Assessment of Creosote-Treated Structures and Other Artificial Substrates in San Francisco Bay

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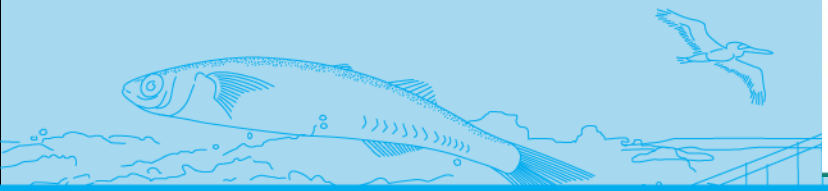
Long-Term Management Strategy Science Symposium

Subtidal Habitat Goals Project

A collaborative effort to establish a comprehensive and long-term management vision for research, restoration, and management of subtidal habitats

- Soft Substrates
- Rocky Habitats
- Artificial Substrates
- Shellfish Beds
- Submerged Aquatic Vegetation Beds
- Macroalgal Beds

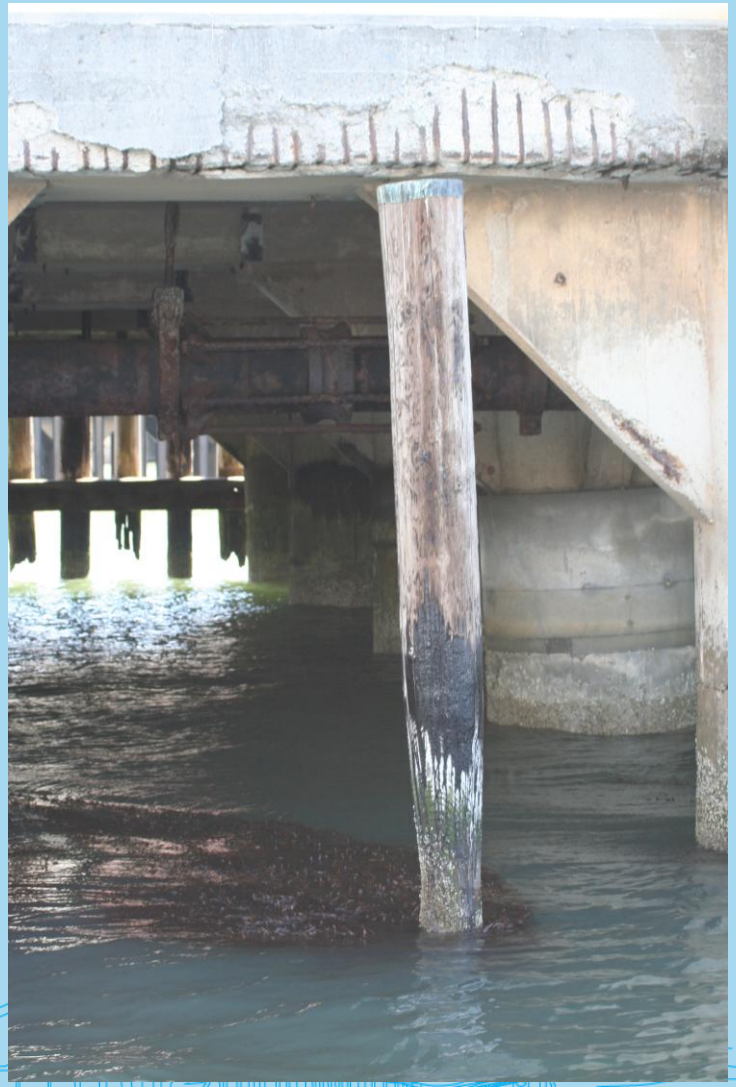


Project Components

- Mapping
- Environmental Assessment
- Historical Significance
- Removal Action Plan

What Is Creosote?

- Distillate of coal tar
- Wood preservatives in aquatic environments
- Hundreds to thousands of chemicals
- Up to 90% polycyclic aromatic hydrocarbons (PAHs)



Regulation of Creosote-Treated Structures in San Francisco Bay

- Department of Fish and Game ban in 1994

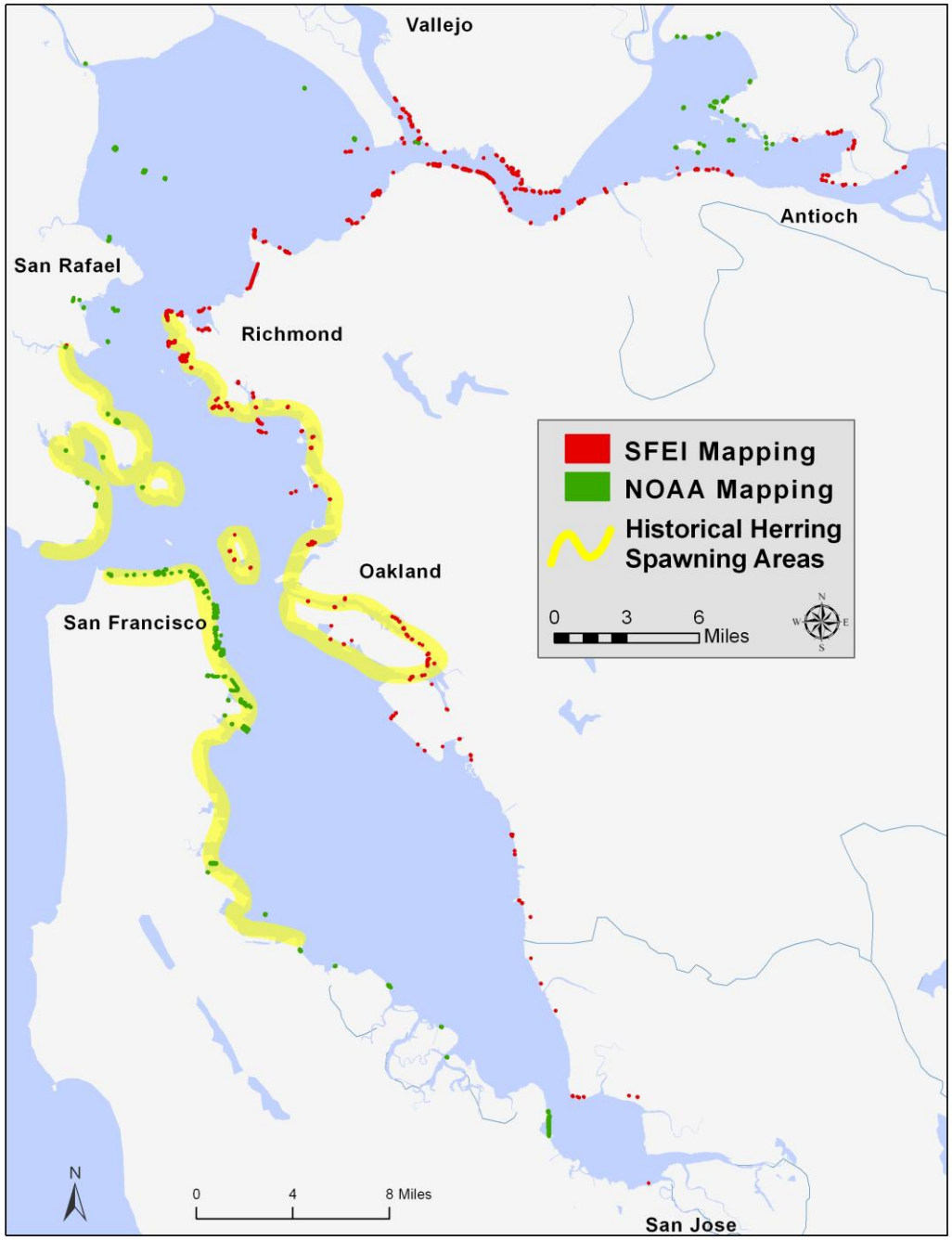
- Regional Water Quality Control Board prohibits use of creosote-treated wood in new construction

Mapping Abandoned Pilings

- What is the distribution of abandoned creosote-treated pilings?
- How does the distribution of abandoned piles relate to herring spawning areas?

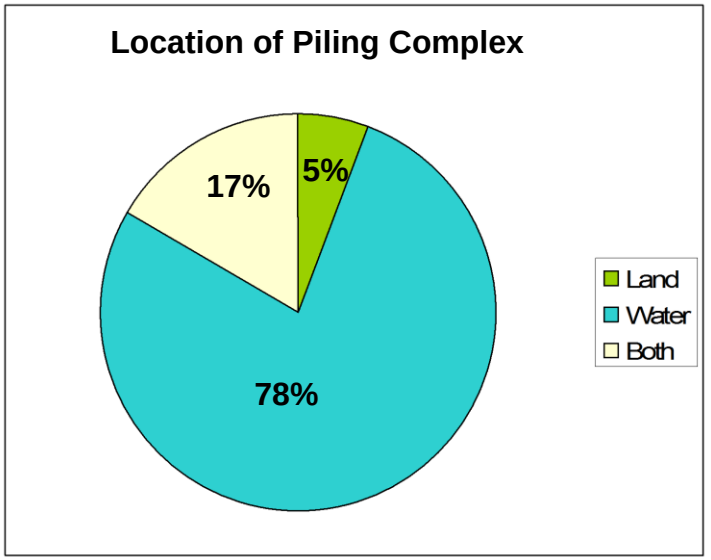
Mapping Attributes

- Estimated Number of Piles per Complex
- Estimated % Deck Cover
- Habitat Type (from Modern Baylands)
- Herring Spawning Habitat
- Depth (min, max, mean)

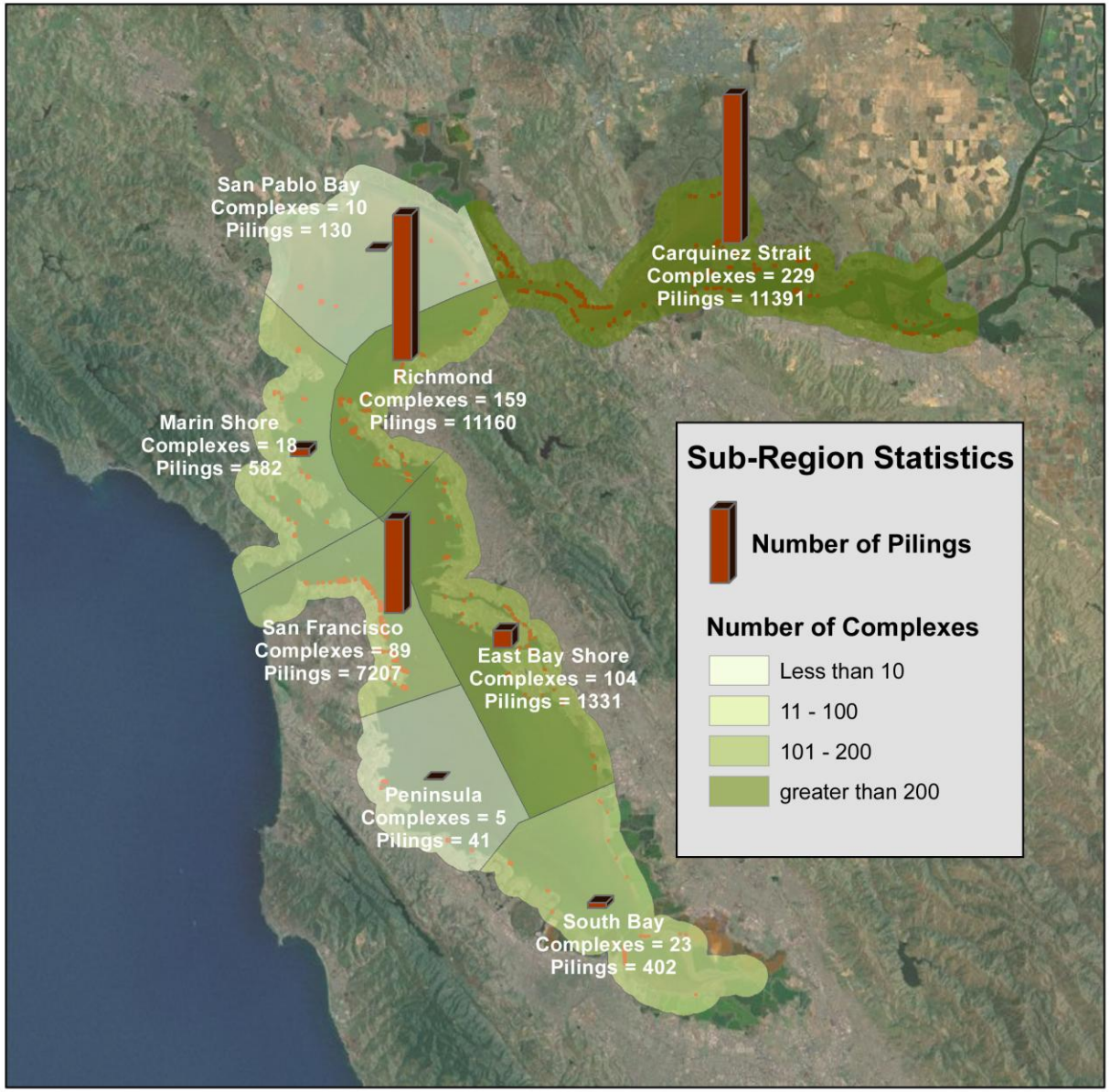


Mapping Results

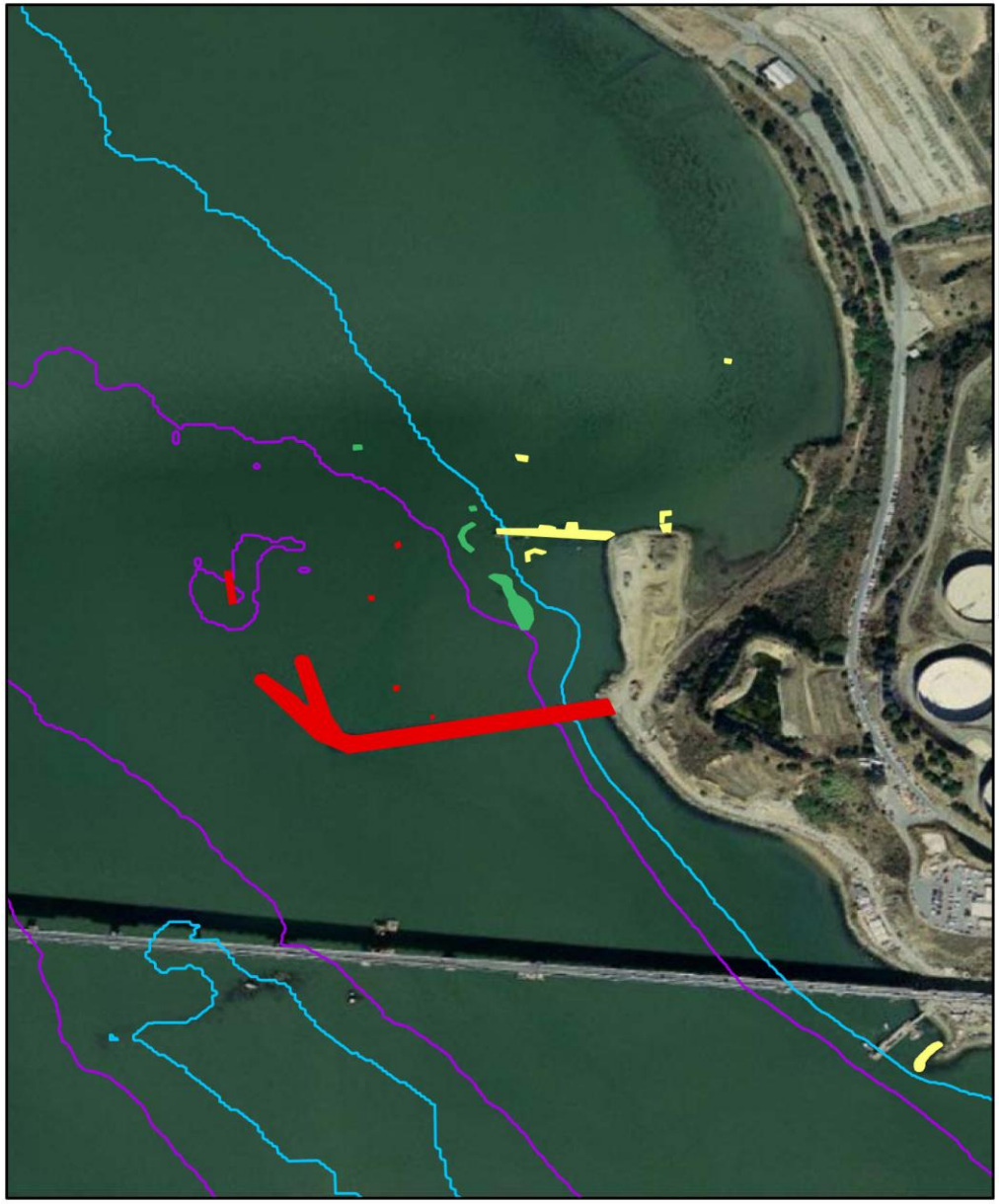
- 30,546 abandoned piles
- 630 complexes

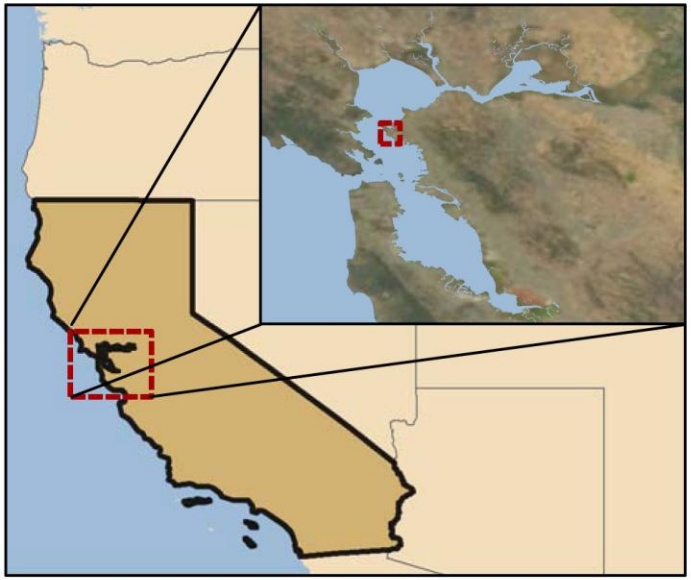


Subregions


San Pablo Bay
Complexes = 10
Pilings = 130
Carquinez Strait
Complexes = 229
Pilings = 11391
Richmond
Complexes = 159
Pilings = 11160
Marin Shore
Complexes = 18
Pilings = 582
San Francisco
Complexes = 89
Pilings = 7207
East Bay Shore
Complexes = 104
Pilings = 1331
Peninsula
Complexes = 5
Pilings = 41
South Bay
Complexes = 23
Pilings = 402
Sub-Region Statistics
Number of Pilings
Number of Complexes
Less than 10
11 - 100
101 - 200
greater than 200

Bathymetry





Piling Location by Average Depth

Average Piling Depth below MLLW

- greater than 12 ft
- 11.99 to 6 ft
- 5.99 to 0 ft

Bathymetric Contour Lines

- 6 ft below MLLW
- 12 ft below MLLW

Environmental Assessment

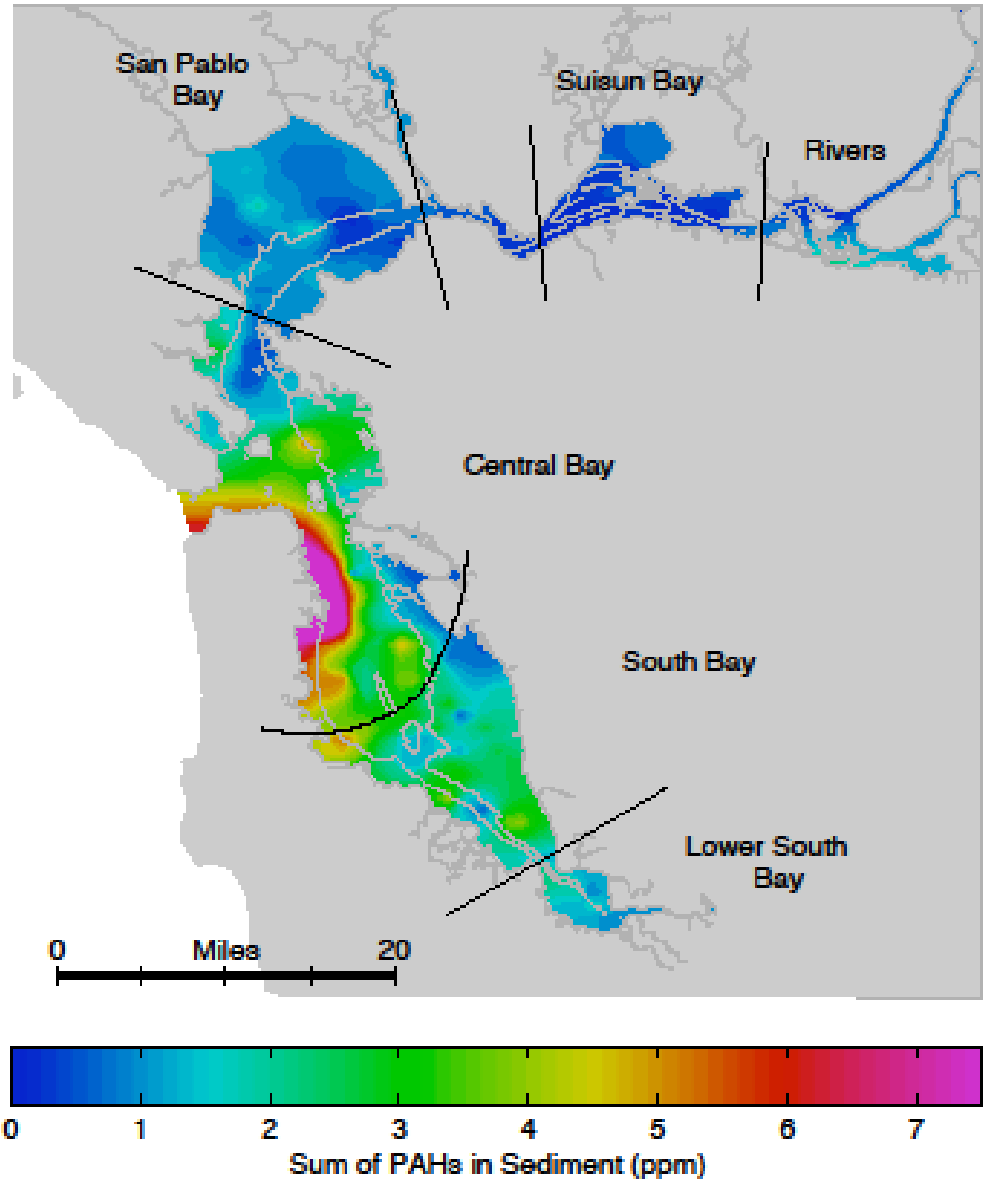
- What adverse effects of creosote-treated wood have been measured?
- Are there potential benefits of these structures for wildlife?

Creosote-Treated Structures in Aquatic Systems

- Creosote is slightly soluble in water
- Leaching increases with temperature and is higher in freshwater
- Leaching decreases with piling age
- Maximum contamination occurs 2 to 3 years post installation

PAHs in San Francisco Bay

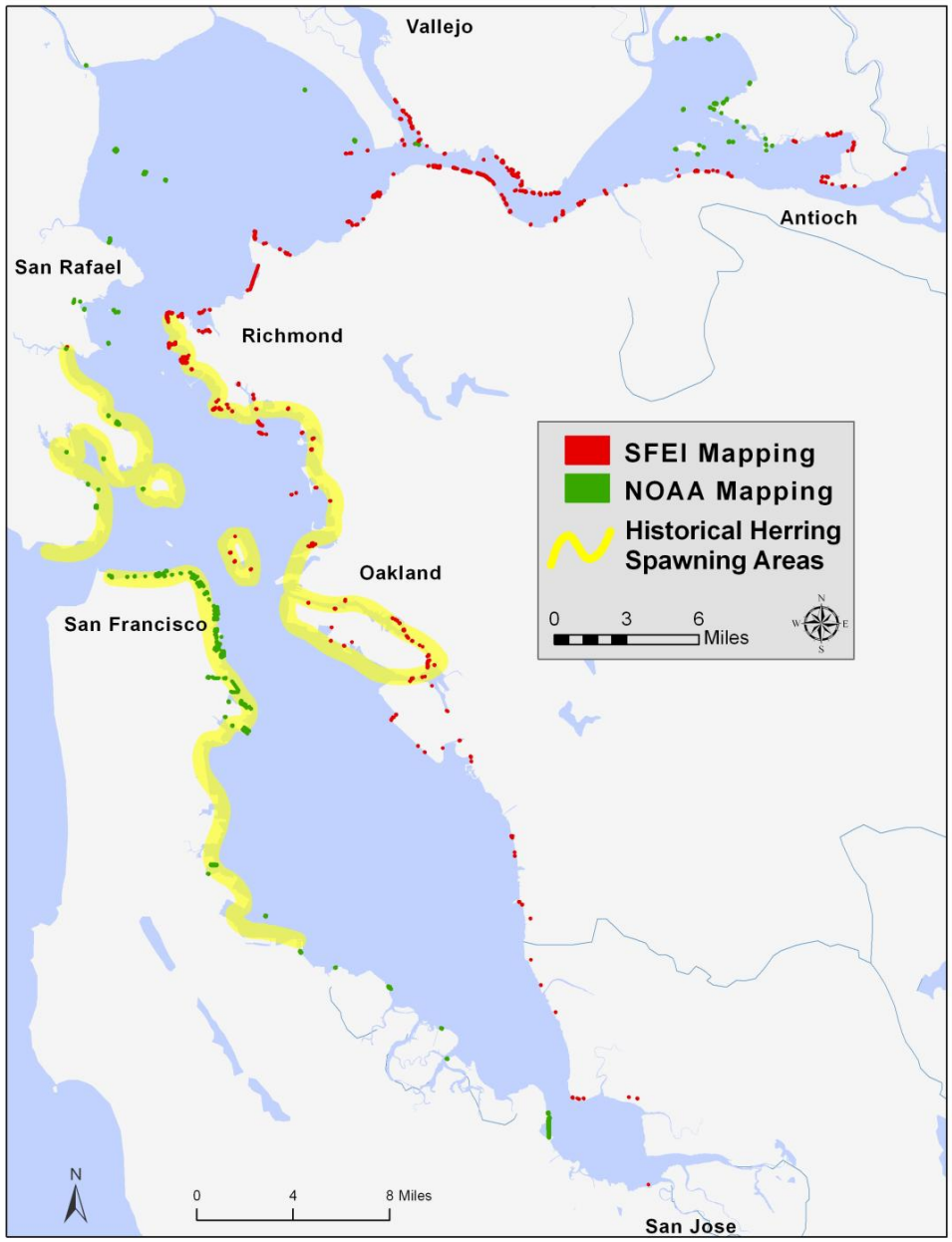
- Primary source is combustion (gasoline, crude oil, coal, and biomass)
- Creosote-treated structures less than 2% of all PAH sources in the Bay

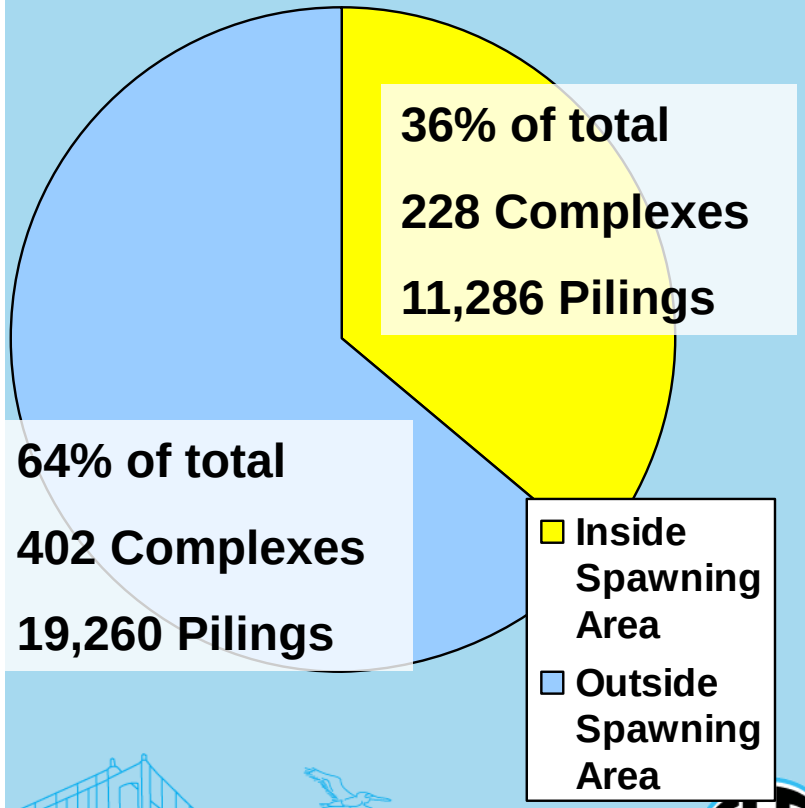


Environmental Risks of Artificial Structures

- Decreased hatching of Pacific herring eggs deposited directly on creosote-treated wood (Vines et al., 2000)
- Increased access to fish by congregating fish near artificial structures (Grossman et al., 1997)
- Replacement of preferred natural habitats (Bryan and Scarnecchia, 1992)
- Reduced fish growth (Able et al., 1999; Able et al., 1998)
- Reduced light penetration and subsequent impacts to submerged aquatic vegetation (Shaefer, 1999; Burdick and Short, 1999)

Herring Spawning Areas





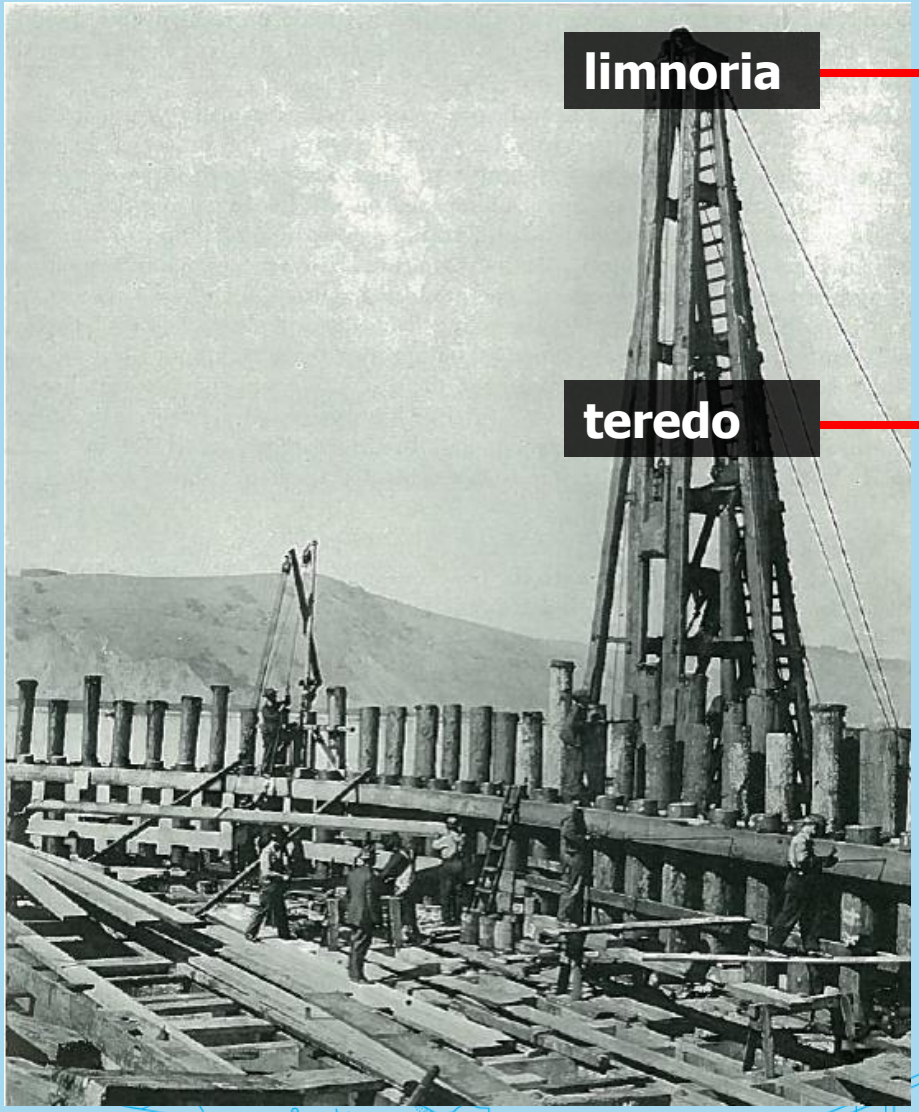
Environmental Benefits of Artificial Structures

- Pacific herring spawning
- Predator avoidance and foraging for fish
- Bird roosting
- Harbor seal and sea lion haul out

Historical Significance

- When was creosote used?
- Why were creosote-treated pilings installed?
- Do creosote-treated pilings have historic significance related to the history of development along the Bay margin?
- Are there historic-preservation issues that would complicate removal?

History of Creosote Use



- 1849: First piles in Bay

1870s-1880s: widespread experimentation

1888: Bethell process (pressure treatment)

1890: SPRR creosoting plant built in Oakland

1920: SF Bay Marine Piling Committee established

1920s: creosote use is widespread

1970: advent of container shipping

1993: creosote use banned

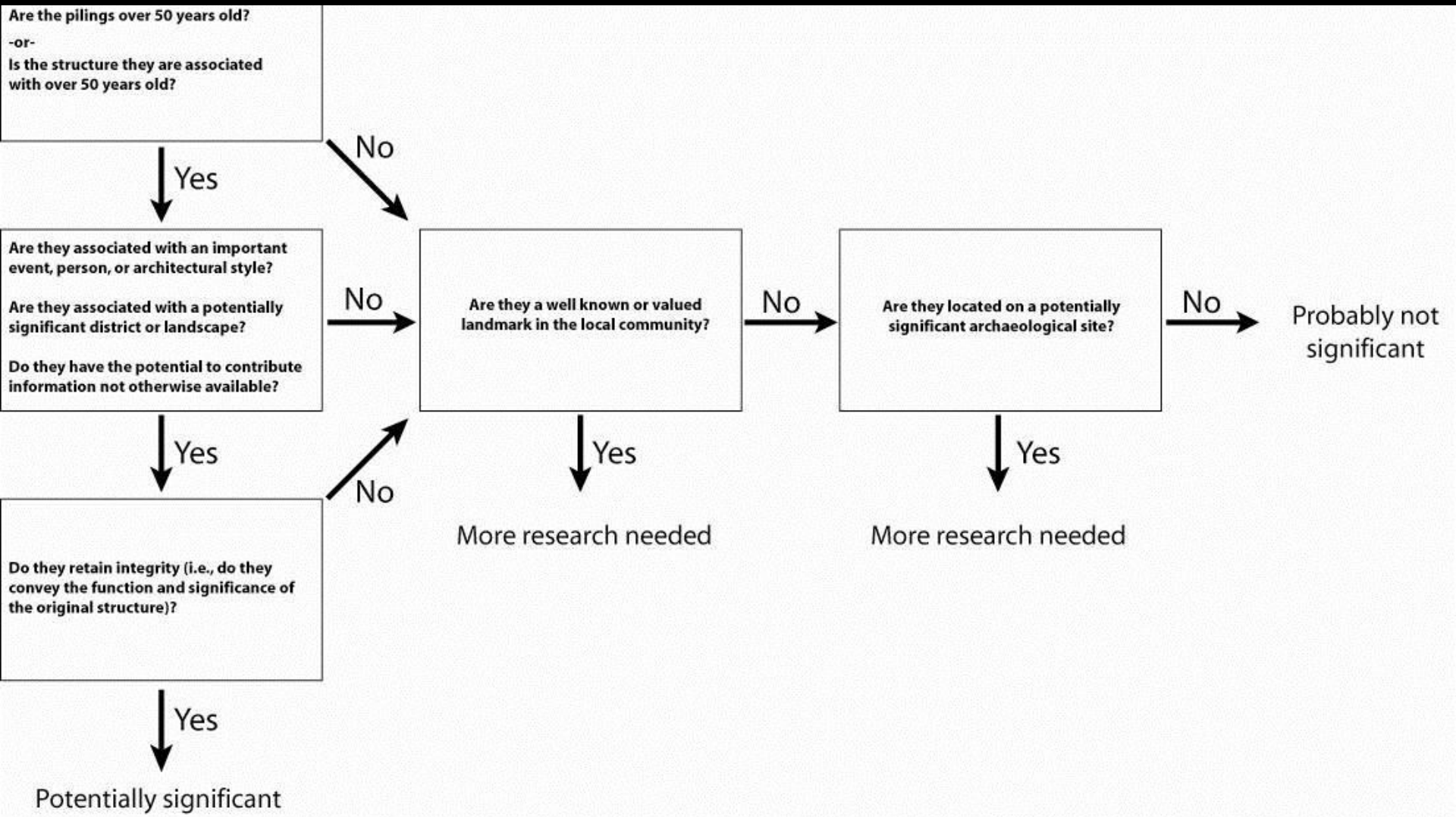
Methods

- Interviewed over 40 experts in maritime history and historical preservation

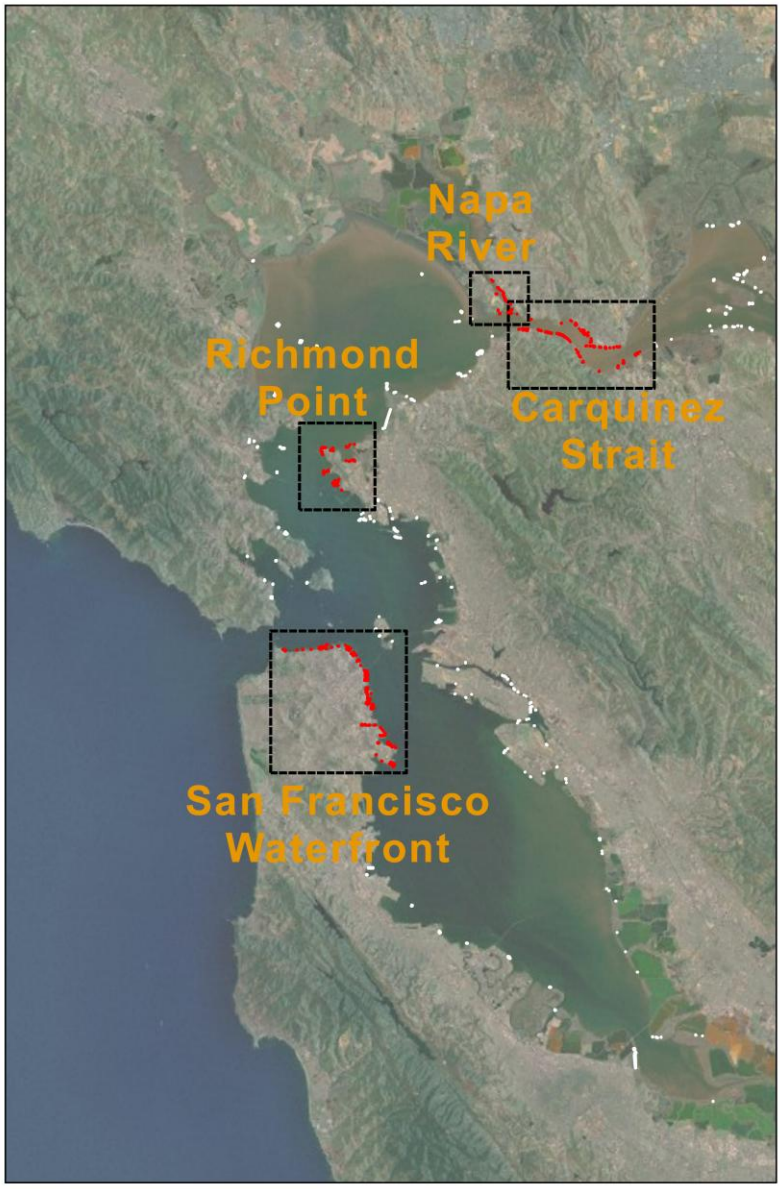
- Extensive literature review

- Technical Review team

Criteria for determining piling significance



Approaches to Evaluation



- **Case-by-Case**
- **Programmatic Approach**

Removal Action Plan

- What are the feasibility and costs of removal?
- What are the disposal options?
- What permits and authorizations are required?
- What are the ownership/responsibility issues?

Water Depth Requirements for Water Based Equipment

- Large marine equipment = 6 feet at MLLW
- Small marine equipment = 3 feet at MLLW
- Special considerations needed in areas of sensitive habitat e.g. eelgrass

Important Considerations

- Timing of projects and dredging work closure periods
- Pile removal Best Management Practices (BMPs)
- Temporary near-shore storage area
- Access to ground transportation required
- Encapsulation may be a good alternative to removal

Estimated Costs

- Medium/large project ~ $300 per pile
- $17/square foot for a 473,000 square-foot project
- Disposal costs ~ $40-$60 per ton
- Vary by size of project, location, timing, permits required, and disposal costs

Permitting

- Regulatory and resource agencies generally positive about pile removal projects
- Permits required by USACE, BCDC, RWQCB with NOAA, USFWS, and DFG consultation
- An ownership title search most likely required with possible legal action needed

Possible Next Steps

Mapping

- Site inspections to locate submerged piles

Environmental Assessment

- Pacific herring laboratory and field studies, including quantification of spawning on creosote-treated piles

Historical Significance

- Implementation of programmatic approach

Action Plan (Feasibility and Logistics of Removal)

- Development of Bay-wide or specific area BMPs

Attributes of high-priority removal projects

Mapping

High density

Environmental Assessment

High probability of enhancing habitat, such as eelgrass beds

Historical Significance

Non-historic (built in the past 50 years)

Action Plan (Feasibility and Logistics of Removal)

Availability of access for removal

Draft Subtidal Habitat Goals Manager Recommendations

Where feasible, remove artificial structures from San Francisco Bay that have negative or minimal beneficial habitat functions.

- Remove creosote pilings with an emphasis on those areas that have high density of pilings and are within current and historic spawning grounds.
- Initiate programmatic evaluation of pilings pursuant to the National Register and associated guidelines.
- Remove 6500 tons of creosote pilings from piling "hotspots" within 5 years.
- Survey and map submerged pilings for potential removal.

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Questions or Comments?
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