Effects on Aquatic Species and Water Quality: Will Aquatic Species be Affected by Restoration?

Dr. James Hobbs, Jonathan Cook, Patrick Crain, Nick Buckmaster, Micah Bisson, Emily Trites, Christina Parker, Zachary Bess

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South Bay Salt Pond Restoration Project
Restoring the Wild Heart of the South Bay

Project Objectives

- Create, restore or enhance habitats of sufficient size, function and appropriate structure to:
  1. *Promote restoration of **native**, special-status plants and animals that depend on South San Francisco Bay for all or part of their life cycle.*
  2. *Maintain current migratory bird species that utilize **existing salt ponds** and associated structures such as levees.*
  3. *Support increased **abundance** and **diversity** of **native species** in various South San Francisco Bay aquatic terrestrial ecosystem components, including, plants, **invertebrates, fish**, mammals, birds, reptiles and amphibians.*

Trulio et al. 2007 South Bay Salt Pond Restoration Proj
Appendix D- Adaptive Management Plan

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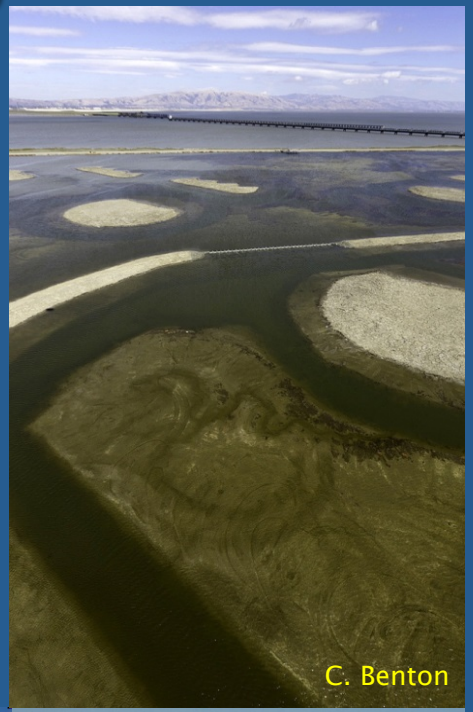
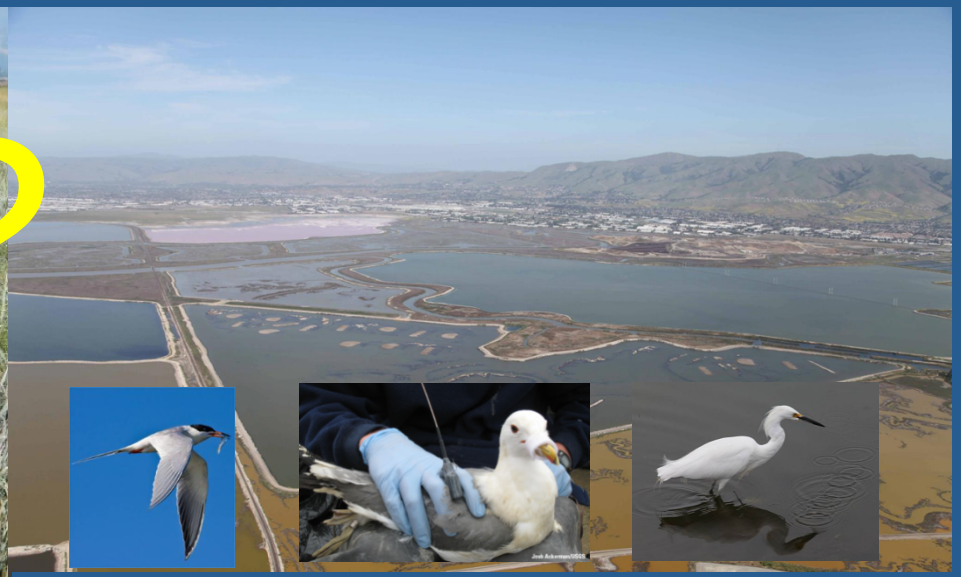
Key Uncertainties

- **Wildlife use of restoring habitats**
- Habitat evolution and sediment dynamics
- Mercury methylation
- **Water quality**
- **Invasive species**
- Public access
- Infrastructure support
- Sea level rise and climate change



Monitoring-Adaptive Management
"Too tidal or not to tidal"
50:50 or 90:10

Ridgeway Rail, Saltmarsh Harvest Mouse, Steelhead , Green Sturgeon



Turns, Shorebirds, Waterfowl

Western Snowy Plover

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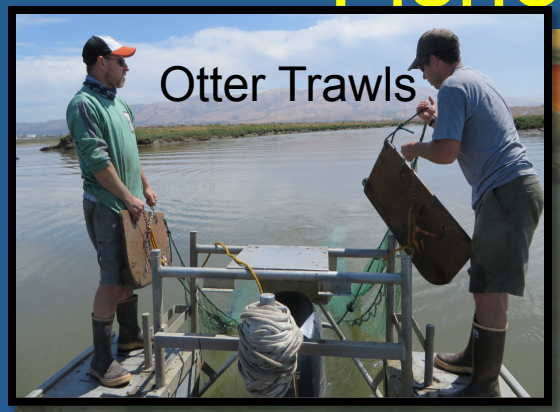
Research Questions

1. How will aquatic species assemblages respond to restoration?

2. Will species of special-status benefit?

3. Will restoration increase the abundance and diversity of aquatic species?

South Bay Salt Pond Fisheries Research Project



LSB 1
COY 3
COY 2
A21 2
A21 1
A19 2
A19 1
UCOY 2
UCOY 1
COY 1
UCOY 3
A17 1
ART 3
DMP
AG
ALV 3
Railroad Bridge
ART 2
ART 1
ALV 2
ALV 1

Otter Trawls in Bay & Sloughs
Otter Trawls in Ponds

Google

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Habitat-Assemblage Evolution

San Francisco Bay Estuary

Restoration

Managed Ponds

Climate?

Managed Ponds

2008 Time (years) 2058

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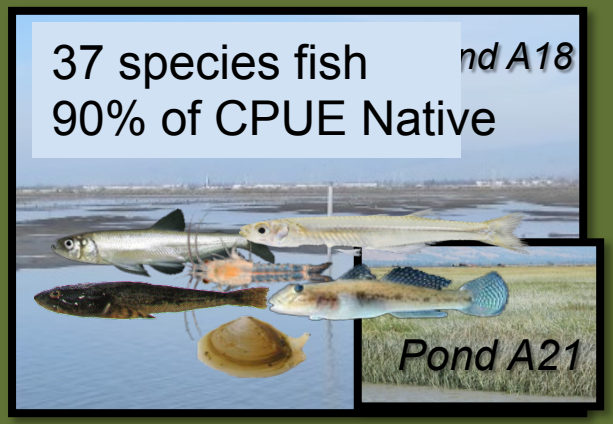
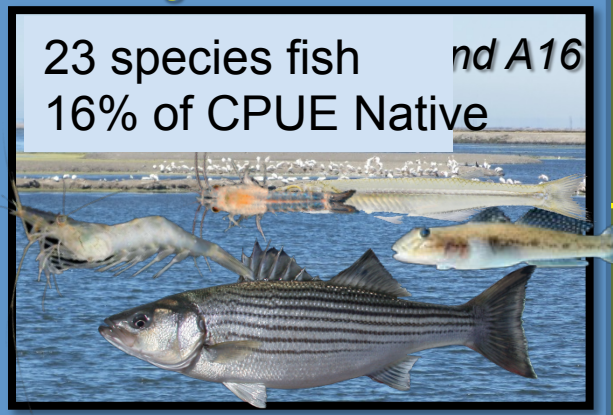
Habitat-Assemblages

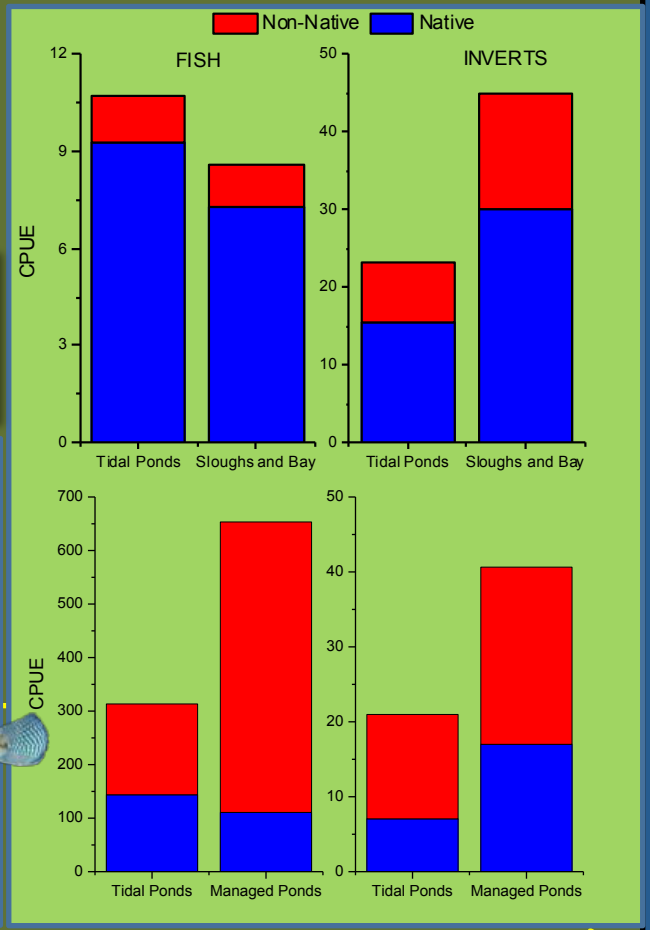
San Francisco Bay Estuary

Tidal Ponds



Managed Ponds





2008 — Time (years) — 2058

2. Will species of special-status benefit?

- Steelhead Trout-Fed-ESA Threater

2013-pit tagged ~73 trout upstream

See report on web

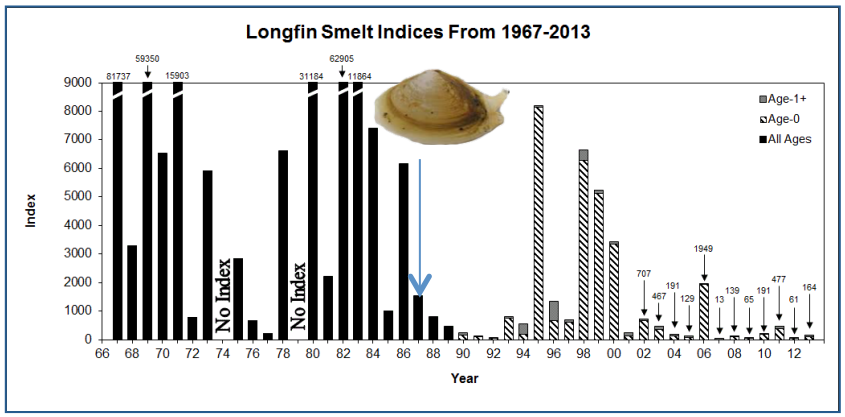
- Green Sturgeon-Fed-ESA S.DPS-Threatened

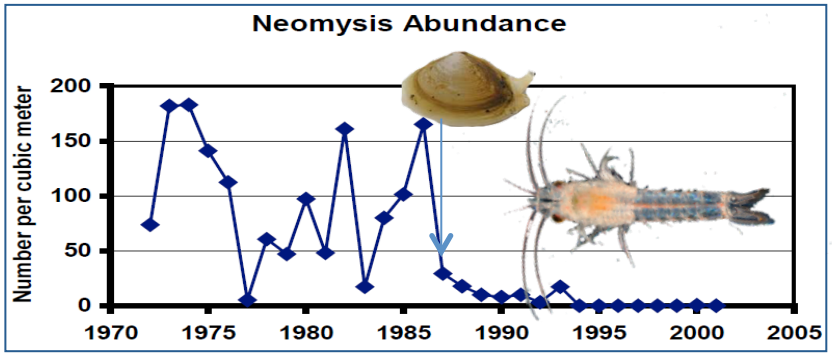
No Green Sturgeon observed

- Longfin Smelt-State ESA Threaten

Longfin Smelt

March 2009 State-ESA Threatened Mar 2012 USFWS-"Warranted" – Added to wait





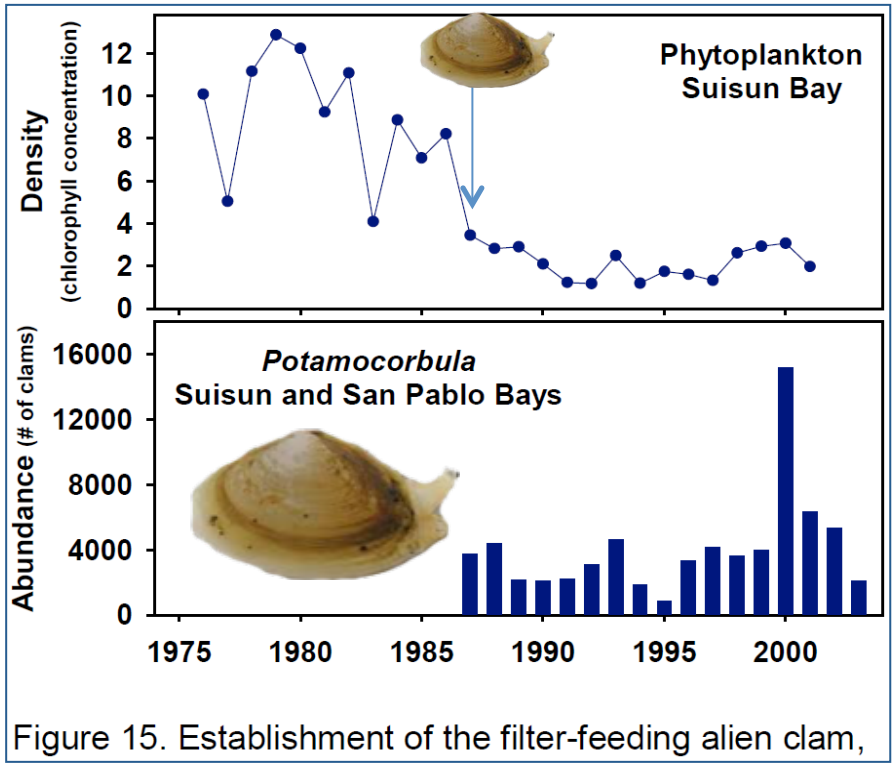


Figure 15. Establishment of the filter-feeding alien clam,

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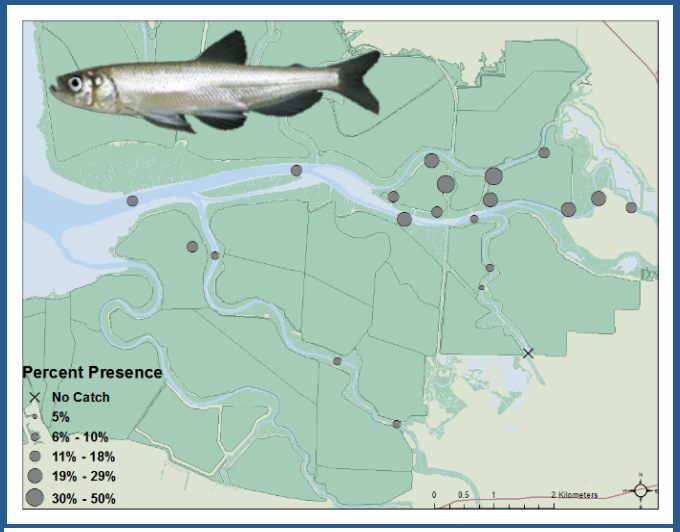
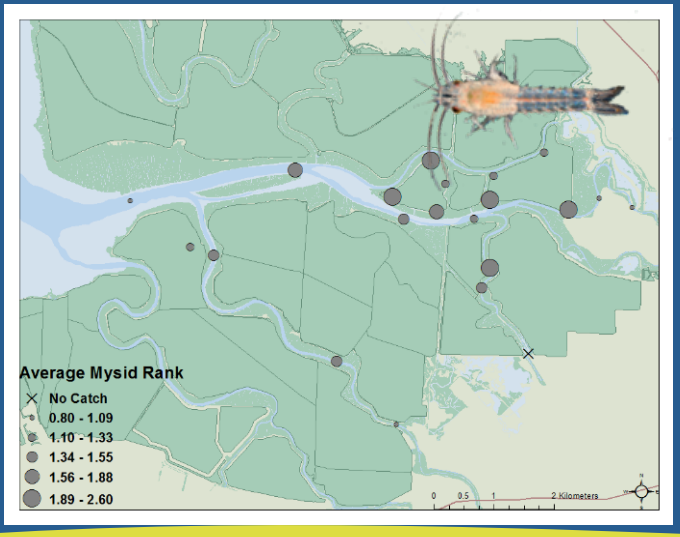
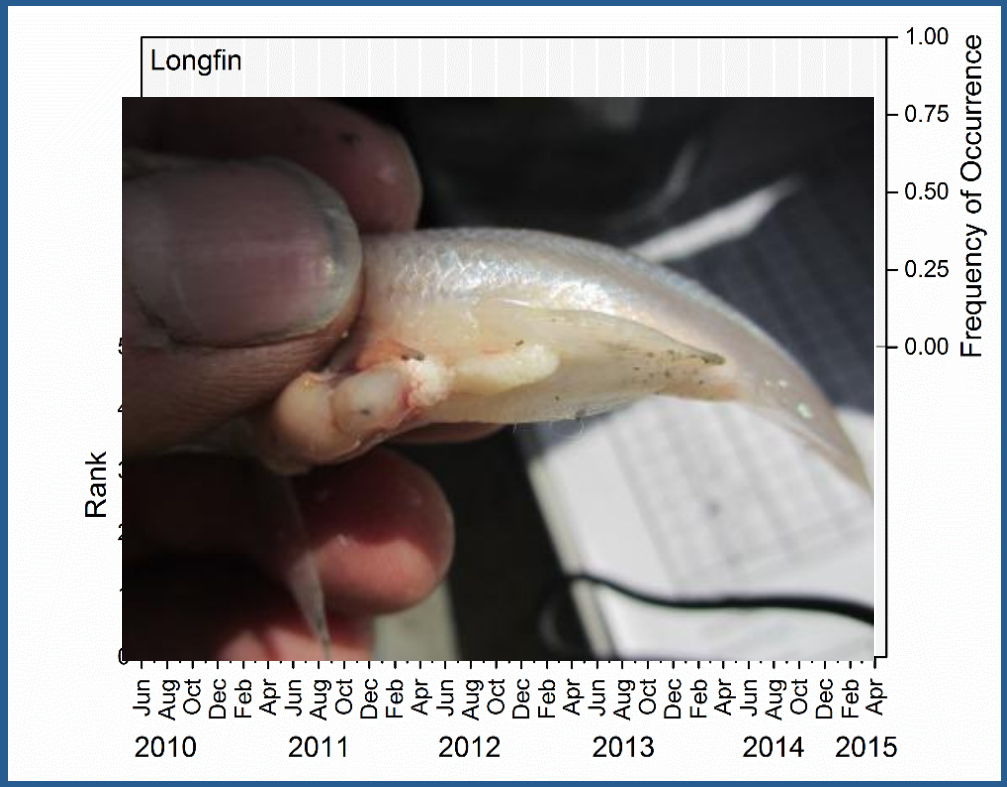
2. Will species of special-status benefit?

Longfin Smelt in Alviso Marsh

Source-Sink or Overwinter Feeding Grounds?







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3. Will restoration increase the abundance and diversity of aquatic species?

Restoration-
Altered Physical-Chemical Attributes

Pop'n Dynamics

Top-Down Effects-
Predation

Environmental Var.
- Freshwater Flows
- Temperature
- Dissolved Oxygen

Life History

Fish Abundance "N"

Which Species?
- Common species
- Resident
- Marsh Dependent

Bottom-Up Effects-
Competition
Food Limitation

Stock-Recruitment-
Prior Fish Abundance

Ocean Recruitment

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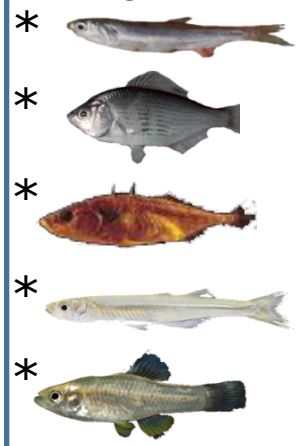
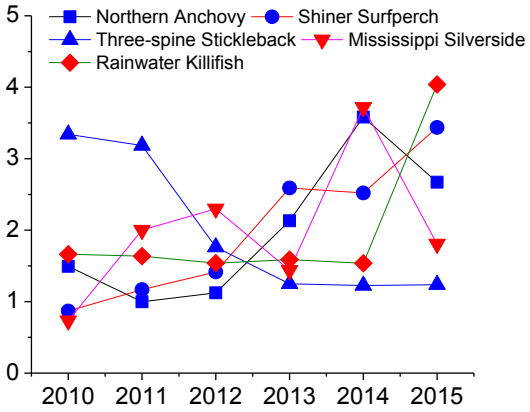
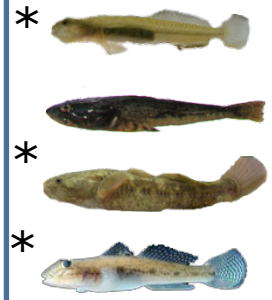
Abundance Trends-Tidal Ponds & Sloughs

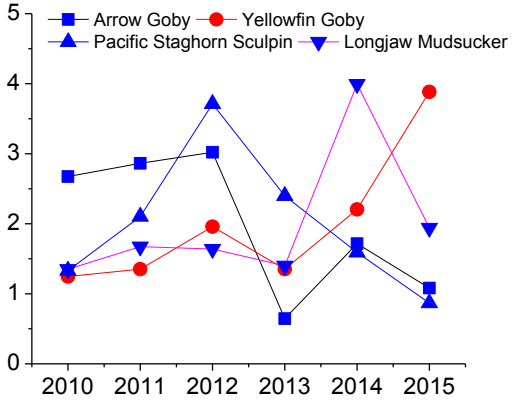
Pelagic Fish



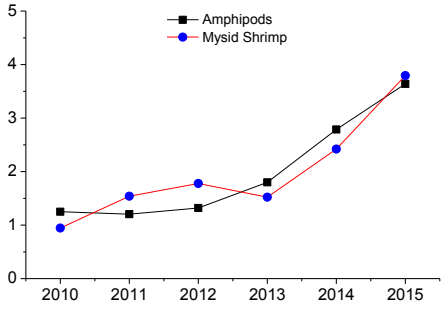


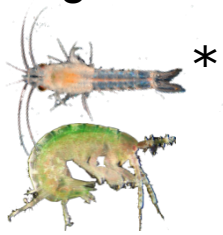
Benthic Fish



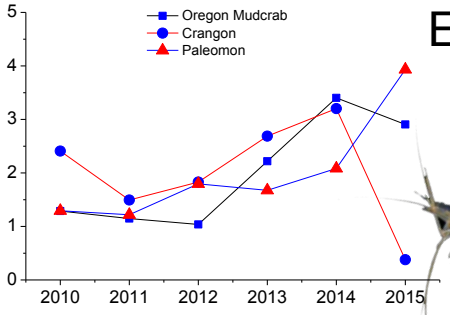


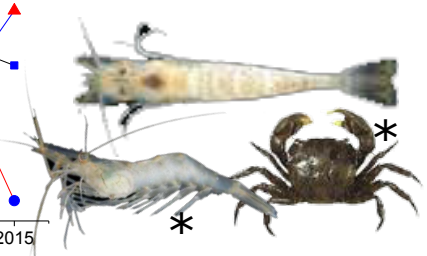
Pelagic Inverts



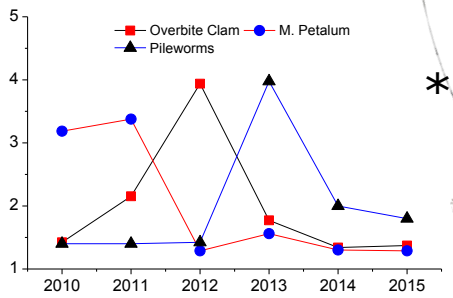


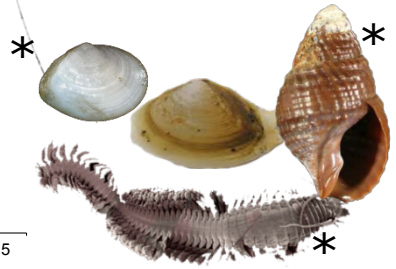
Epi-Benthic Inverts



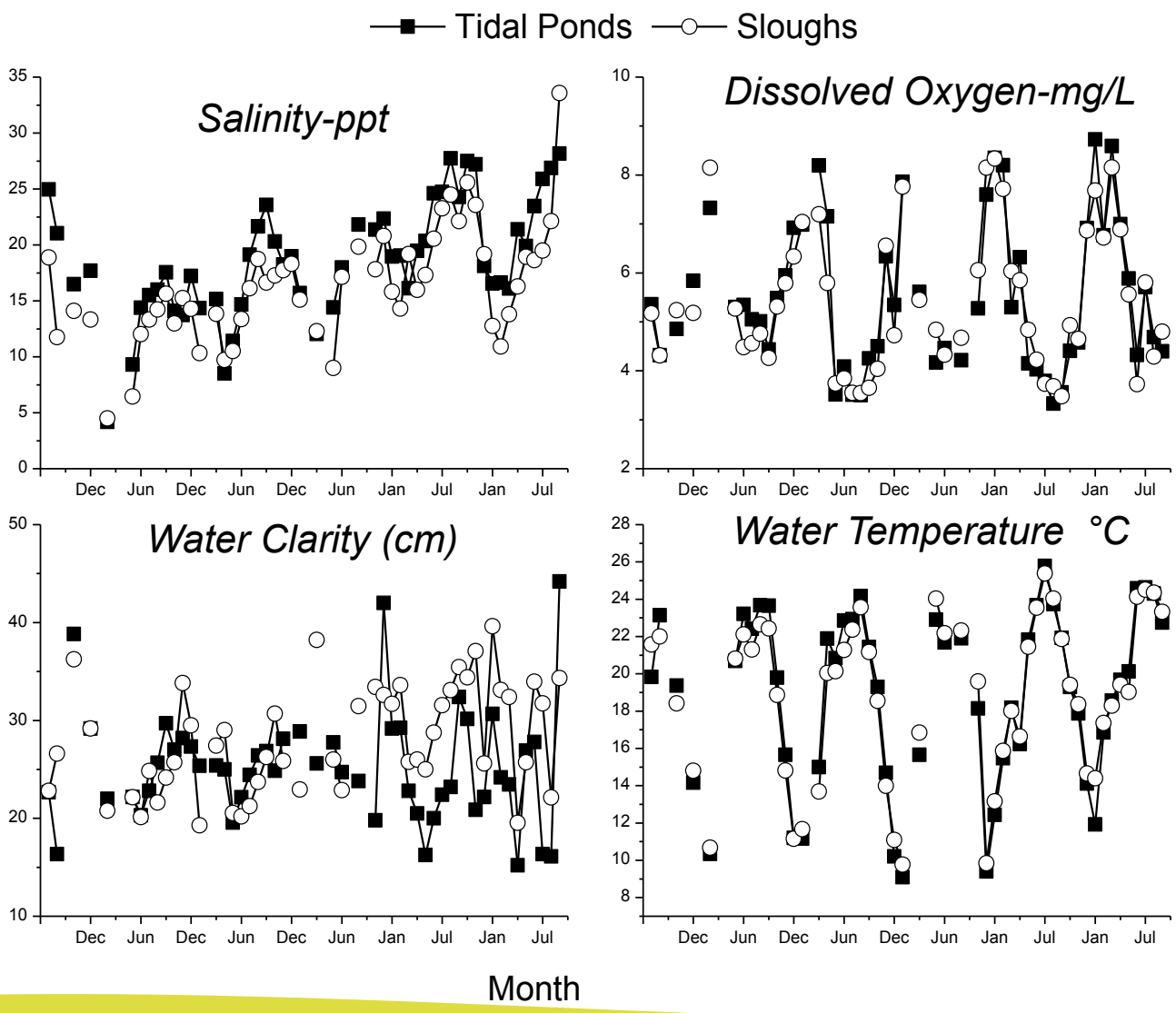


Infaunal Inverts





Environmental Variability-Water Quality



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Top-Down Effects-
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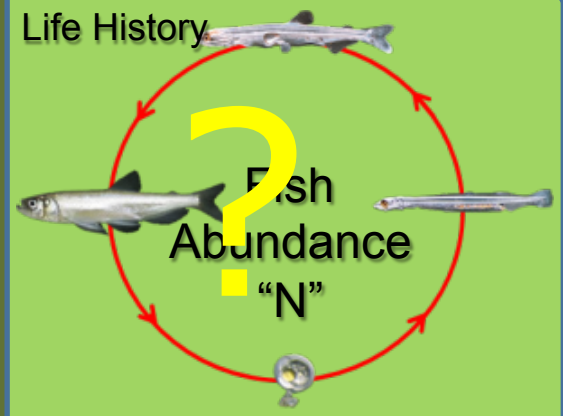
Bottom-Up Effects-
Competition
Food Limitation

Life History



Environmental Var.
- Freshwater Flows
- Temperature
- Dissolved Oxygen

Which Species?
- Common species
- Resident
- Marsh Dependent

Stock-Recruitment-
Prior Fish Abundance
Ocean Recruitment

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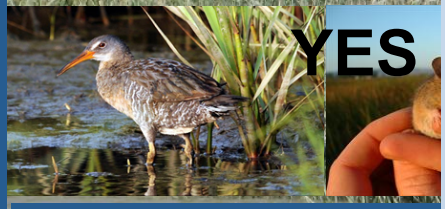
Research Questions

1. How will aquatic species assemblages respond to restoration?
   - Tidal Ponds similar to the sloughs and bay
   - Managed Ponds support abundance of Non-native sp.
2. Will species of special-status benefit?
   - Tide gates on managed ponds predation hotspot
   - Abundance of prey could provide benefits
3. Will restoration increase the abundance and diversity of aquatic species?
   - Managed Ponds increase non-native sp. ↑Diversity
   - Some sp. ↑ trends

Recommendations

"*Too tidal or not to tidal*"



Ridgeway Rail, Saltmarsh Steelhead , Green Sturge

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orebirds, Waterfowl

Western Snowy Plover

Thanks

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Jim Ervin, Ryan Mayfield, Bryan Frueh-SJ-SCRWF

Aaron O'Callahan-RLF

Volunteers, Students & Staff

Felipe La Luz, BillyTu, Eva Bush, Mackenzie Gilliam, James Chhor, Steven Anderson, Jesse Vargas

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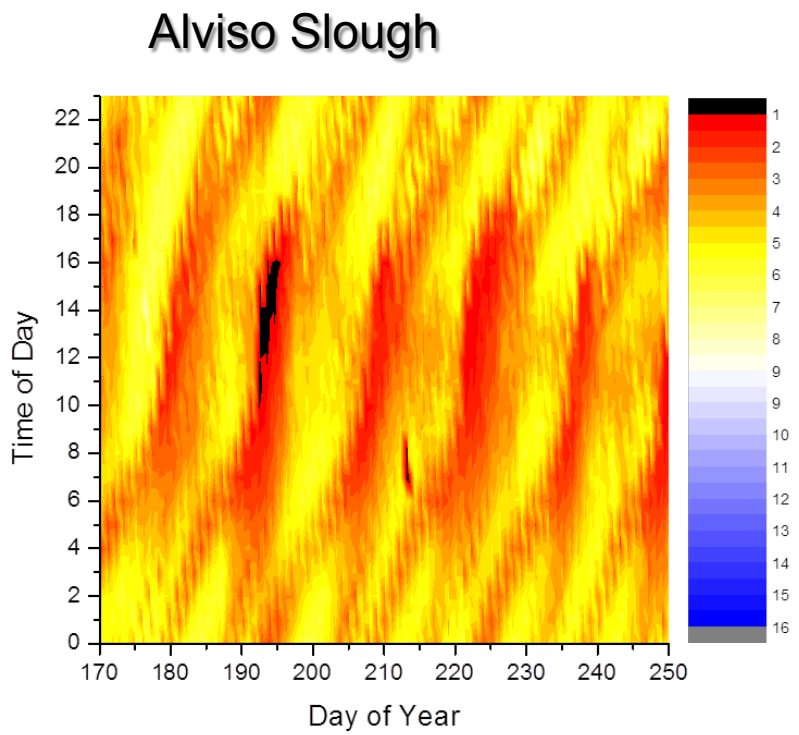
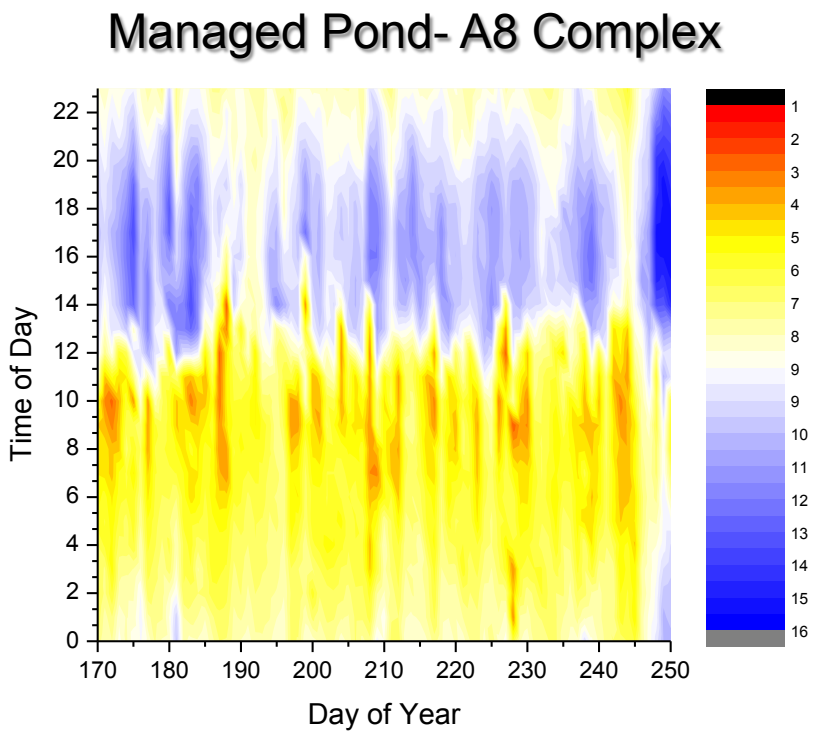
Alviso Marsh Summer Low-DO





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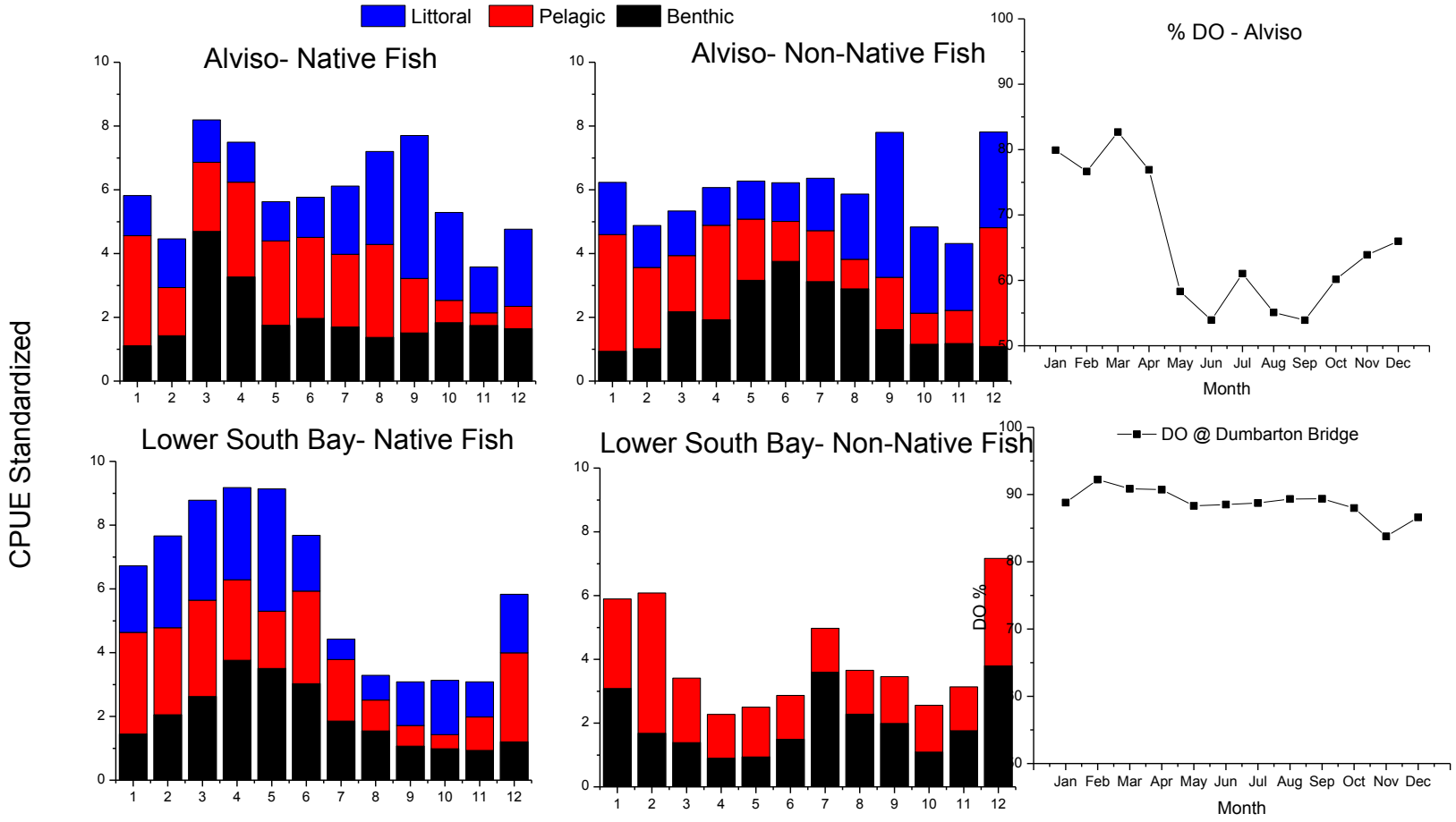
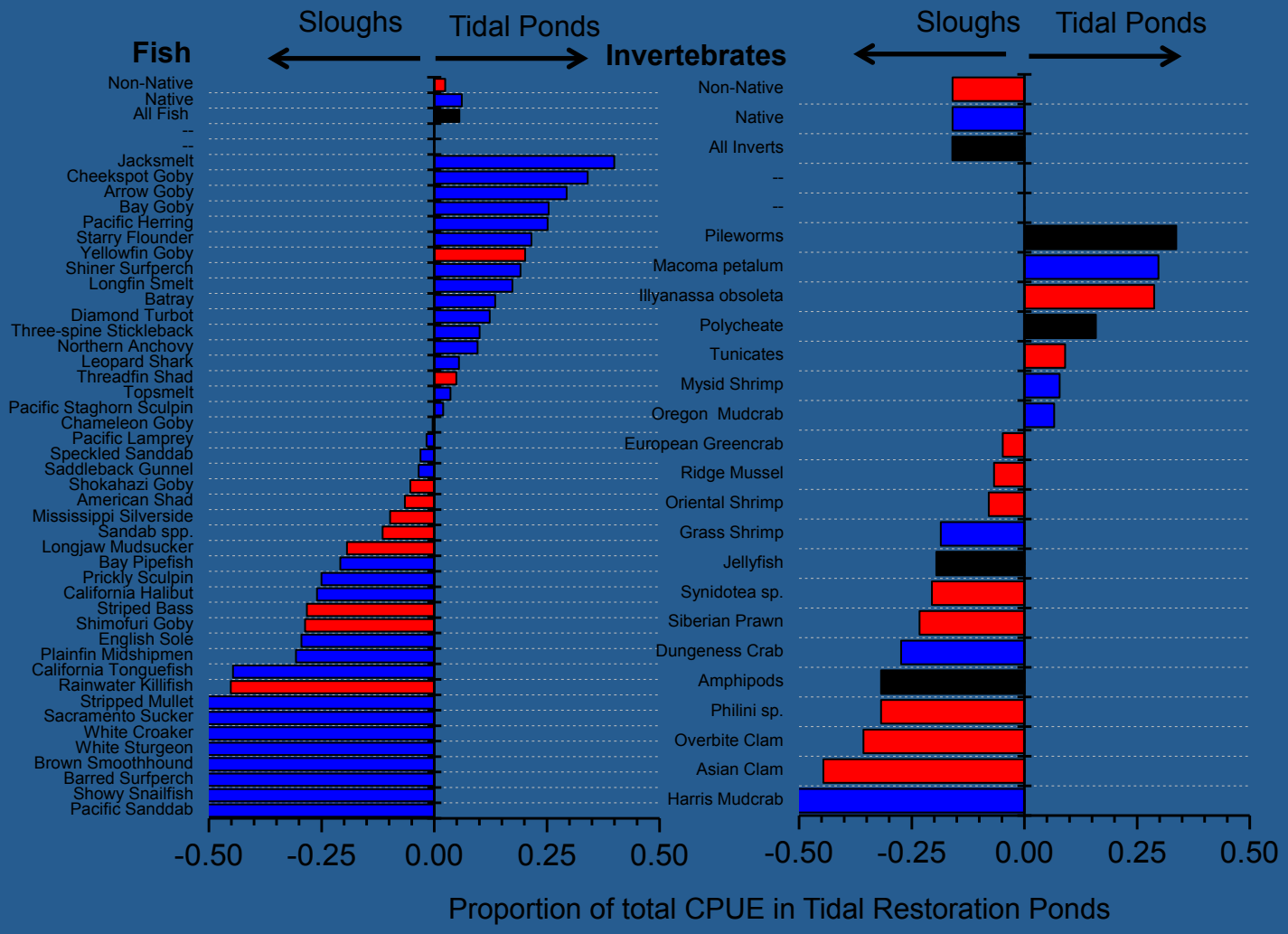
Is Hypoxia Impacting Fish?



Tidal restoration v. Managed Ponds



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Tidal restorations v. Sloughs-Bay