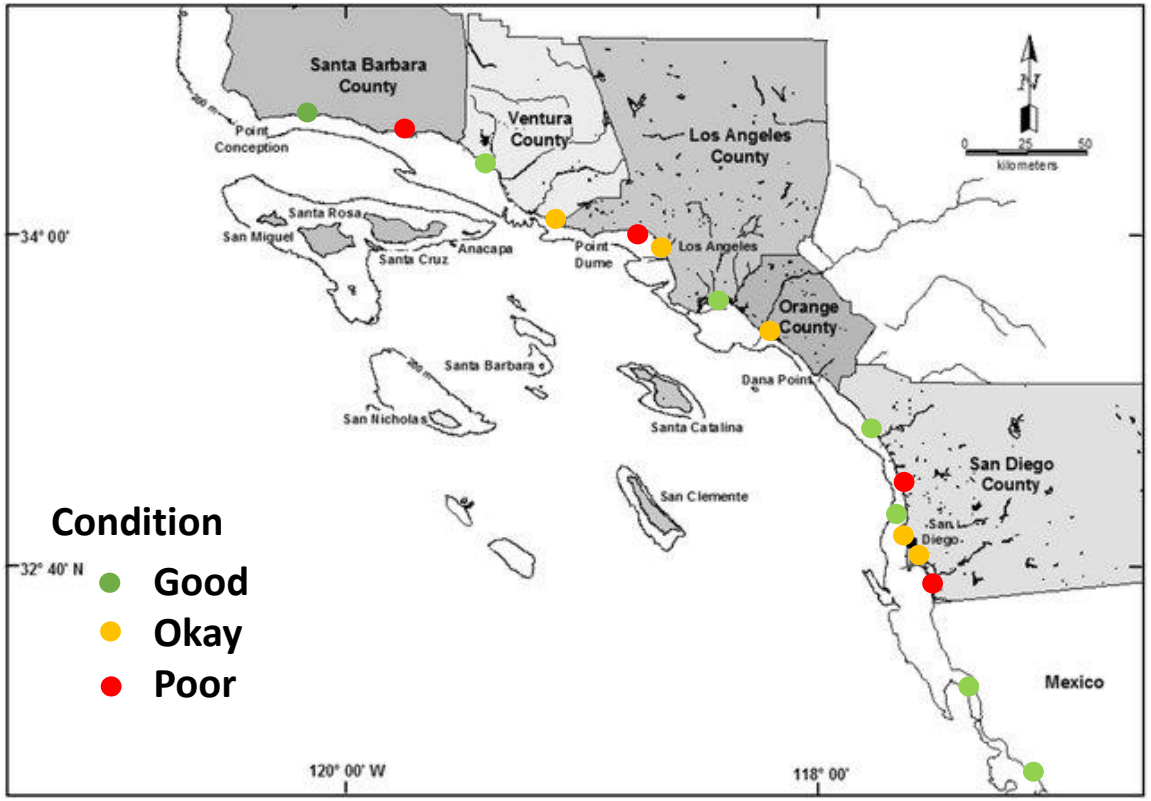
Example Function:
Support of Vascular Plant Communities

Site Name	General habitat condition	Marsh vegetation distribution & diversity		Marsh plain elevation		Sediment accretion rates	SAV/ macroalgae distribution	Final Score
	High CRAM Index, physical, and biotic attribute scores	*Native plant cover*	*Vegetation Cover*	*Varied marsh plain topography*	*Appropriate amount of inundation*	*Sediment supply*	*Low presence of floating algae*	
Ten Mile River	3.00	3.00	NA	3.00	NA	NA	3.00	3.00
Big River	3.00	3.00	1.50	3.00	NA	NA	3.00	2.70
Navarro River	3.00	3.00	1.33	3.00	NA	NA	NA	2.58
Drakes Estero	3.00	3.00	1.67	3.00	NA	NA	NA	2.67
Bolinas Lagoon	3.00	3.00	1.67	2.00	NA	NA	3.00	2.53
Pajaro River	1.33	1.67	2.00	2.00	NA	NA	3.00	2.00
Moro Cojo Slough	1.33	2.67	2.00	1.00	NA	NA	3.00	2.00
Carmel River	2.67	2.67	3.00	3.00	NA	NA	3.00	2.87
Arroyo de la Cruz	2.67	2.67	2.33	2.00	NA	NA	NA	2.42
Morro Bay	2.67	2.33	2.00	2.00	NA	NA	3.00	2.40
Goleta Slough	2.00	2.00	1.67	2.00	NA	NA	3.00	2.13
Ventura River	2.67	1.67	2.17	2.00	NA	NA	3.00	2.30
Malibu Lagoon	2.00	3.00	2.33	2.00	NA	NA	2.00	2.27
Newport Bay	3.00	2.67	2.33	3.00	NA	NA	3.00	2.80
Batiquitos Lagoon	1.67	2.67	1.33	2.00	NA	NA	3.00	2.13


Native Species Diversity by MPA Status
Year 1
Year 2
Site ID
MPA
Non-MPA
0.0
0.5
1.0
1.5
2.0
Diversity Index

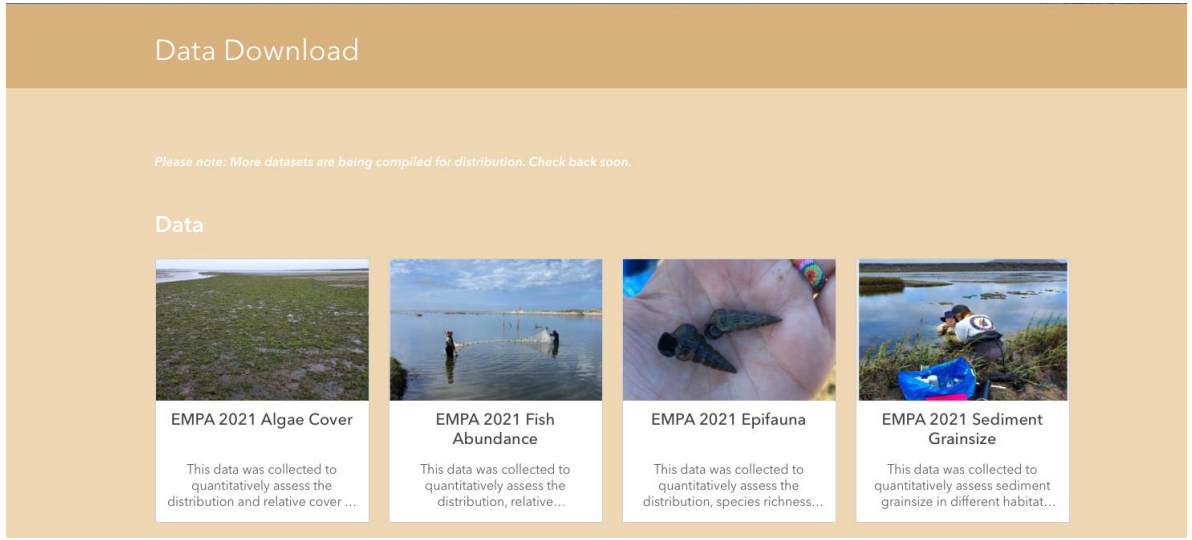
Management centric, function-based scoring criteria to evaluate condition.

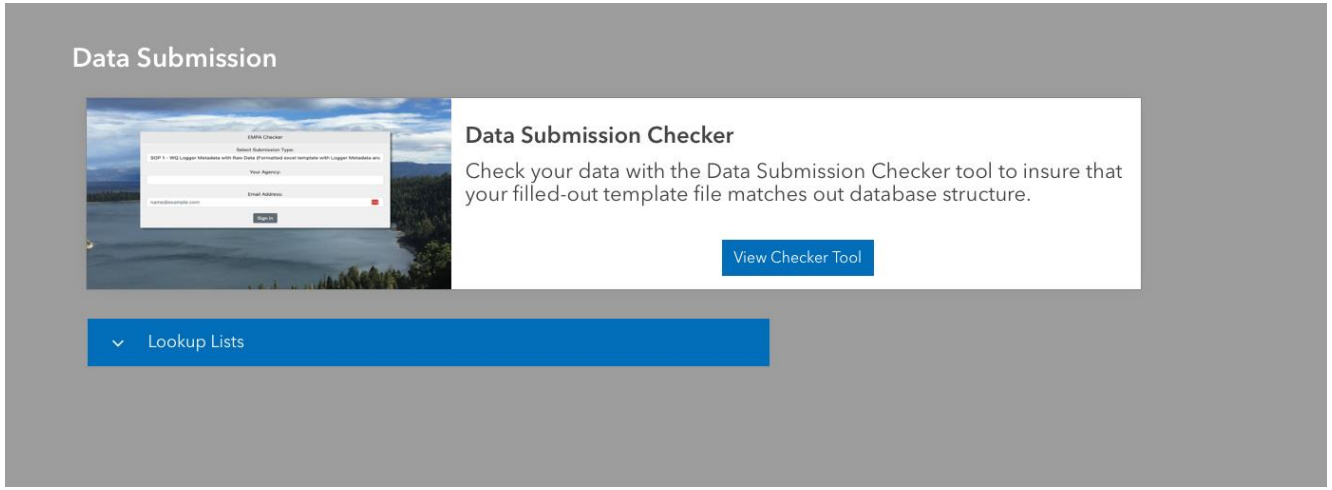
Standardization of condition assessment process by assigning each ecosystem function a suite of condition statements linked to individual indicators.



Standard data assembly and infrastructure to increase comparability and encourage collaboration.

https://empa.sccwrp.org



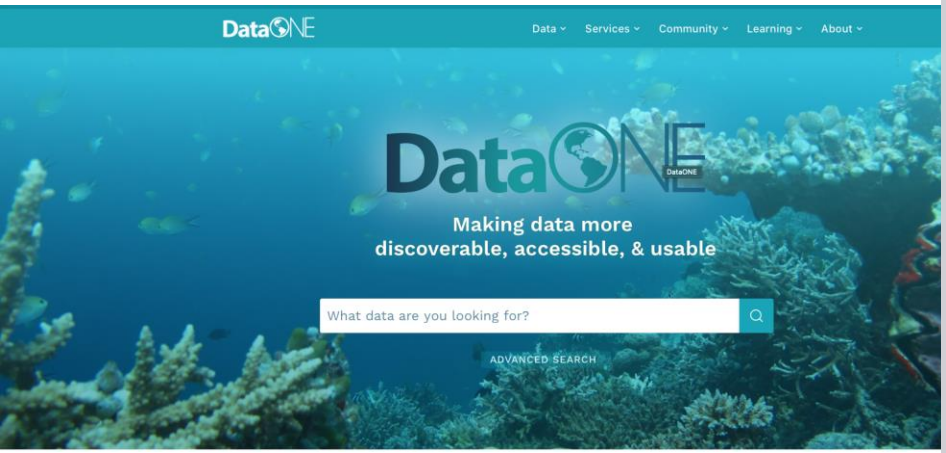


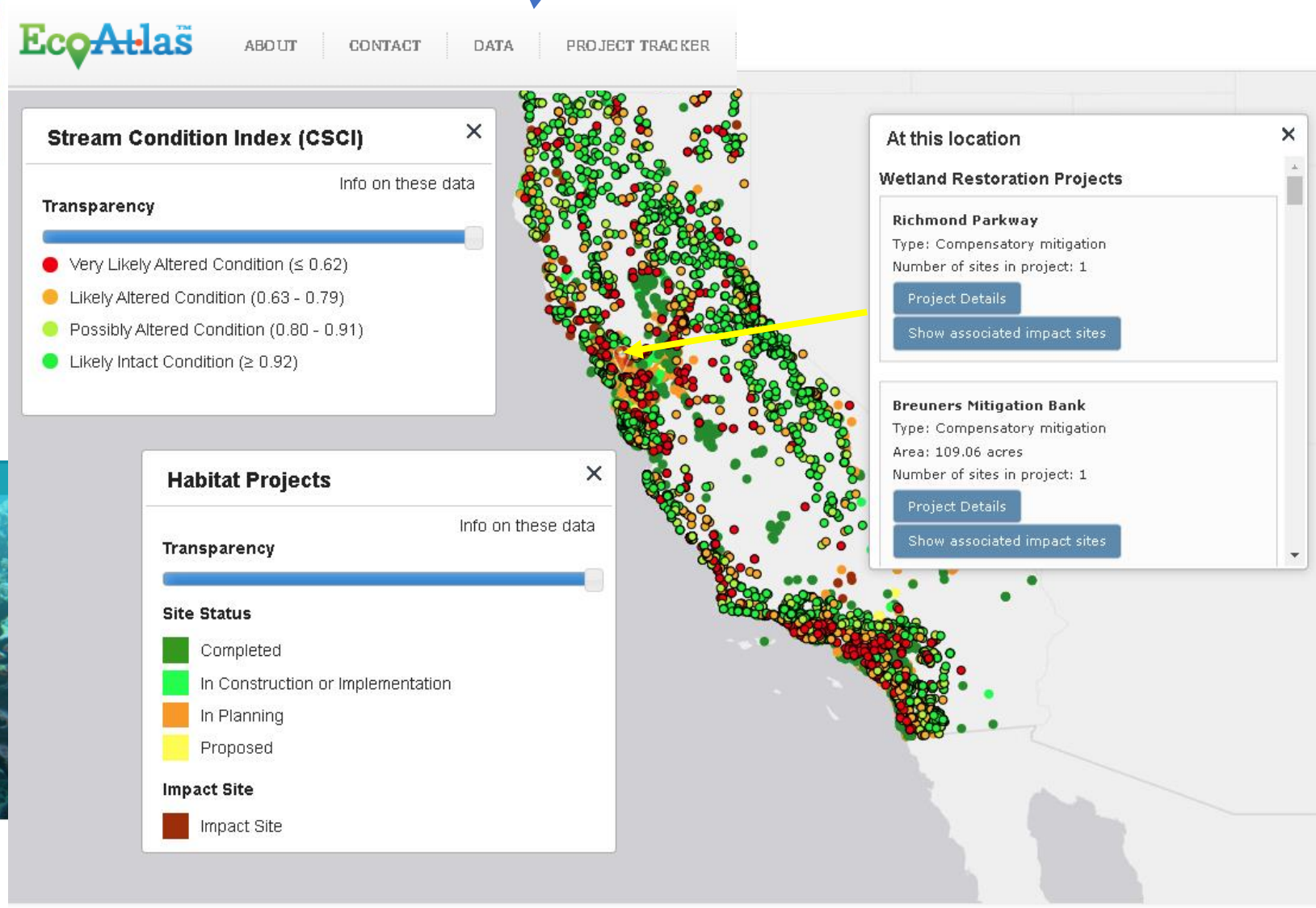
The main objective of the EMPA project is to develop an enhanced, coordinated Statewide Estuarine Monitoring Program called out in the California Marine Life Protection Act (MLPA) Monitoring Action Plan.

This project includes the compilation and analysis of select, currently available data sets, a focused field data collection effort to fill data gaps through implementation of standard protocols (abiotic, biotic, habitat, and stressor parameters), quantification of the current benefits of MPA status, and the development of long-term monitoring and management recommendations to expand the benefits of EMPA designation and document changes through time.

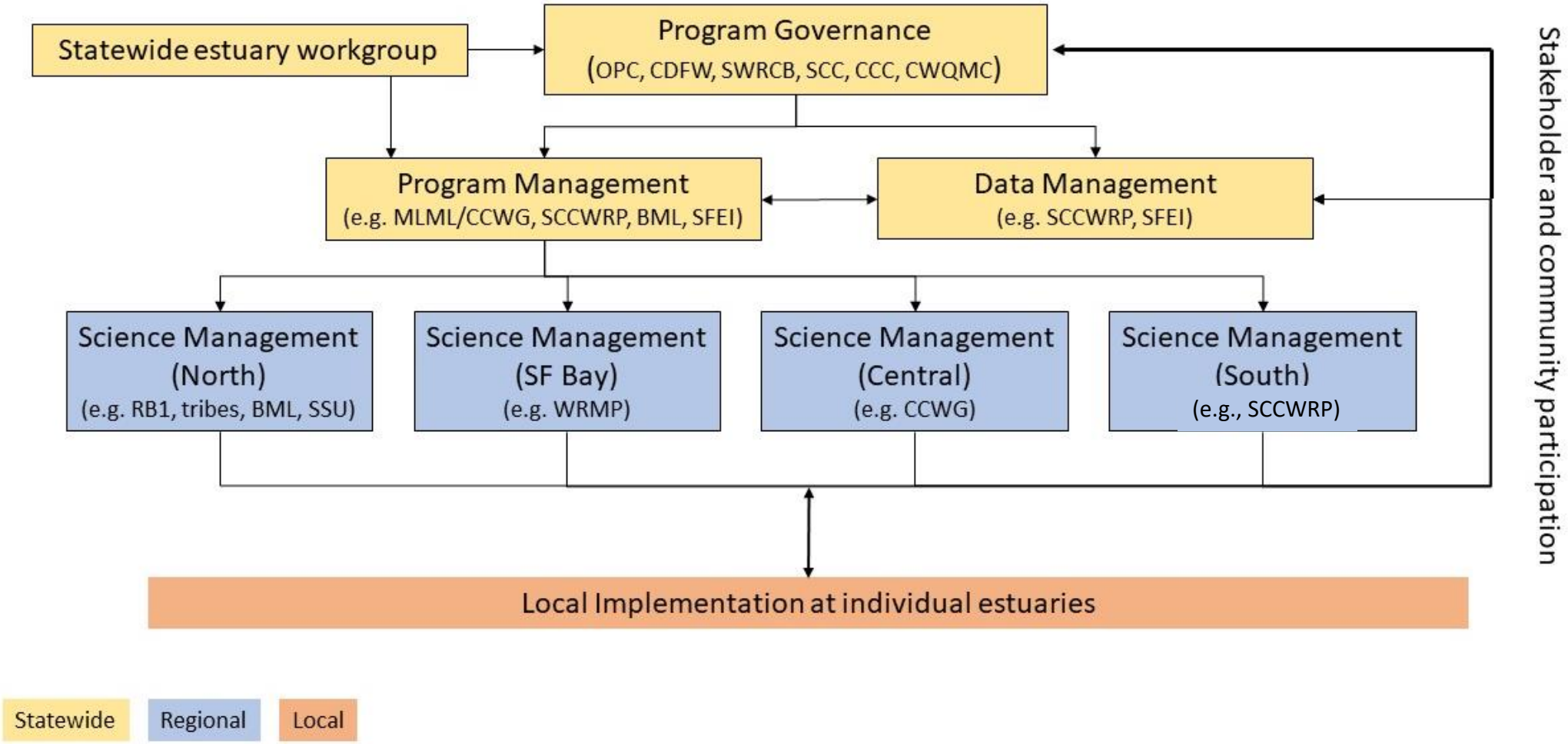
This website provides access to the technical reports generated from the project, monitoring protocols, field data sheets, and instructions for accessing and uploading data generated using the EMPA monitoring protocol.

https://empa.sccwrp.org





A proposed implementation plan includes a tiered governance structure: State-Regional-Local.



Development of a Statewide Estuary Monitoring Program to Evaluate California's Estuarine Marine Protected Areas

Estuary Marine Protected Area Program Overview

Version 1.2
December 2022

EMPA
Monitoring Program

OCEAN PROTECTION COUNCIL

Development of a Sta
Evaluate California's E

Estuary Marine Protected A

Estuary Marine Protected Area
Monitoring Protocol

Version 1.2
December 2022

Version 1.3 *Draft*
December 2022

EMPA
Monitoring Program

OCEAN
PROTECTION
COUNCIL

Development of a Sta
Evaluate California's E

Estuary Marine Protected A

Version 1.2
December 2022

Estuary Marine Protect
Monitoring Prot

Version 1.3 *Draft*
December 2022

Estuary Marine Protected Area
Data Analysis Report

Version 1.1 *Draft*
December 2022

EMPA
Monitoring Program

OCEAN PROTECTION COUNCIL

Development of a Sta
Evaluate California's E

Estuary Marine Protected A

Version 1.2
December 2022

Estuary Marine Protect
Monitoring Prot

Version 1.3 *Draft*
December 2022

Estuary Marine Protect
Data Analysis Re

Version 1.1 *Draft*
December 2022

Estuary Marine Protected Area
Monitoring Program Implementation Blueprint

Version 1.3 *Draft*
December 2022

EMPA
Monitoring Program

OCEAN PROTECTION COUNCIL

Operationalizing the EMPA framework into other programs and agency specific guidelines.

1. **California Estuary Monitoring Workgroup** - A forum to coordinate regional programs across the state into a more coordinated statewide effort

2. **Southern CA Bight Regional Monitoring Program** - Integrated, coordinated monitoring answering basic questions about environmental status and trends every five years

3. **Southern California Wetland Recovery Project Regional Monitoring Program** – Working to incorporate standard coastal wetland monitoring methods into permit- and funding-required monitoring programs

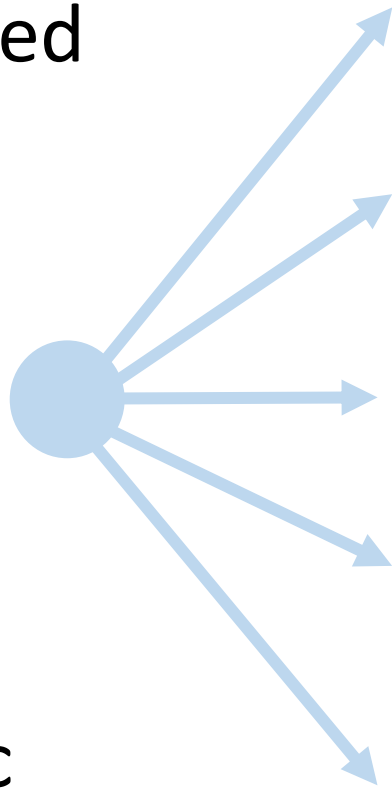
WATER QUALITY MONITORING COUNCIL

SOUTHERN CALIFORNIA BIGHT REGIONAL MONITORING PROGRAM

SOUTHERN CALIFORNIA WETLANDS RECOVERY PROJECT

An ecosystem function framework will help move us forward in collecting estuary long-term monitoring data.

1. **Flexible:** Modular, function-based approach
2. **Comparable:** Synthesize across geographic areas
3. **Interpretable:** Comprehensive and consistent sampling
4. **Practical:** Feasible sampling campaign, Management centric



- Baseline conditions
- Bioassessment tools
- Trend analysis
- Evaluate restorations
- Answer management questions

Next Steps

- Field sampling 2024-2026
- Refinement of SOPs
- Adding more function-based assessments
- Buildout of online support system to automate function-based assessments

Monitoring for management: A modular, ecosystem function-based assessment framework for estuaries

EMPA
Monitoring Program

Christine.Whitcraft@csulb.edu

SCCWRP Established 1969

CCWG central coast wetlands group

Biological Sciences

SONOMA STATE UNIVERSITY

UCDAVIS Coastal and Marine Sciences Institute

UCLA

CALIFORNIA WATER BOARDS San Francisco Bay · R2