    

Getting to the Bottom of It:

Connecting Submerged Habitats, Wetland Design and Climate Change in San Francisco Bay

Subtidal Habitat Goals

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Restore America's Estuaries
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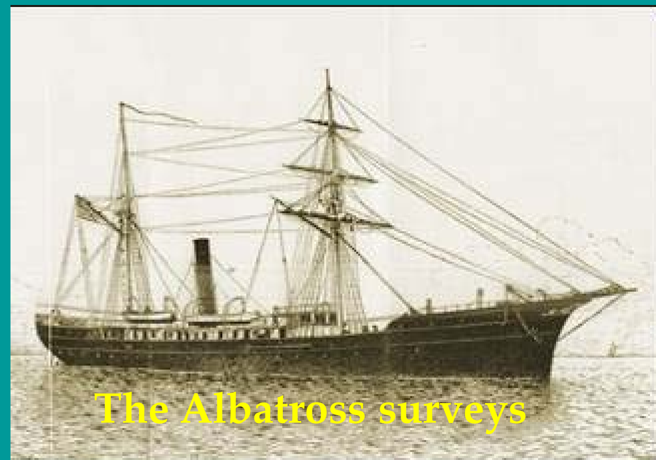
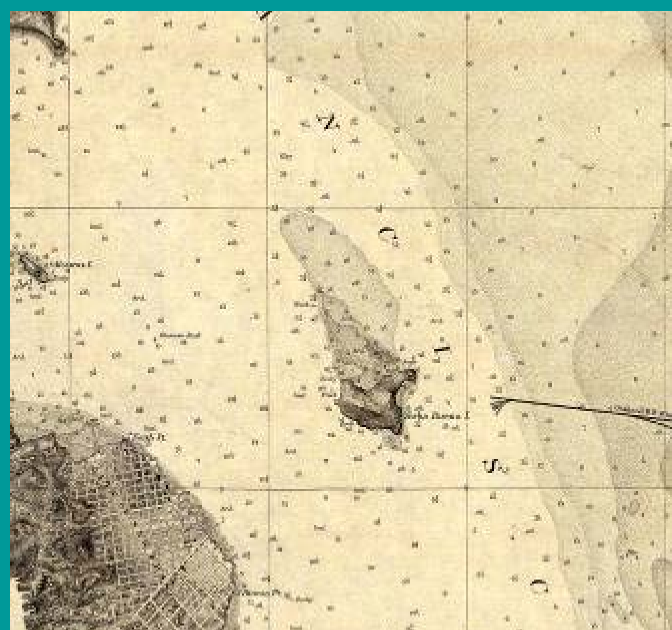
Subtidal Goals Report

- Designed to give resource managers, regulatory agencies, environmental groups, researchers, industry, and anyone interested in this important bay habitat the basic information they need to plan conservation, restoration, research, and management activities related to subtidal habitat in the San Francisco estuary.
- Provides specific goals and recommendations to habitats below the mean high tide mark
- 10 year effort , 50 year time horizon
- “out of sight, out of mind”
- Final 100 + report due in January 2011

Historical Abundance





Hydrographic surveys

Habitats in San Francisco Bay

- Tidal marsh ~40,000 acres
- Tidal flats ~30,000 acres
- Eelgrass beds ~3,500 acres
- Native oyster and other shellfish beds (?)
- Creeks – over 1,000 miles
- Shallow and deep subtidal ~250,000 acres



Photo credits: www.lorenz-avelar.com

Objectives of Subtidal Goals Report

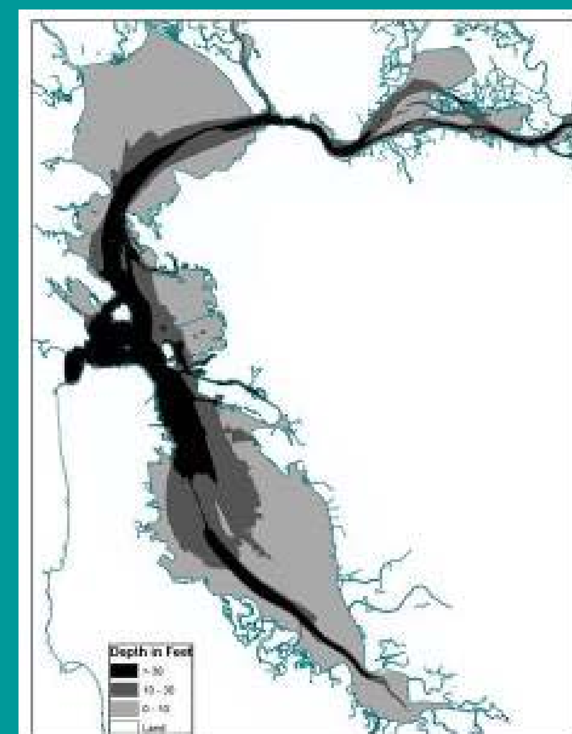
- Regional 50-year vision to improve subtidal habitats
- Forward visioning
- Non-regulatory, interagency, collaborative approach
- Science goals to address data gaps
- Protection goals to maintain quality and function
- Specific restoration targets based on phased approach
- Audience: resource managers, academics, non-profits, etc.

Project Vision

Achieve a net improvement of the San Francisco Bay's subtidal ecosystem over the next 50 years through restoration, science, and management.

To achieve this improvement, the project proposes:

- Increasing the quantity of desired but currently limited habitats;
- Emphasizing support of native species;
- Increasing our understanding of the physical and biological processes that affect subtidal habitats and species.







Guiding Principles

- Subtidal and intertidal habitats
- Precautionary approach
- Science, restoration, protection
- Avoids prioritization of habitats
- Adaptive management approach
- 10 year review in 2020


Submerged Aquatic Vegetation
Rock Habitats
Artificial Structures
Soft substrate: sand
Macroalgal Beds
Photo credits: www.bluewaterimages.com
Shellfish Beds
Soft Substrate:Mud/ shell mix





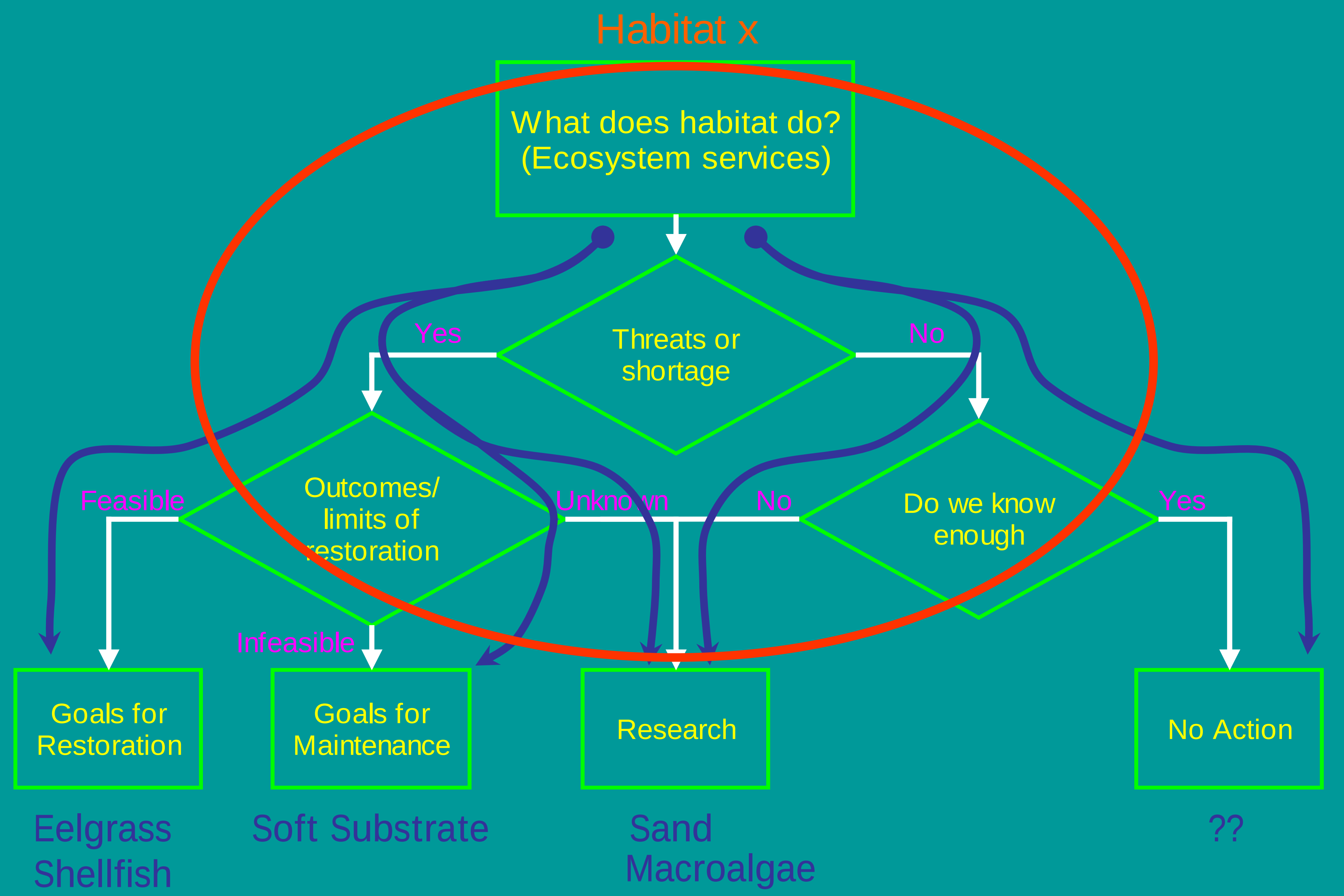
Types of Goals

Science – improve protection and restoration

Protection – stressor narratives, precautionary approach

Restoration – quantifiable and regionally specific targets

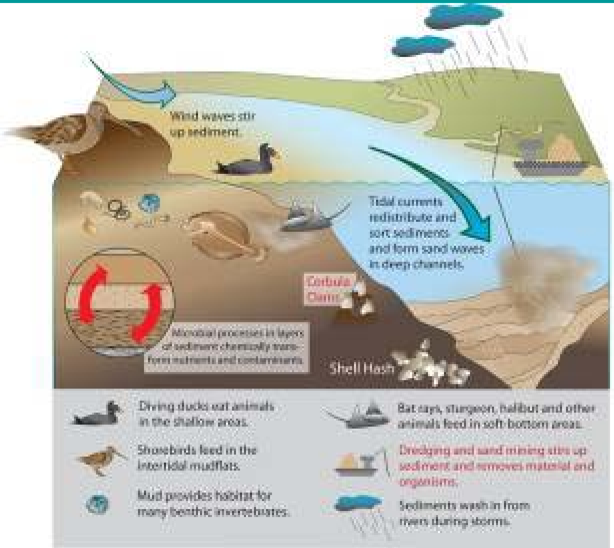
Idealized Flow Diagram for Managing Habitats

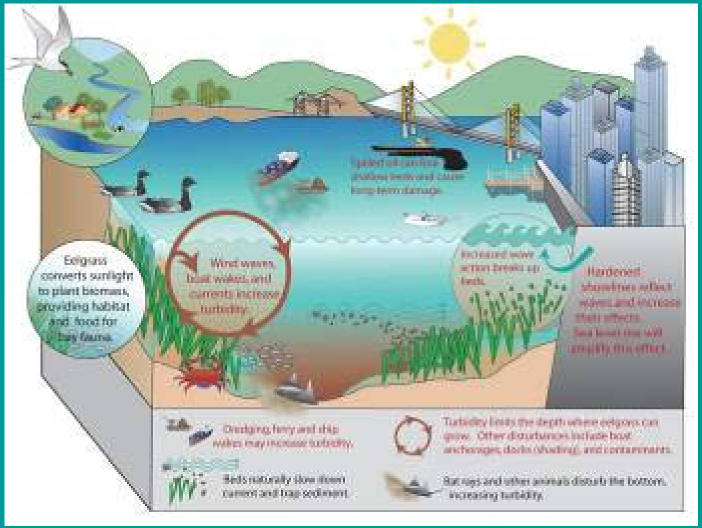


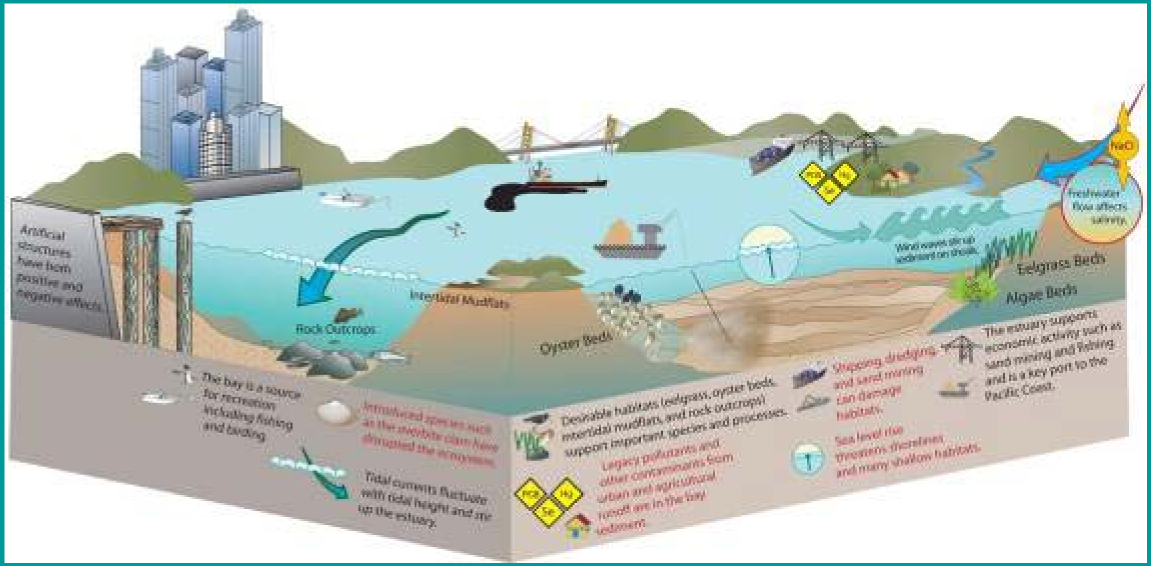
Subtidal Habitat Conceptual Models

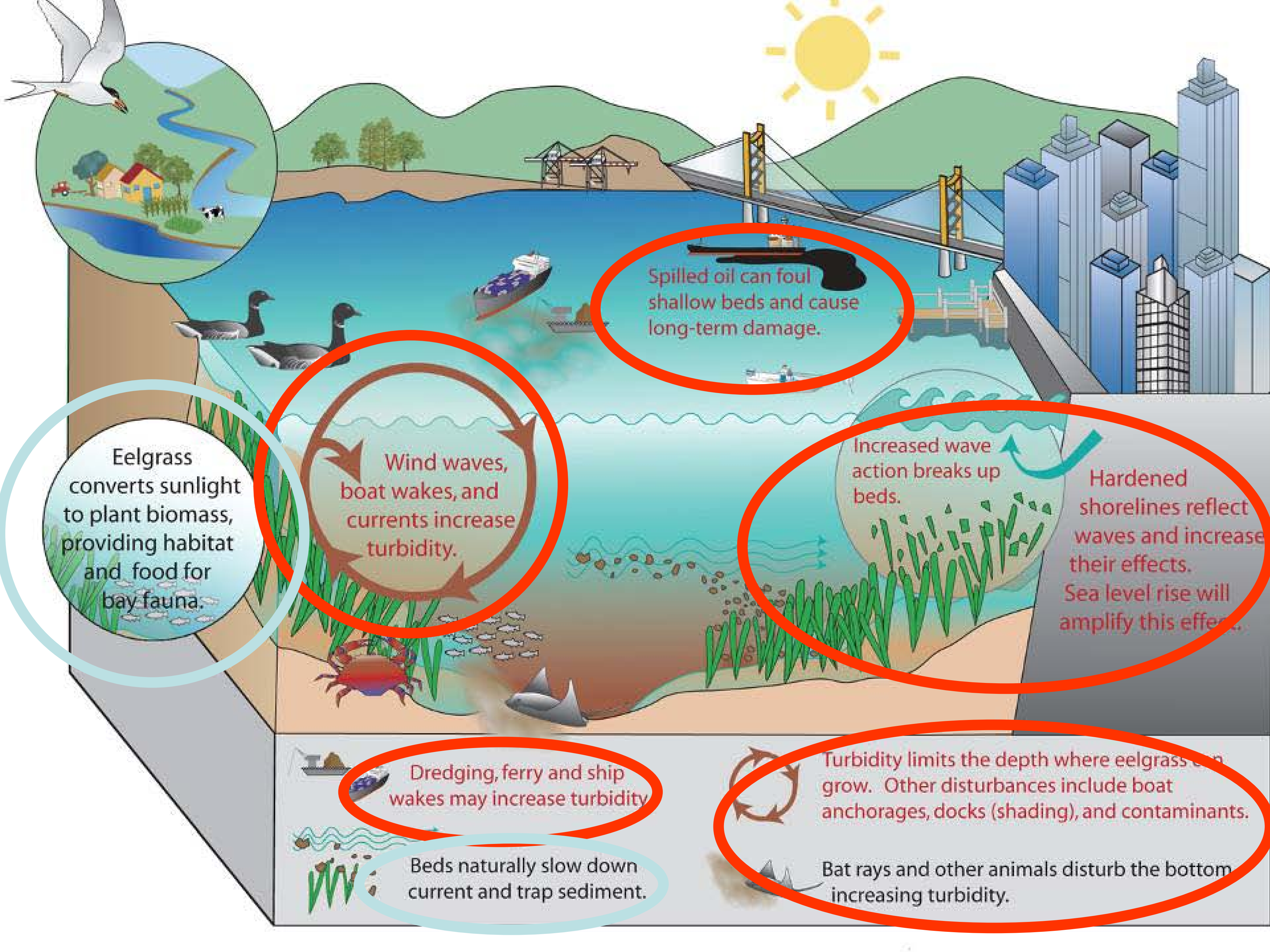
Science Goals and Research Questions

Wim Kimmerer





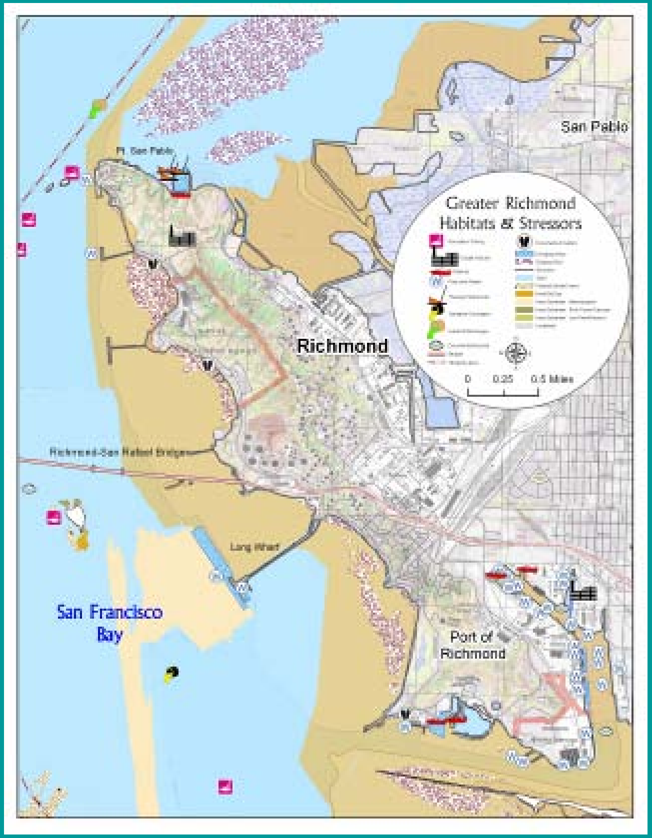




Spilled oil can foul shallow beds and cause long-term damage.
Eelgrass converts sunlight to plant biomass, providing habitat and food for bay fauna.
Wind waves, boat wakes, and currents increase turbidity.
Increased wave action breaks up beds.
Hardened shorelines reflect waves and increase their effects. Sea level rise will amplify this effect.
Dredging, ferry and ship wakes may increase turbidity.
Beds naturally slow down current and trap sediment.
Turbidity limits the depth where eelgrass can grow. Other disturbances include boat anchorages, docks (shading), and contaminants.
Bat rays and other animals disturb the bottom increasing turbidity.

GIS Maps Being Produced

- Subtidal Habitat Types
- Habitat Stressors
- Informed Siting of Projects
- Web-based mapping

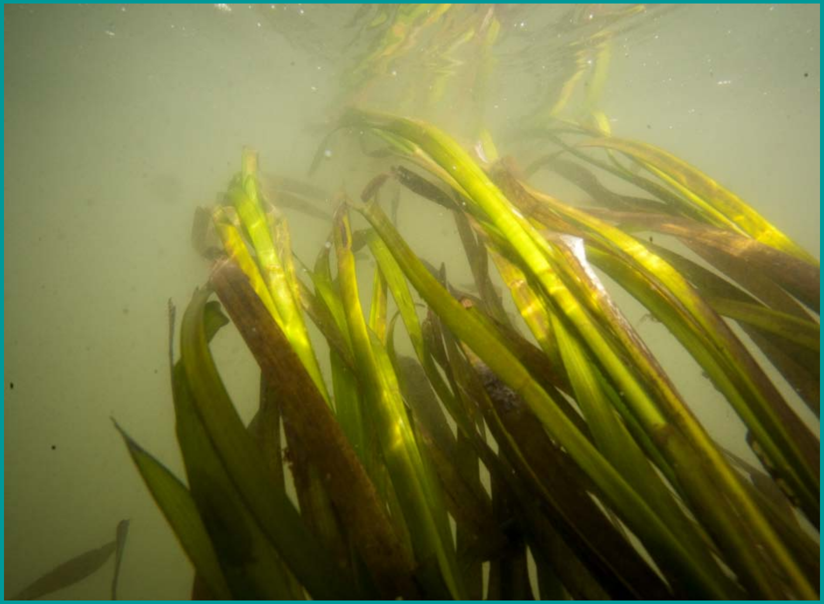


Consultant Reports

Stressor Narrative Papers
- Andrew Cohen, San Francisco Estuary Institute

Subtidal Economic Evaluation Report
- Battelle

Eelgrass Recommendations Report
- Katharyn Boyer, SFSU
- Sandy Wyllie-Echeverria, UW



Shellfish Recommendations Report
- Chela Zabin, UC Davis, SERC
- Ted Grosholz, UC Davis

Creosote and Artificial Structures Assessment
- San Francisco Estuary Institute





Examples of Goals

Science Goals

- Develop mechanisms to adapt to climate change.
- Understand the factors controlling the development of oyster beds.
- Determine suitable methods for protecting mudflats and beaches.

Protection Goals

- Protect existing eelgrass habitat through no net loss to existing beds.
- Protect subtidal and intertidal sand habitats through no net loss to existing sand beds and beaches.

Restoration Goals

Focus on quantifiable and regionally-specific targets

• Increase native eelgrass within 8,000 acres of potential suitable subtidal area through a phased pilot project approach.

• Promote pilot projects to remove artificial structures and creosote pilings at targeted sites, in combination with "Living Shoreline" techniques.

• Reduce habitat fragmentation and increase connectivity across upland, intertidal, and subtidal habitats.





Cross-Habitat Goals

Climate Change

Non-native/ Invasive Species

Oil Spill

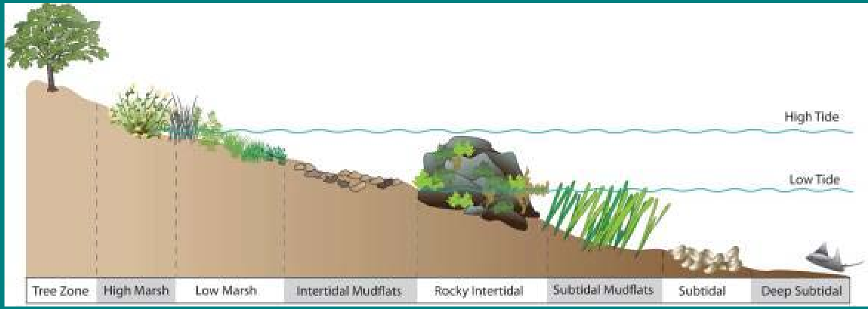
Marine Debris

Public Education

Integration

Subtidal-Wetland Design Integration

Living Shorelines



Climate Change

Increases the Need to Integrate Project Design

Sea Level Rise
- current populations: submerged to deeper depths
- changes in light attenuation: primary productivity

Temperature Increase
- changes to spawning timing
- increased epiphytes on eelgrass: shading

Salinity Decrease
- salinity change will alter species ranges
- shellfish die at sustained low salinities

Sediment Dynamics
- less bottom stress at depth may decrease turbidity
- potential for increased scouring below hard structures





Subtidal Climate Measures

- SAV propagation/conservation banks
- Native oyster seeding
- Plan for salinity changes
- Subtidal landownership and purchase/easements
- Wetland integration - top to bottom



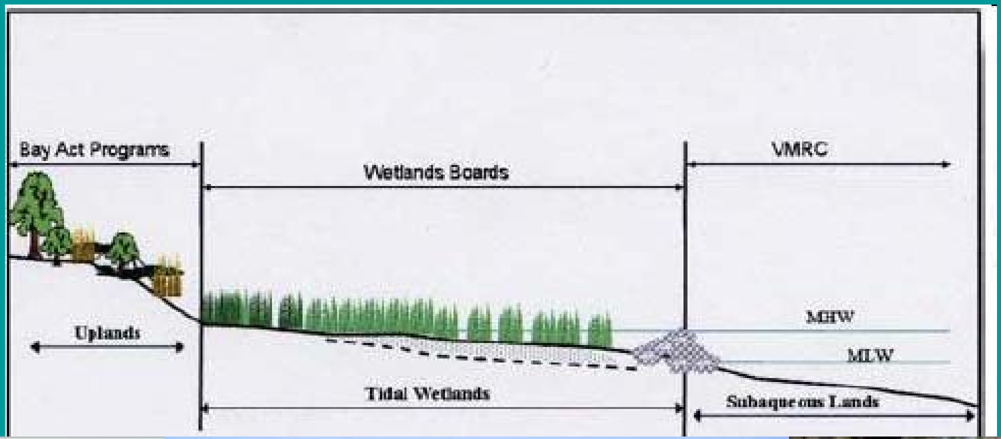



Intrinsic Subtidal Connection to Wetlands


Transition Zones on Both Edges

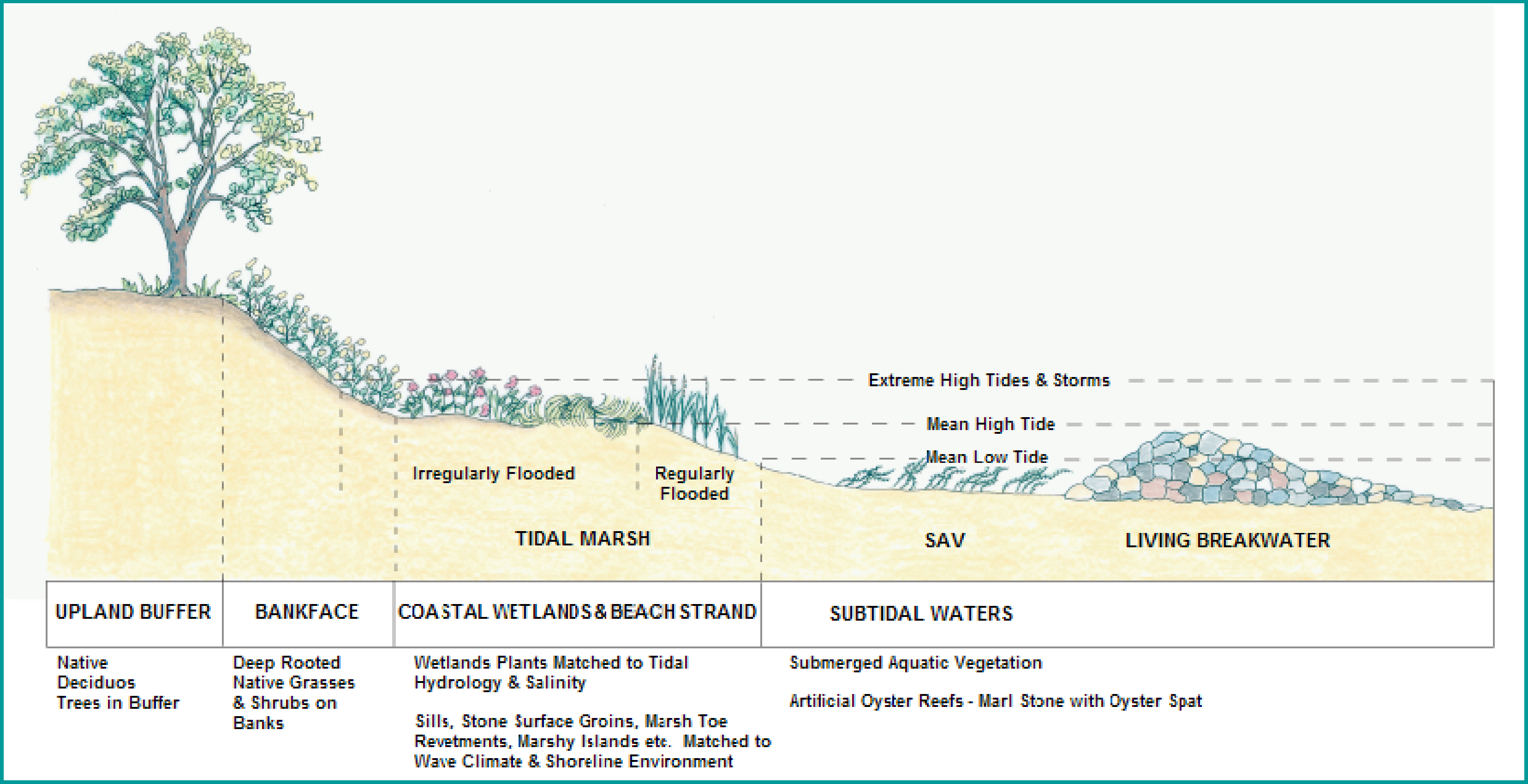
Upland transition

Subtidal transition



Wetland edges: sand bars, shell beds, kelp and eelgrass fringe, rocky intertidal

Living Shorelines: A soft bioengineering approach



Living Space: employ natural habitat elements to protect shorelines from erosion while also providing water quality benefits and critical habitat.

Living Shorelines: Issues for study in SF Bay

- **Scale:** what acreage is needed to slow wave action?
- **Suitability:** must be matched to site conditions
- **Permitting:** fill considerations in the subtidal zone
- **Monitoring:** functional connections between habitats
- **Pilot:** test effectiveness thru experimental designs




Katharyn Boyer, SFSU




Robert Abbott, Environ

Adaptive Management Principles

- Explicit statements of problems and goals.
- Clear conceptual models of processes to be affected.
- Predictions of outcomes and performance measures.
- Designed monitoring programs evaluating progress towards goals.
- A team charged with evaluating results and making recommendations for revising goals, desired outcomes, models, or actions.





Summary

- Subtidal areas are poorly understood in San Francisco Bay
- The Subtidal Habitat Goals Project is the first regional plan
- Subtidal ecosystem services benefit multiple species
- Climate changes will impact subtidal habitat locations and function
- Goals are phased and based on adaptive management principles
- Subtidal treatments may be a cost-effective approach to resiliency






Thank You

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