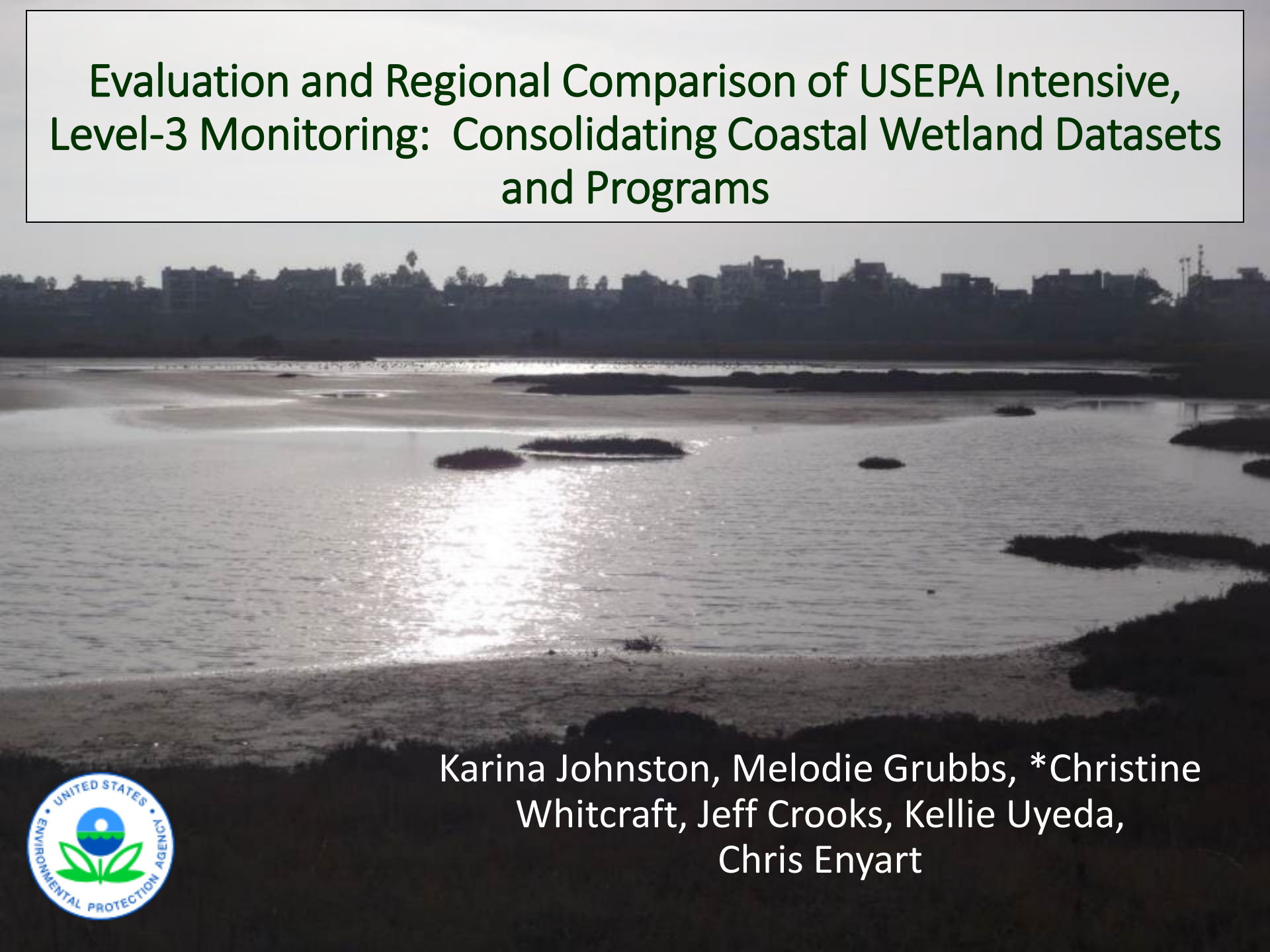
Evaluation and Regional Comparison of USEPA Intensive, Level-3 Monitoring: Consolidating Coastal Wetland Datasets and Programs

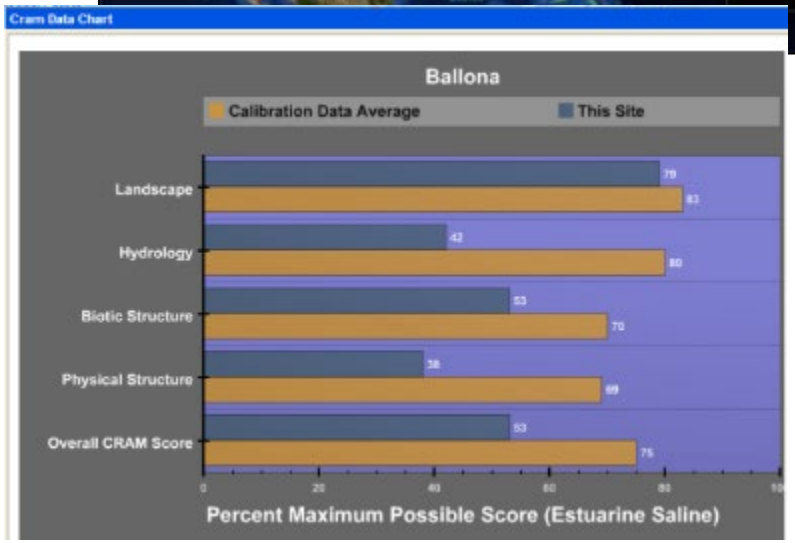


Karina Johnston, Melodie Grubbs, *Christine Whitcraft, Jeff Crooks, Kellie Uyeda, Chris Enyart

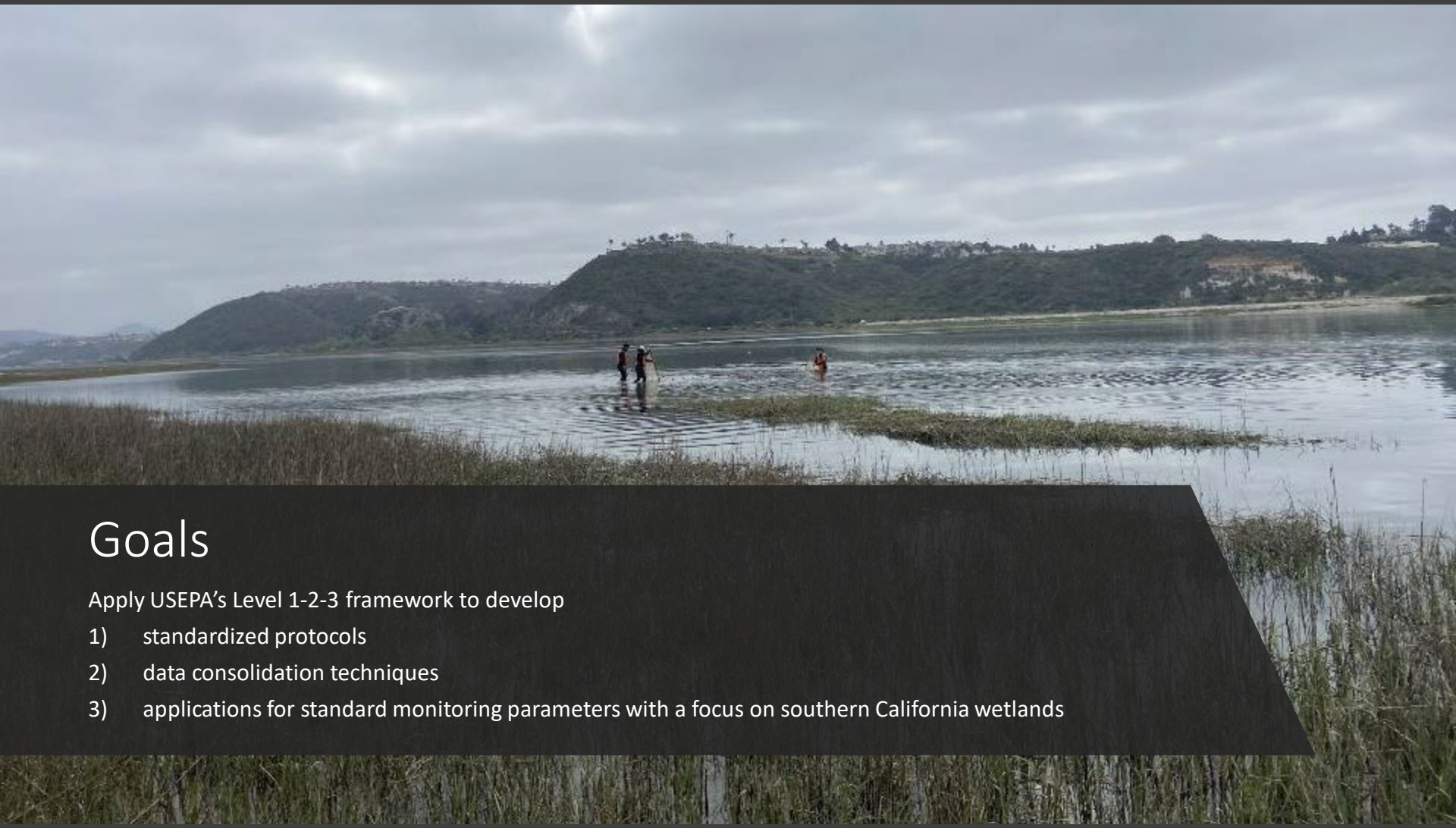
EPA 3-Tier Wetland Monitoring Program

LEVEL 1 – mapping and landscape-level assessments

LEVEL 2 – rapid assessments (e.g. CRAM)



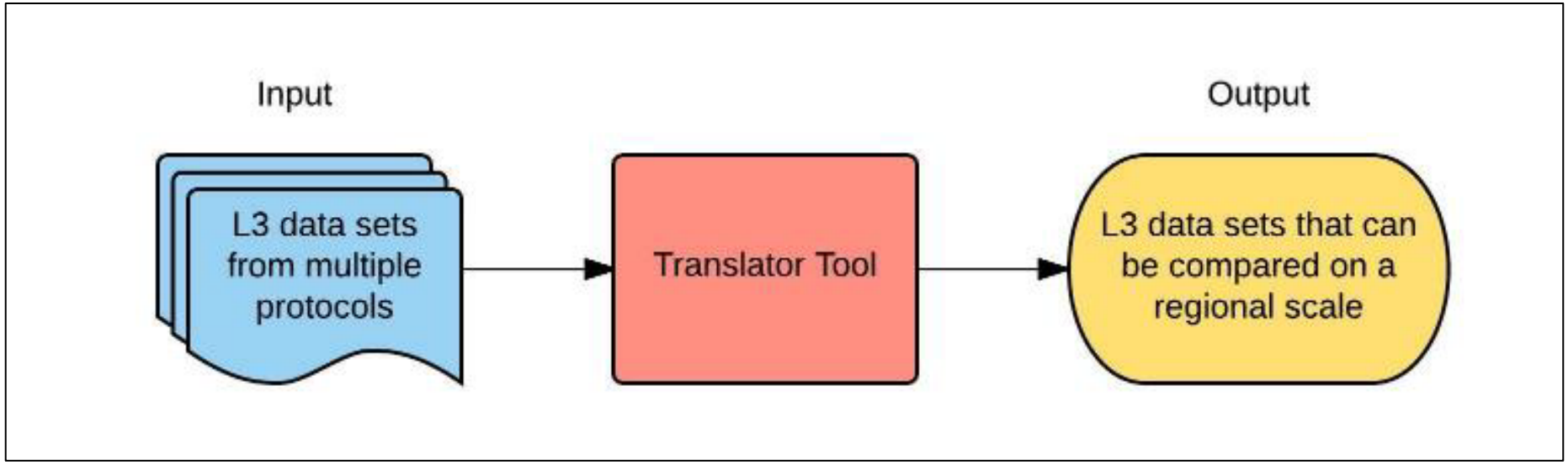
LEVEL 3 – site-intensive monitoring



Goals

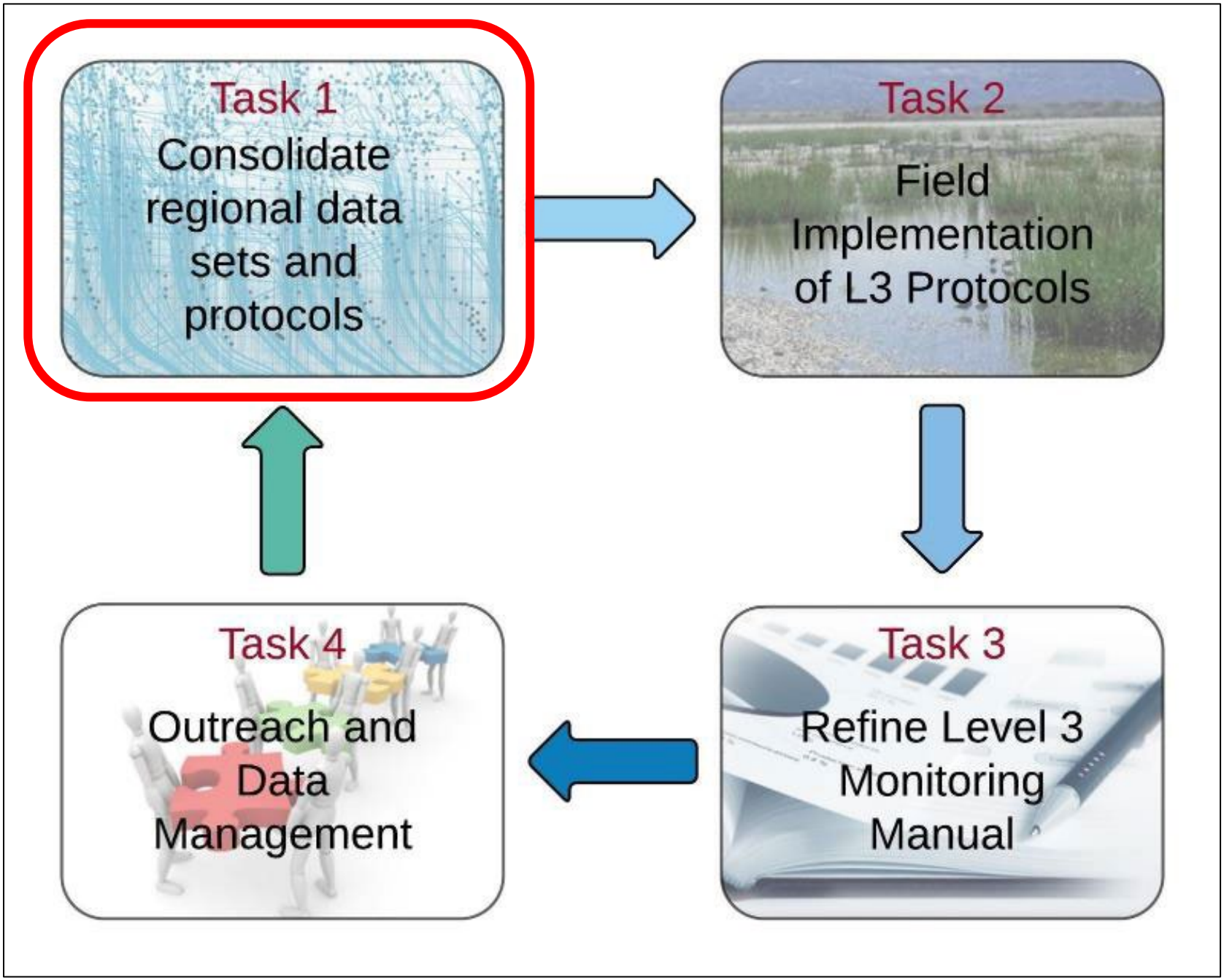
Apply USEPA's Level 1-2-3 framework to develop

1) standardized protocols
2) data consolidation techniques
3) applications for standard monitoring parameters with a focus on southern California wetlands


Input
Output
L3 data sets from multiple protocols
Translator Tool
L3 data sets that can be compared on a regional scale

“But what is your question?”

- ***Extent-distribution***
  - How has the area of a wetland changed over time?
- ***Typology***
  - Has wetland habitat shifted habitat classification (e.g. from salt flats to salt marsh)?
- ***Diversity***
  - Has the composition of key populations changed in response to environmental or anthropogenic drivers?
- ***Function-based questions***
  - How did the composition of functional groups in the vary as a function of wetland type or through time?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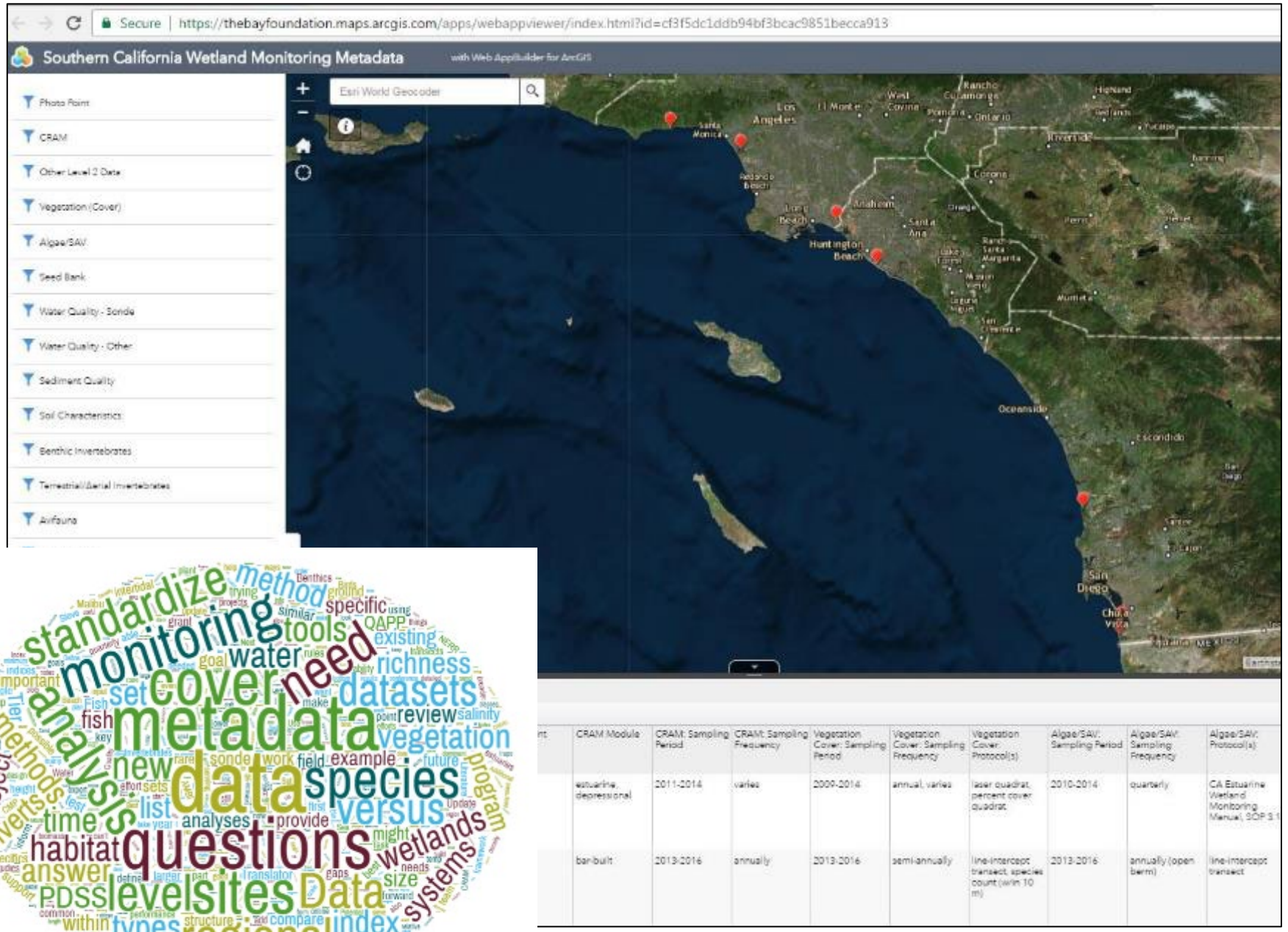
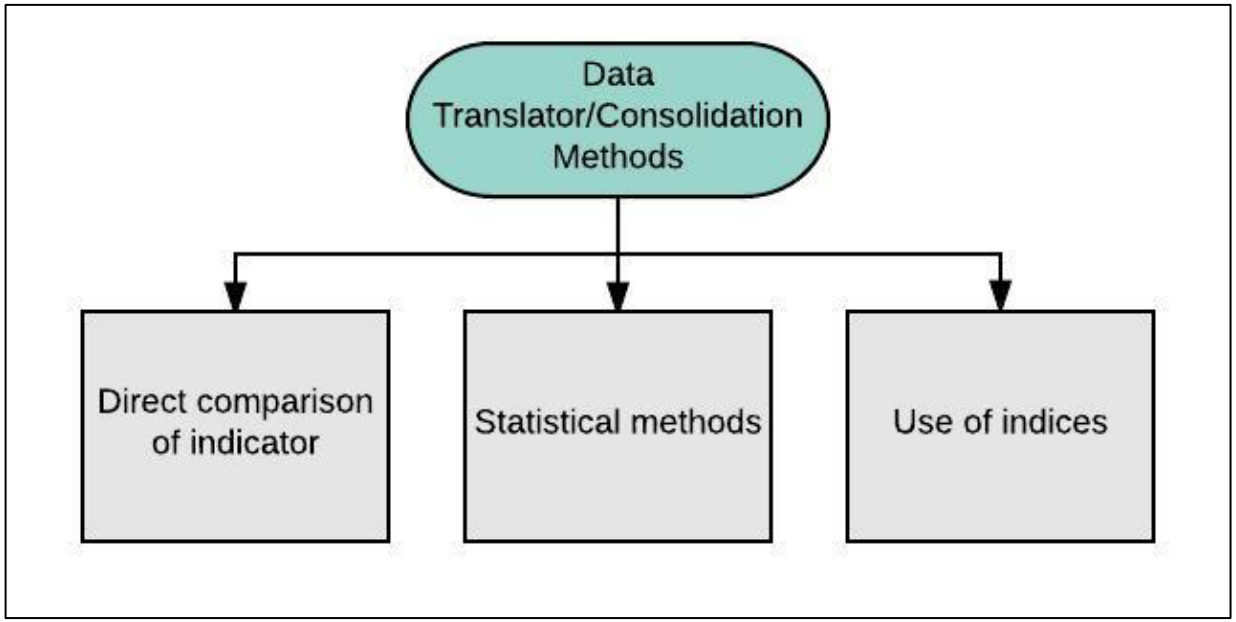
Outreach and Data Management

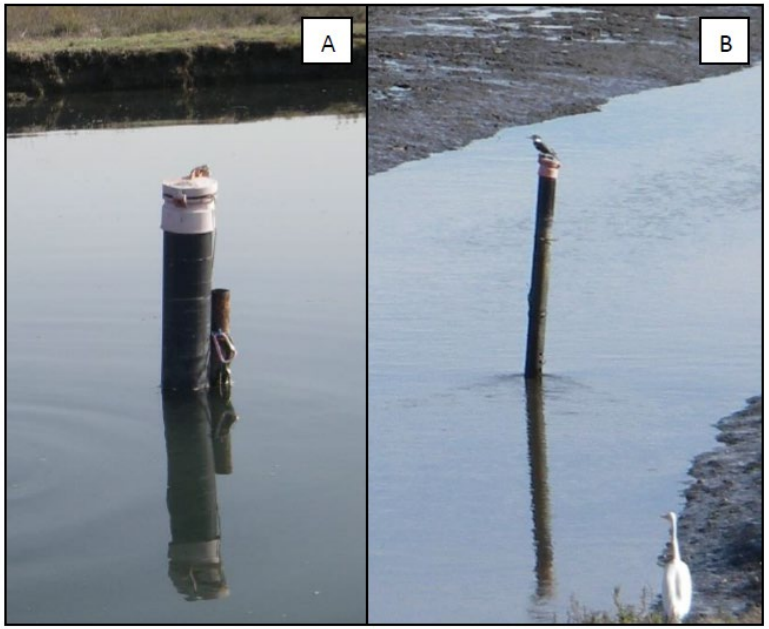

Secure | https://thebayfoundation.maps.arcgis.com/apps/webappviewer/index.html?id=cf3f5dc1ddb94bf3bcac9851becca913
Southern California Wetland Monitoring Metadata
with Web AppBuilder for ArcGIS
Esri World Geocoder
Photo Point
CRAM
Other Level 2 Data
Vegetation (Cover)
Algae/SAV
Seed Bank
Water Quality - Sonde
Water Quality - Other
Sediment Quality
Soil Characteristics
Benthic Invertebrates
Terrestrial/Aerial Invertebrates
Avifauna
Los Angeles
Santa Monica
Anaheim
Huntington Beach
Oceanside
San Diego
CRAM Module
CRAM: Sampling Period
CRAM: Sampling Frequency
Vegetation Cover: Sampling Period
Vegetation Cover: Sampling Frequency
Vegetation Cover Protocol(s)
Algae/SAV: Sampling Period
Algae/SAV: Sampling Frequency
Algae/SAV: Protocol(s)
estuarine, depressional
2011-2014
varies
2009-2014
annual, varies
laser quadrat, percent cover quadrat
2010-2014
quarterly
CA Estuarine Wetland Monitoring Manual, SOP S
bar-built
2013-2016
annually
2013-2016
semi-annually
line-intercept transect, species count (w/in 10 m)
2013-2016
annually (open berm)
line-intercept transect

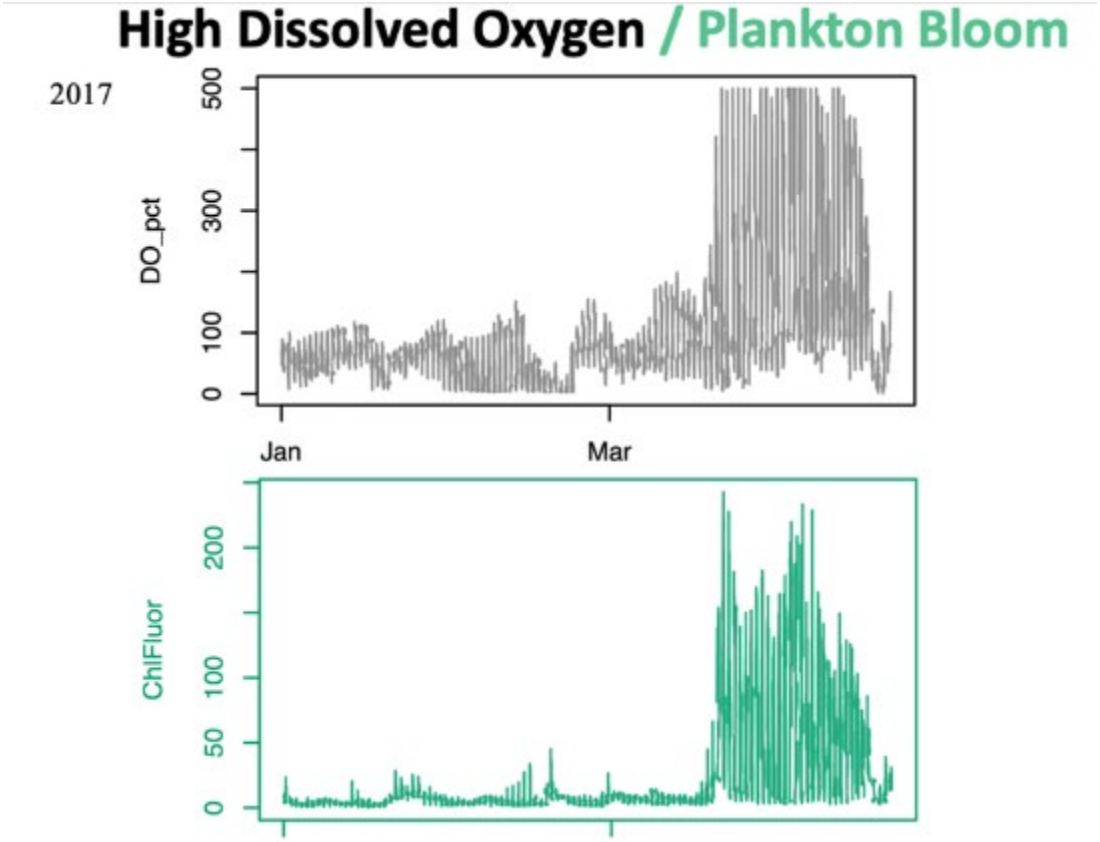
standardize
method
monitoring
tools
specific
QAPP
existing
water
need
richness
cover
datasets
set
metadata
review
vegetation
analysis
data
species
new
versus
program
methods
project
inverts
time
list
analyses
provide
might
wetlands
habitat
questions
answer
systems
PDSS
levelsites
Data
size
index
types
regional
within
develop
across
area
SOPs
WRP



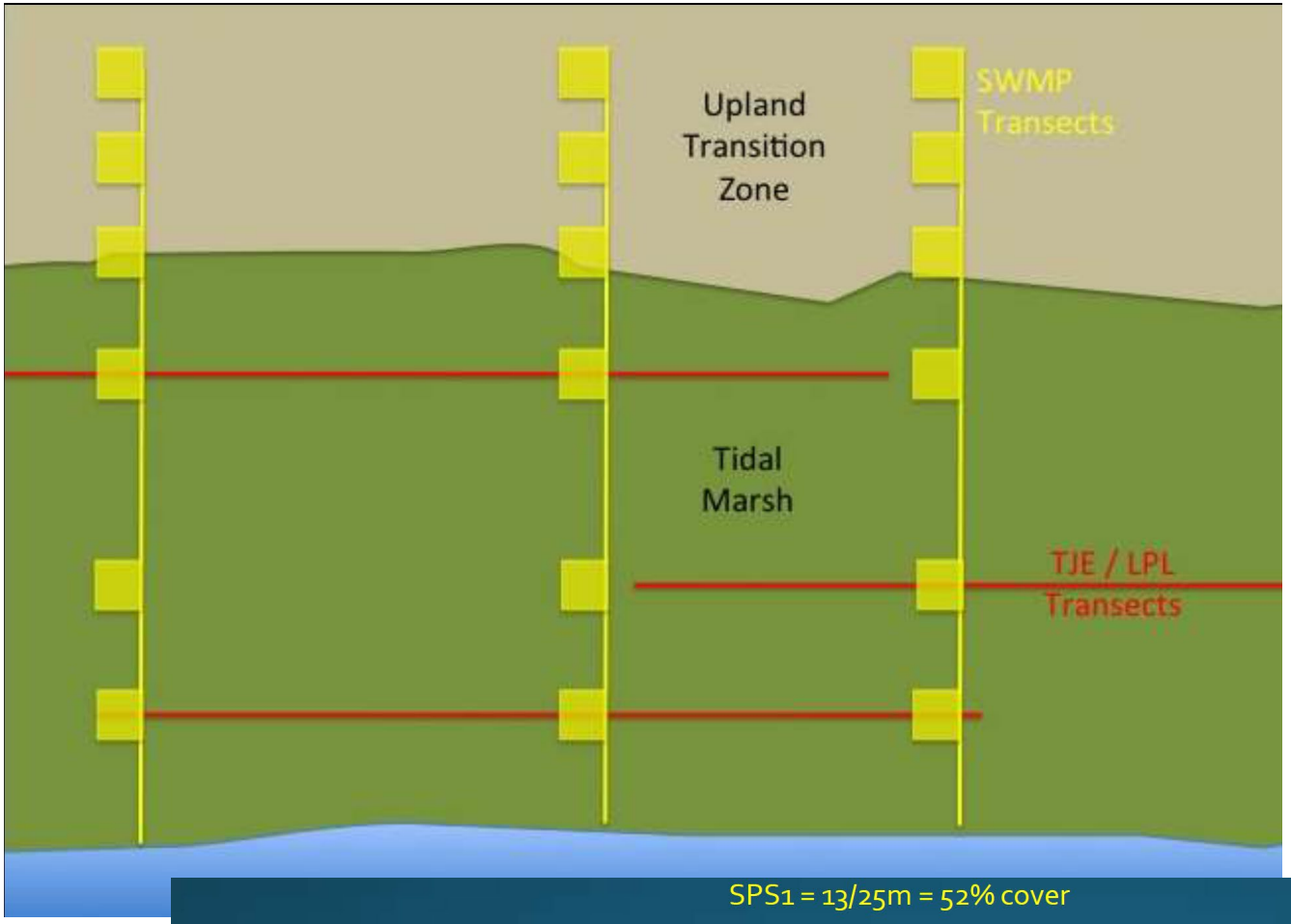
- Water quality
- Plant community
- Invertebrates
- Fish community

Water quality

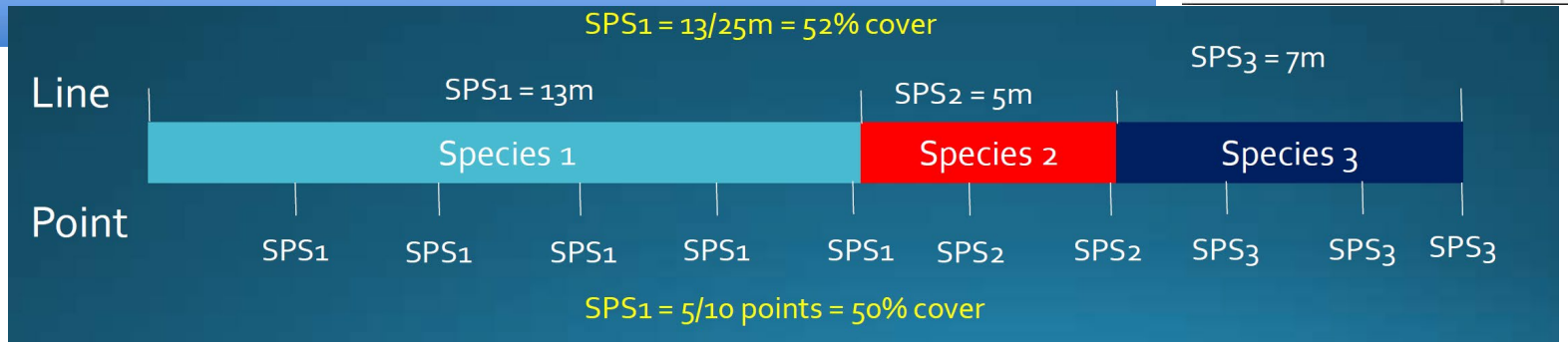




Plant sampling methods

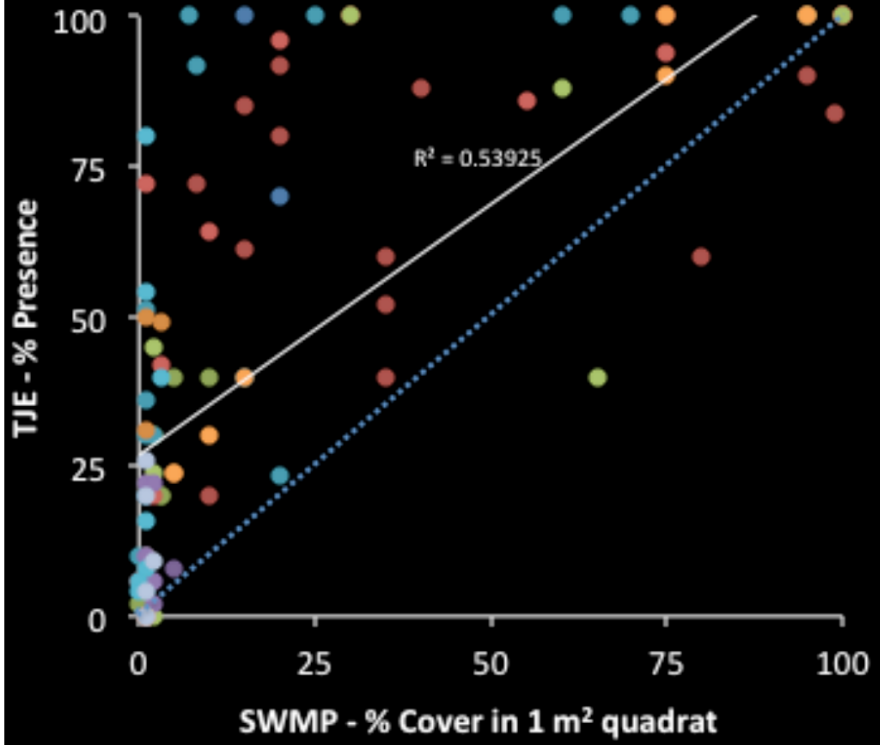


Estimated cover category	Cover class
> 0 - 1 %	1
> 1 - 5 %	2
> 5 - 25 %	3
> 25 - 50 %	4
> 50 - 75 %	5
> 75 - 95 %	6
> 95 - 100 %	7

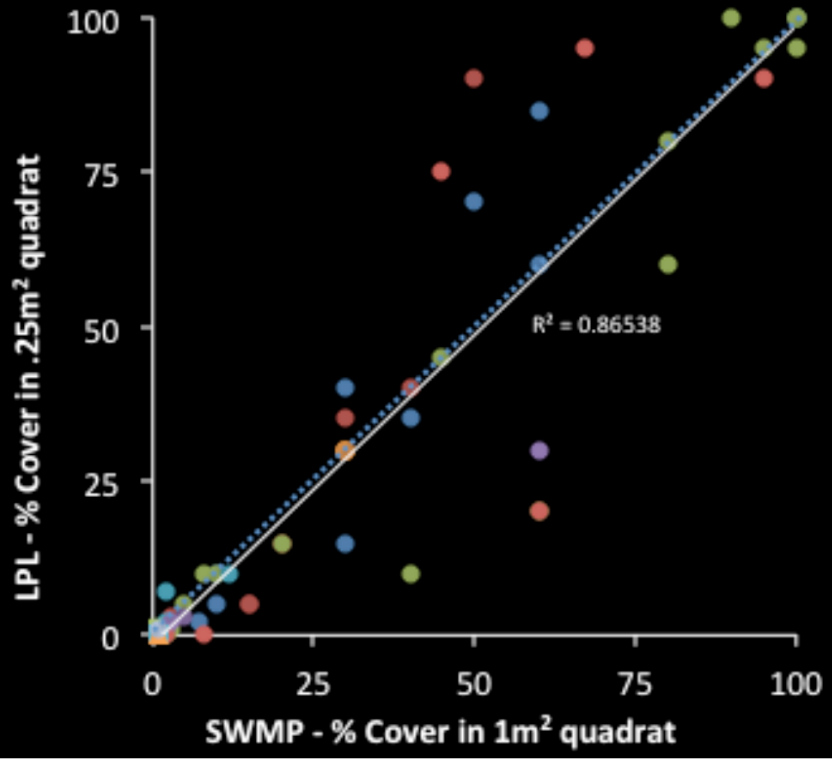


Comparisons of Vegetation Sampling

Per-plot comparisons by species



Tijuana Estuary
Line Intercept vs. % Cover in Quadrats

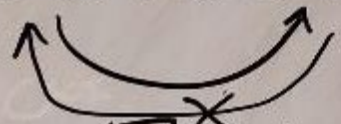


Los Peñasquitos Lagoon
% Cover in Different-Sized Quadrats

Crooks et al. unpublished

Can Do's

- exact # vs binned data



☑ analysis datasets (HBW vs TBF)

- percent cover > 100 ? = percent cover = 100 ;-?!

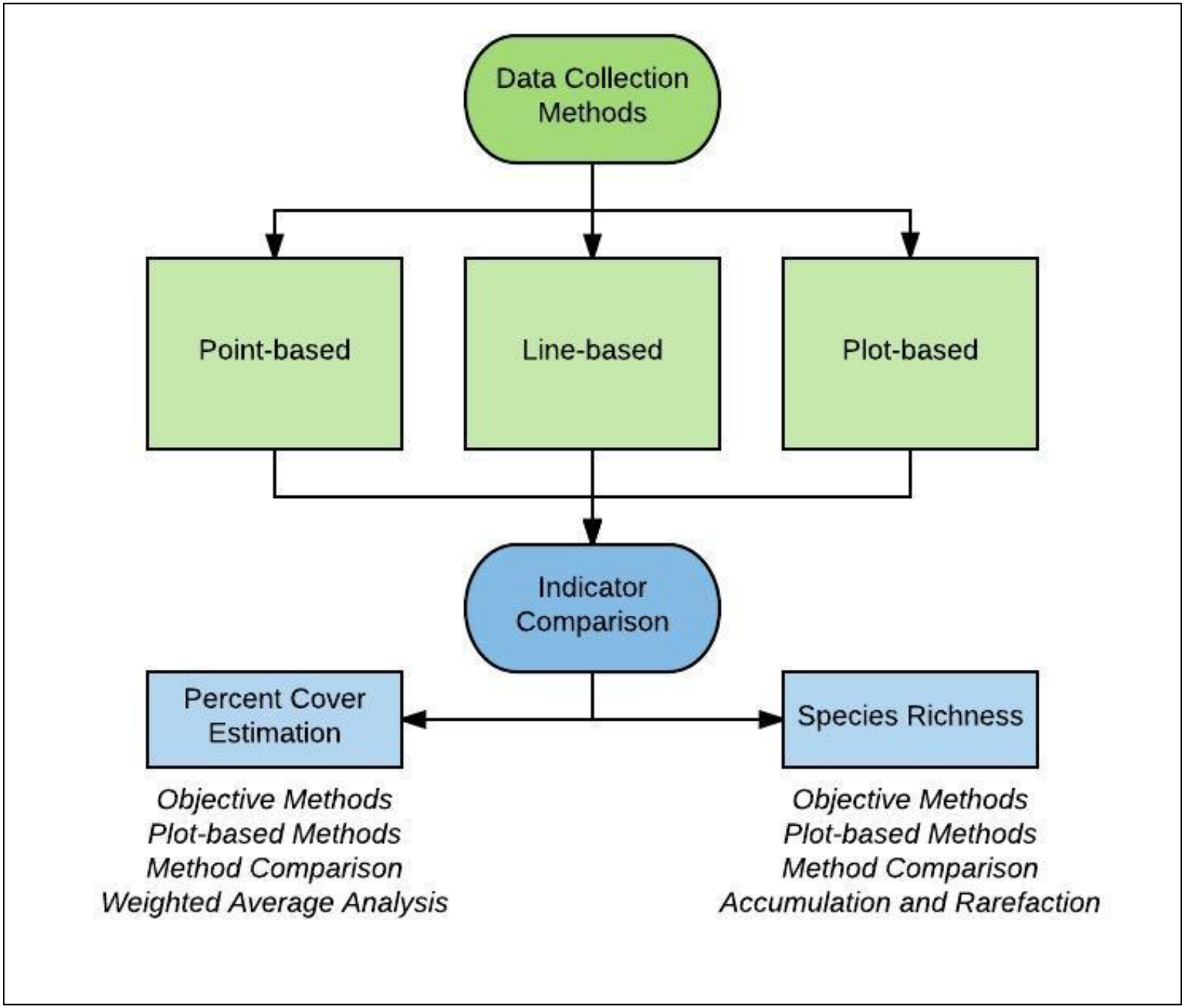
☐ analysis new data?

- quadrat size
  - % cover

Don't Do's

- open not listed
  - 100 − total cover ≠ open
  - if method = "> 100 allowed"

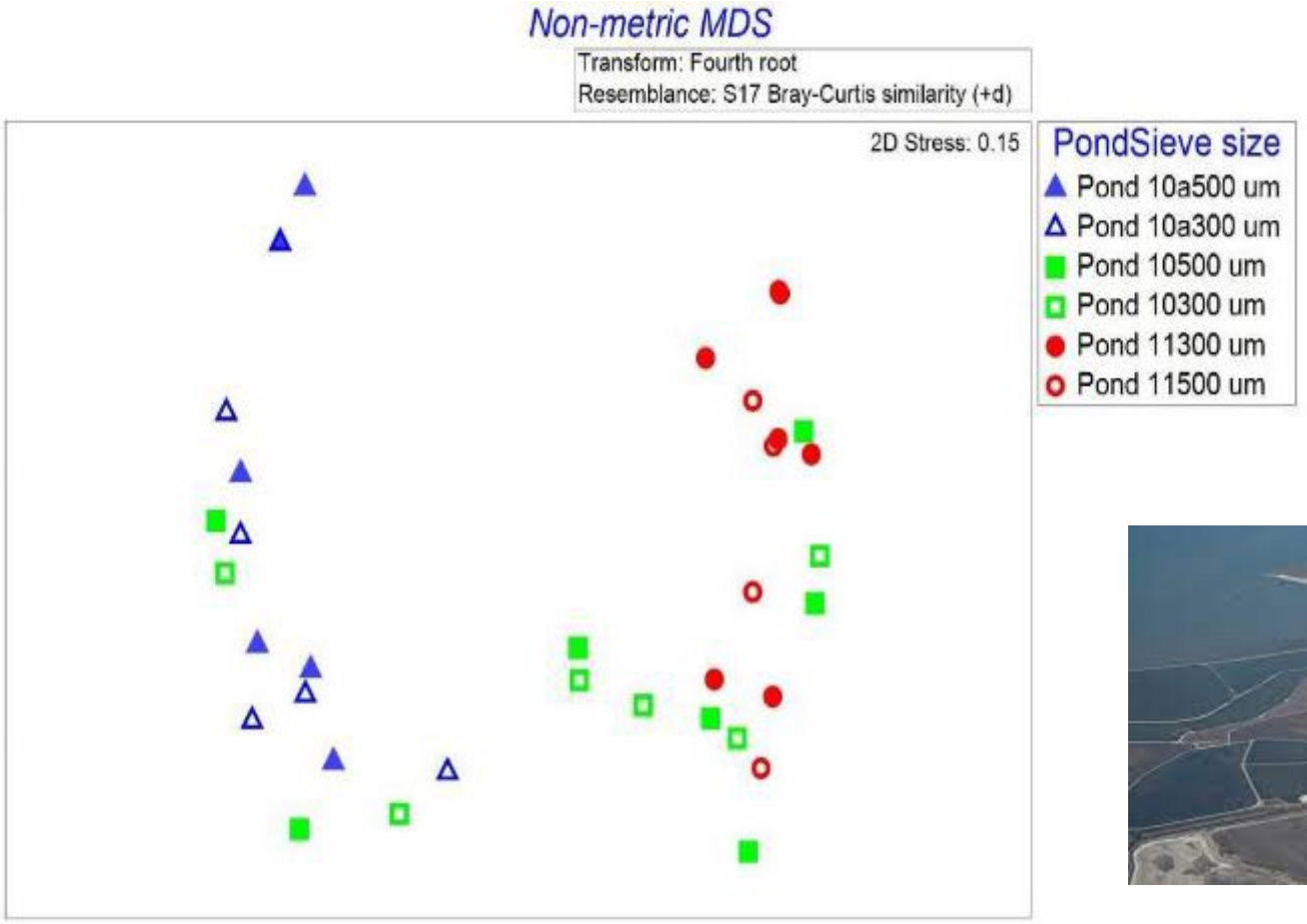
- quadrat size
  - # S_1 rare spp.
- # quadrat (effort → area)


Data Collection Methods
Point-based
Line-based
Plot-based
Indicator Comparison
Percent Cover Estimation
Species Richness
Objective Methods
Plot-based Methods
Method Comparison
Weighted Average Analysis
Objective Methods
Plot-based Methods
Method Comparison
Accumulation and Rarefaction

Invertebrate sampling methods

- Core size (area)
- Core depth
- Sampling frequency
- Sieve size
- Preservation technique
- Identification
- Taxonomic resolution

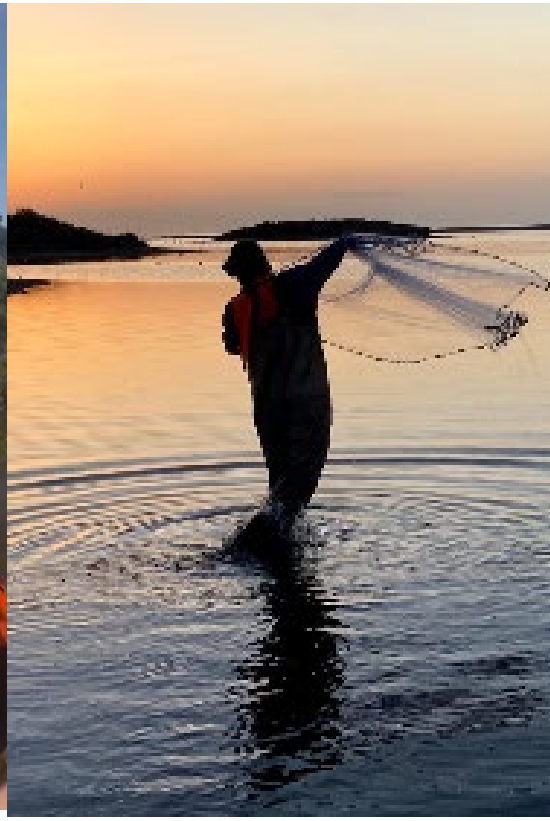
Community composition did not differ between 300 µm and 500 µm samples at the species or phylum levels

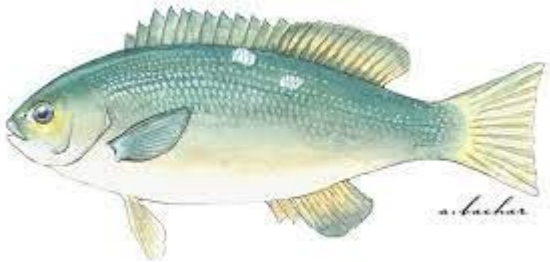


(Pseudo-F = 0.92, p= 0.454, species: pseudoF = 0.59, p= 0.742)

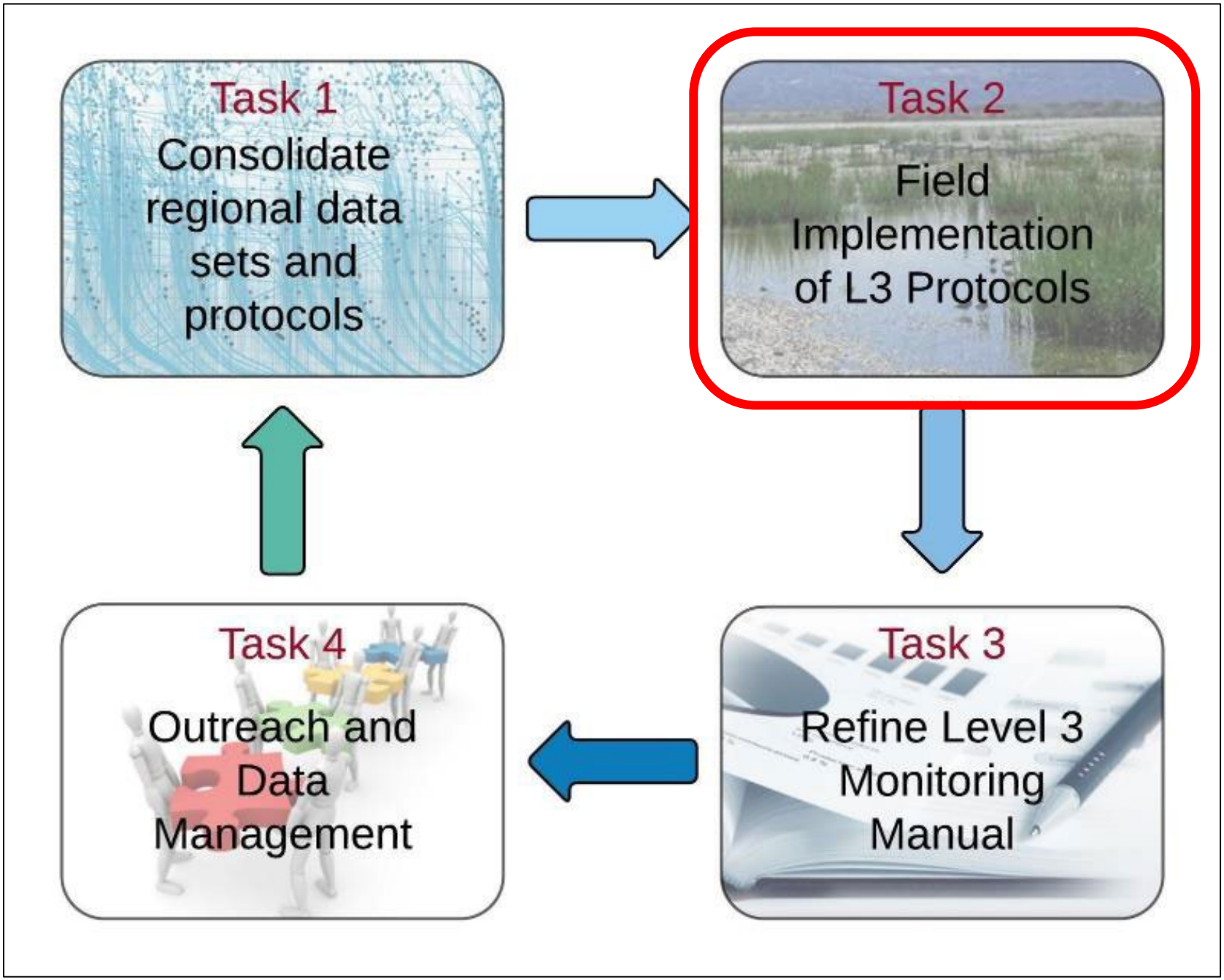
Metric	Notes
Species richness	Affected by sampling area/volume
Total abundance/density	Affected greatly by sieve size
Diversity metrics (J', H", 1/D)	Affected by sampling area/volume
Community composition (multivariate)	Level of analysis can vary – species, higher taxonomic, functional groups, relative abundance - but may provide an alternative to univariate metrics of species richness and diversity. Usually outside assumptions of underlying distributions.
Cumulative distribution functions (CDFs) (Ferraro et al 2005)	
Diversity estimation via rarefaction curves (species and sample based)	Can be used to overcome issues with species richness and area relationships as well as lower sample size.
Biological Condition Gradient (BCG)	Descriptive modelling that can focus on key species but requires best professional judgement from experts
Indices (condition) (e.g. AZTI Biotic Index [AMBI], M-AMBI, Invertebrate Community Index [ICI], Benthic Response Index [BRI])	Most of these are based on the proportional abundance of species belonging to groups based on their sensitivity/tolerance to environmental stress Requires best professional judgement from experts
Biomass	Less affected by sieve size than other metrics (e.g. Valenca and Los Santos YR)

Fish sampling methods





Whitcraft et al. unpublished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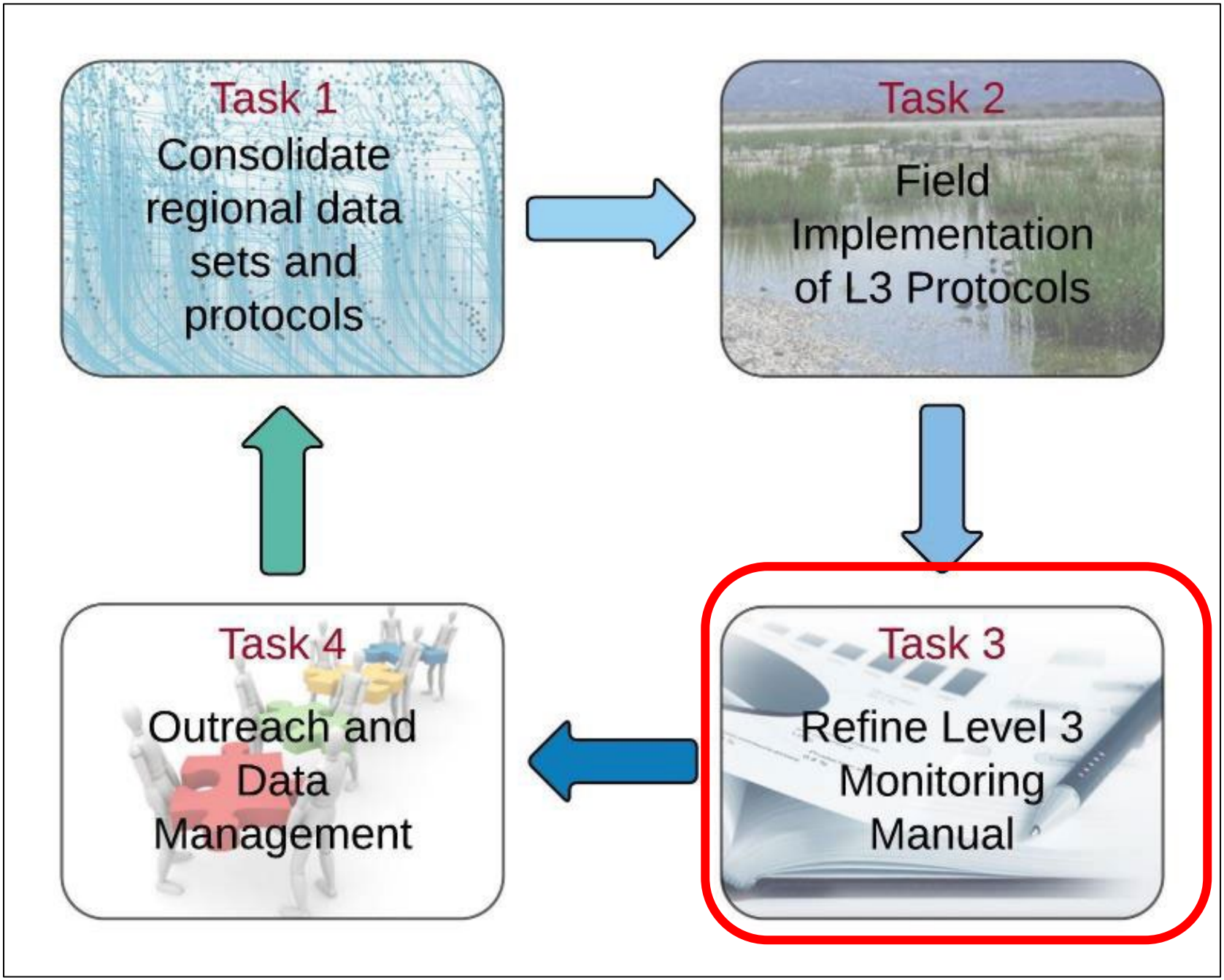
Estuary Marine Protected Area

Monitoring Protocol

Version 1.3 *Draft*
December 2022

EMPA
Monitoring Program

OCEAN
PROTECTION
COUNCIL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March 2020

Prepared for United States Environmental Protection Agency

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California Estuarine Wetland Monitoring Manual (Level 3)

March 2021 (Version 2.0)

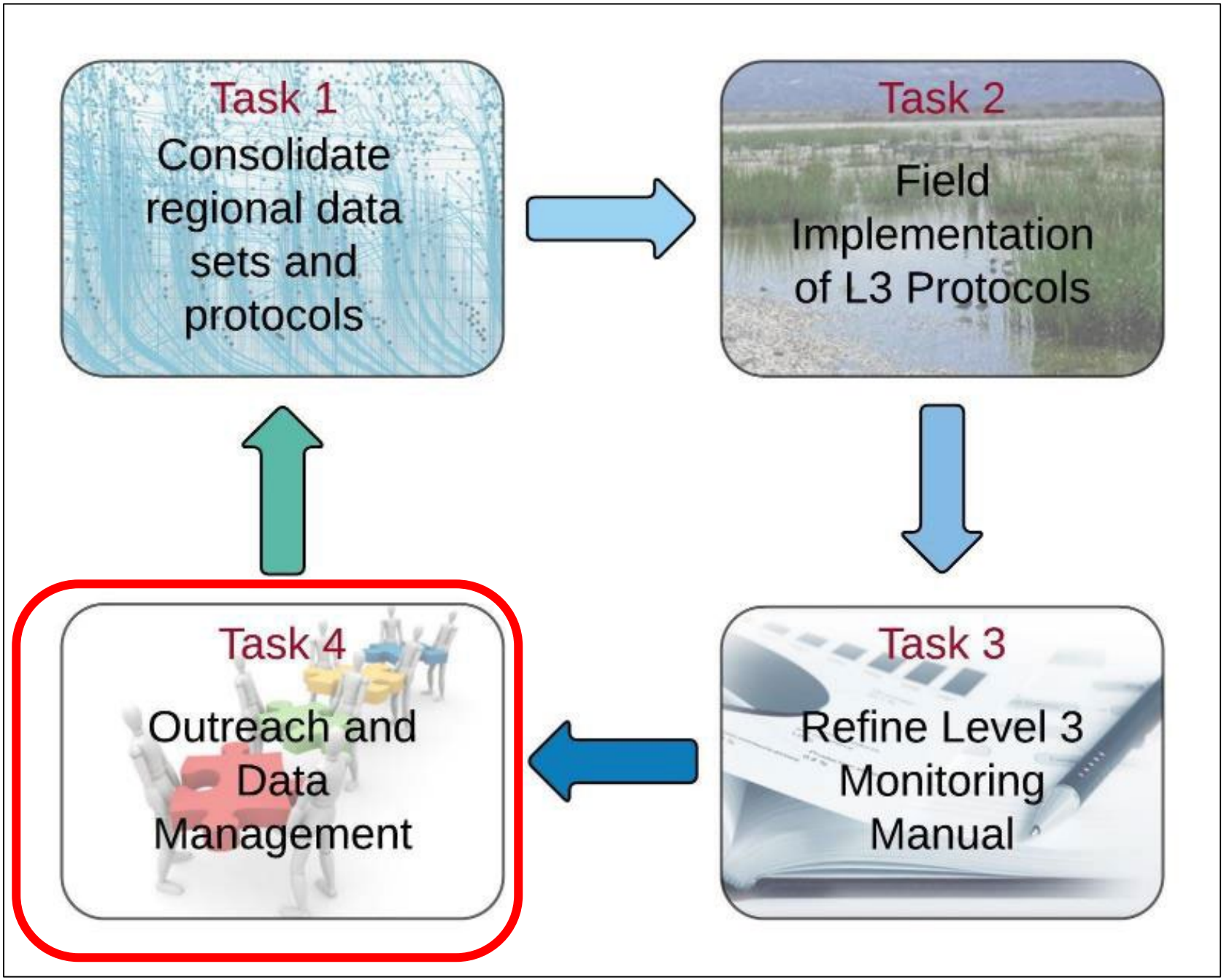
The Bay Foundation
California State University, Long Beach
Tijuana River National Estuarine Research Reserve
Southern California Coastal Water Research Project
University of Southern California Sea Grant Program
California State University, Channel Islands

SOP Comparison / Evaluation Matrix

Category	Evaluation Metric	Type of Output
	Correlation to L2 CRAM	List
	Relationship to Uniform Performance Metrics *	Notes
Time / Effort	Office Preparation Time	Categorical
	Equipment Construction Time (one time)	Categorical
	Field Time	Categorical
	Laboratory Time	Categorical
	Post-Survey Processing / QAQC Time	Categorical
	Minimum Repetition (site-dependent)	Categorical
	Relative Cost (equipment and supplies)	Categorical
Personnel Requirements	Specialty Equipment or Clothing Required	Categorical
	Ease of Transport (amount or weight of supplies)	Categorical
	Ease of Implementation	Categorical
	Expertise / Skill Level	Categorical
	Number of Personnel	Categorical
	Training Requirements	Notes
	Seasonality of Survey Time	Time Range
	Suggested Frequency	Categorical
Survey / Data Quality	Accuracy (at a survey area level)	Categorical
	Precision (at a survey area level)	Categorical
	Type of Output	Categorical
	Qualitative-Quantitative Score	Categorical
	Subjectivity-Objectivity Score	Categorical
	Active or Passive Monitoring Style	Categorical
	Specialty Computer Software Required	Categorical
	Availability of Online / External Resources	Categorical
Potential Limitations	Wetland Type Applicability	Notes
	Images or Multi-Media Required	Categorical
	Degree of Impact / Disturbance	Categorical
	Vegetation Height Limitation	Categorical
	Appropriate for Tidal / Wet Habitats	Categorical
	Tide Height	Categorical
	Regional or Broad Implementation **	Categorical
	Potential for Hazards / Risk	Categorical
	Restrictions	Notes

** based on the USACE UPM metrics*

*** based on monitoring literature review table*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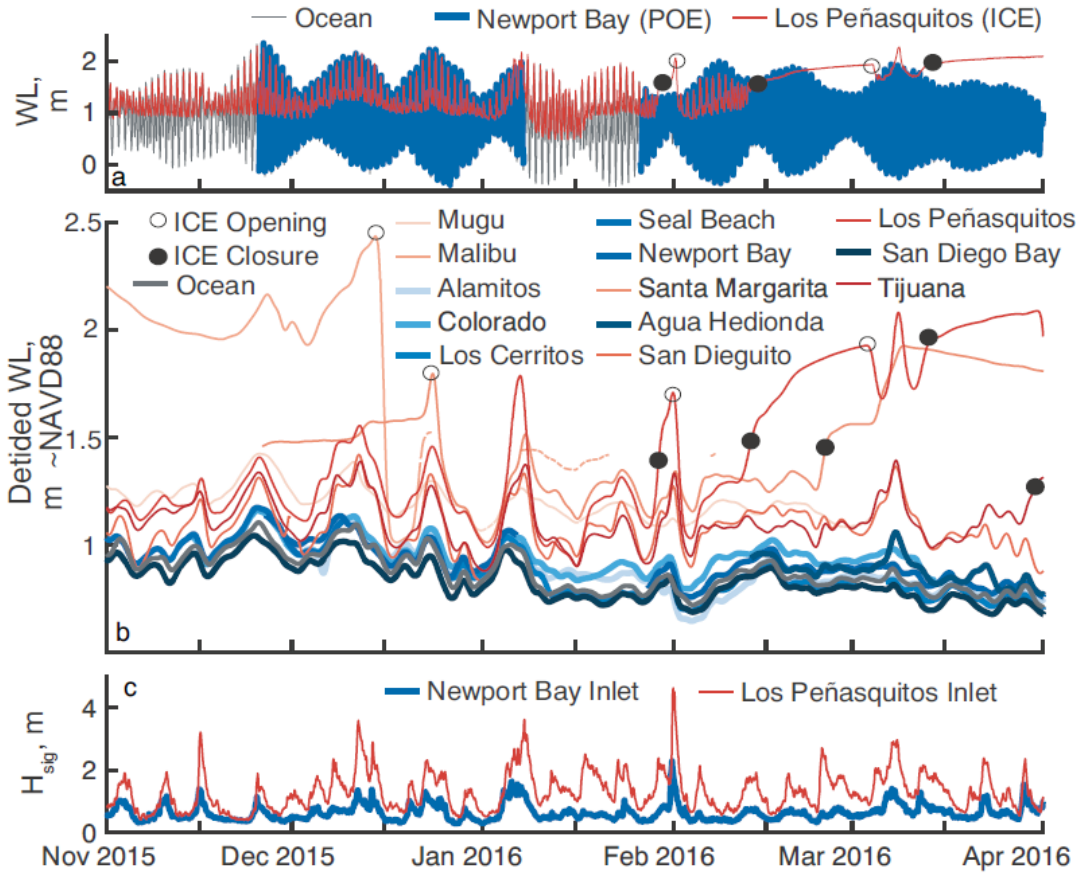
Estuaries and Coasts (2020) 43:256–271
https://doi.org/10.1007/s12237-019-00676-1

Effects of Elevated Sea Levels and Waves on Southern California Estuaries During the 2015–2016 El Niño

Madeleine E. Harvey[1] · Sarah N. Giddings[1] · Eric D. Stein[2] · Jeffrey A. Crooks[1,3] · Christine Whitcraft[4] · Timu Gallien[5] · John L. Largier[6] · Liesl Tiefenthaler[2] · Hallee Meltzer[7] · Geno Pawlak[8] · Karen Thorne[9] · Karina Johnston[10] · Richard Ambrose[11] · Stephen C. Schroeter[12] · Henry M. Page[12] · Hany Elwany[13]



Thank you!

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