

Survey of native oyster, *Ostrea
conchaphila*, distribution in San
Francisco Bay in 2001-2003 with
observations on population-limiting
factors

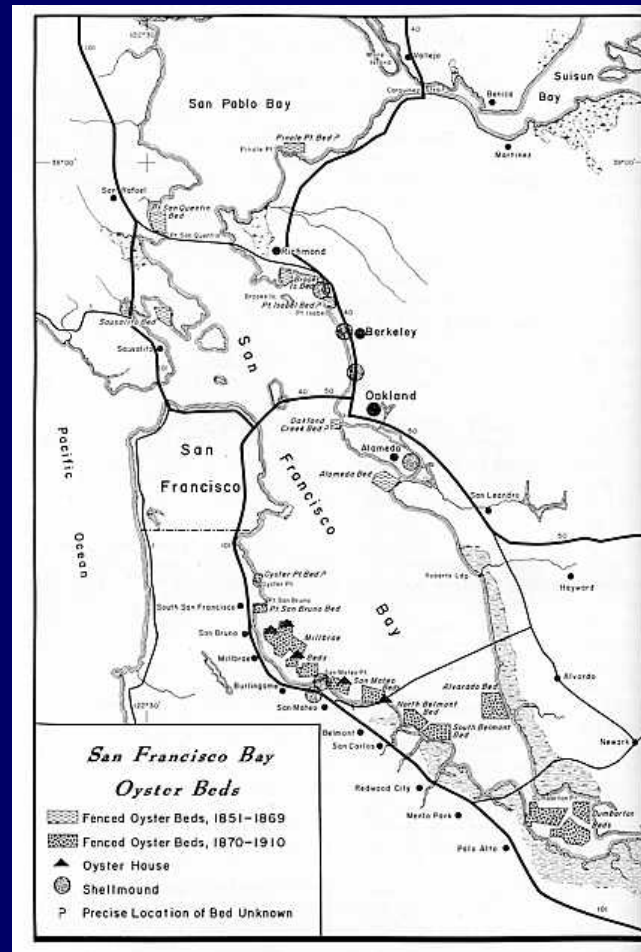
by

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Outline

- Introduction
 - Background
 - Hypothesized Limiting Factors
- Three Study Components
 - Methods
 - Results
 - Discussion
- Conclusions

Potential Distribution Based on Historic Native and Cultured Oyster Beds (after Barrett 1963, Calif. Fish and Game Bull. 123)



Limiting Factors



- Salinity 20-30 psu
- Predator: *Urosalpinx cinerea*
- Substrate grain size from mud to concrete

photo from SFBay:2K study

Hypothesis

H_0 : There will be no significant relationship between oyster density and the limiting factors of salinity, predation and substrate

- Alternative hypotheses:
 - Oyster density will be greater in 20-30 psu
 - Number of oysters will be inversely related to the density of predators
 - Oyster density will be higher on rocky substrates than on silty mud
 - Density on docks would be higher than on shore because drifts and mud are absent on docks

Three Study Components

- Subtidal Distribution
- Intertidal Distribution
- Marina dock vs.
Shoreline intertidal
Abundance



Methods: Subtidal sampling

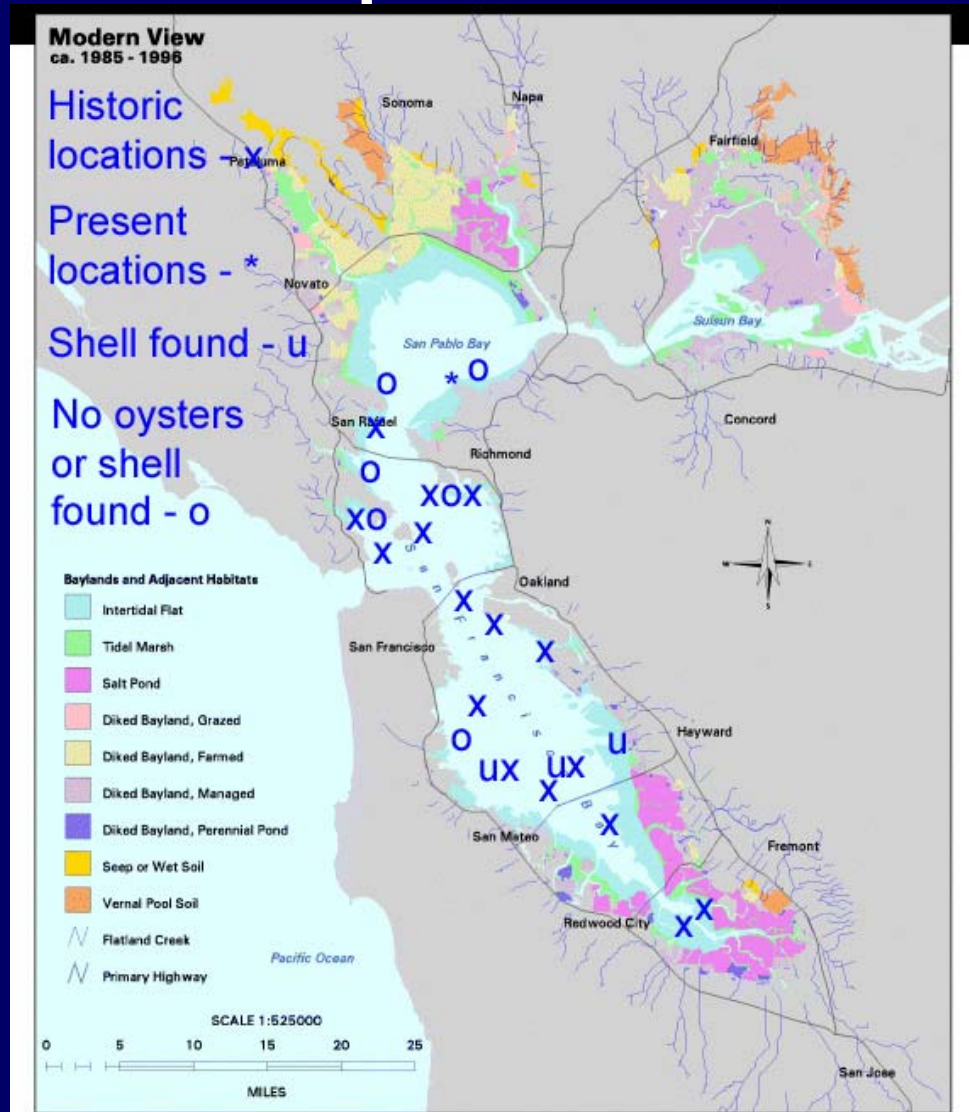


- Oyster dredge
- Salinity, depth, size, and number of oysters noted
- Predators noted
- CTD and Secchi disc
- Locations: North Bay, South Bay, San Pablo Bay

Subtidal Samplings by Bay Region

Locations	Number of Hauls
North Bay:	
Southampton Shoal	3
Richardson Bay	3
Central Bay	4
South Bay	3
San Pablo Bay	3
Total	16

Historic and present locations



Modern View Primary Sources:
CA State Lands Commission, US Geological Survey, US Fish and Wildlife Service, US National Aeronautical and Space Administration, and local experts.

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Results: Subtidal sampling



- 16 locations
- Live oysters found at Point Pinole
- Shell and cobble substrate
- Strong currents maintain mud-free substrate

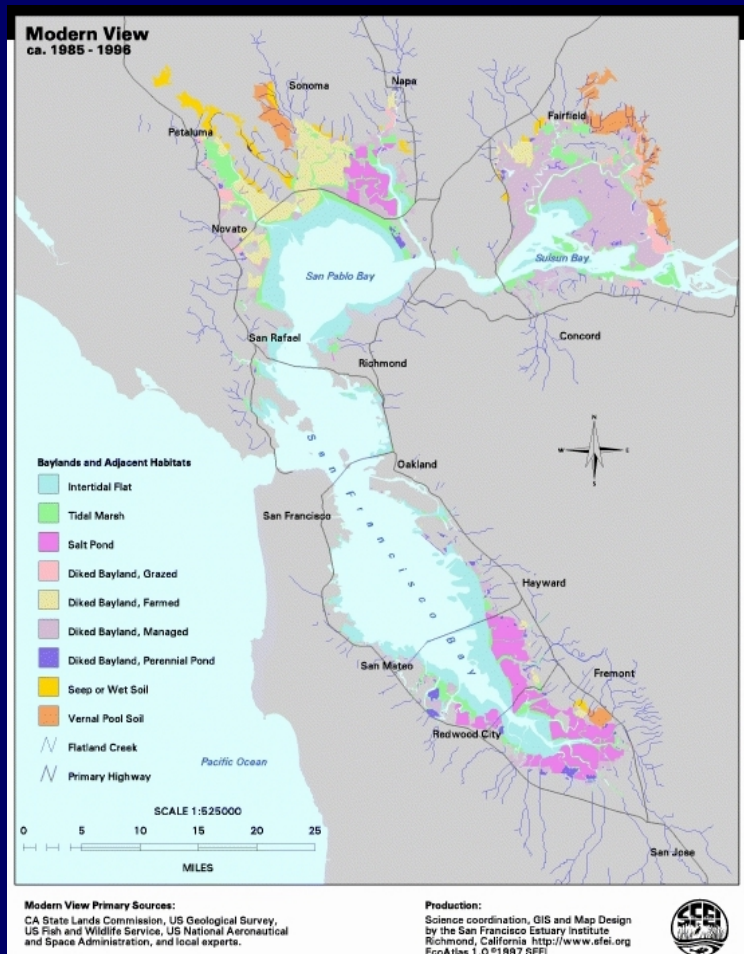
Discussion: Subtidal sampling



Tripp straining mud from San Lorenzo Creek tow

- Oysters found on one site
- Location had no fine sediment
- All other sites had fine sediment

Methods: Intertidal sampling



- Abundance indexed by CPUE
- Substrate classified
- Subset of oysters measured
- Salinity measured, predators and other organisms noted
- Abundance vs. salinity sediment grain size, and predators analyzed by regression and non-parametric correlation

Map from San Francisco Estuary Institute

Intertidal Samplings

Location	Number of surveys	Avg. time spent in min/survey
North Bay	10	21
Richardson Bay	5	16
Central Bay	14	23
South Bay	6	51
Total	35	918

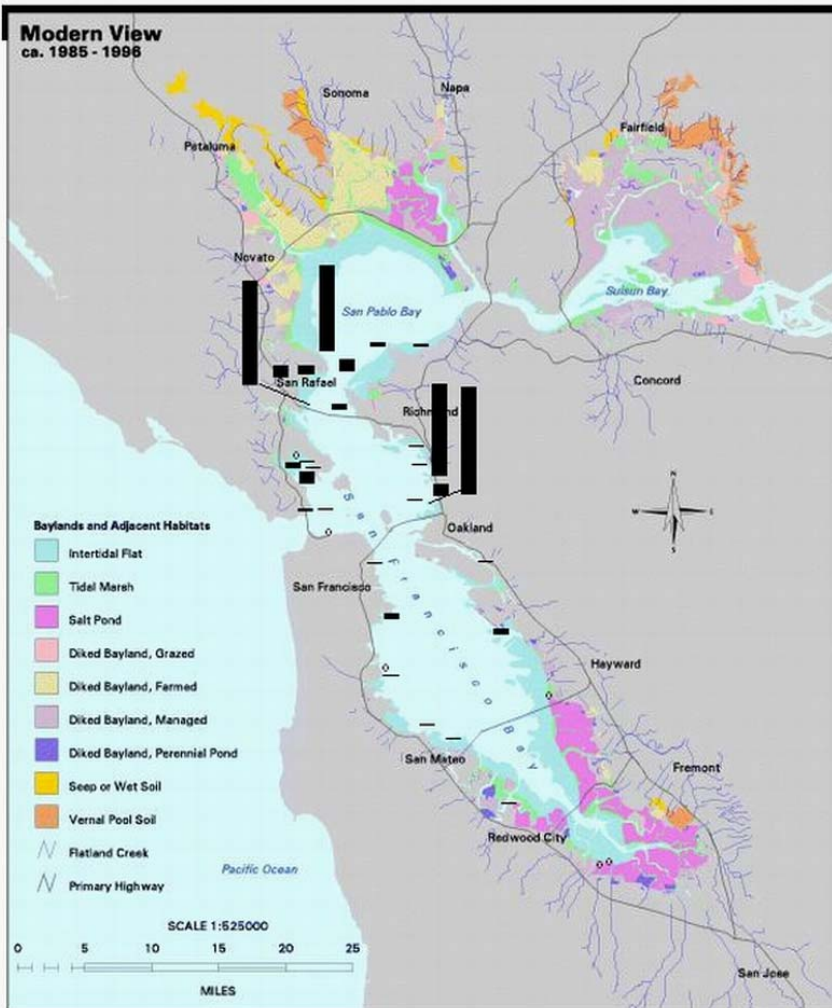
Oysters on Rock or Structures



Native Oysters on Pacific Oyster Shell and on Live Mussel



Results: Intertidal sampling



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and Space Administration, and local experts.

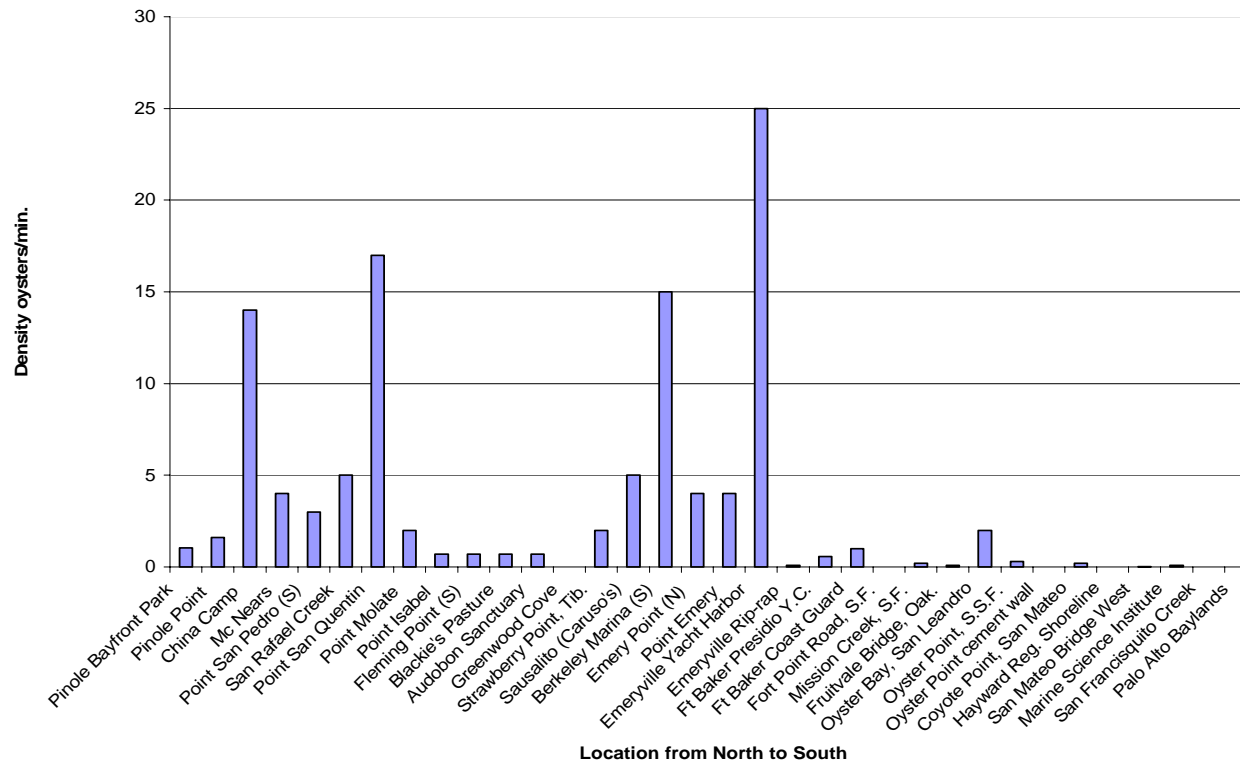
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- Densities high in North and Central Bay
- More oysters found on hard substrate
- Larger oysters found at high salinities, range from 10 – 32 psu
- Fewer oysters where drills were present
- Oysters smaller at the 6 of 34 sites with drills

Discussion: Intertidal sampling

- Oysters found widely distributed North to South
- Drills were found mostly in the South Bay



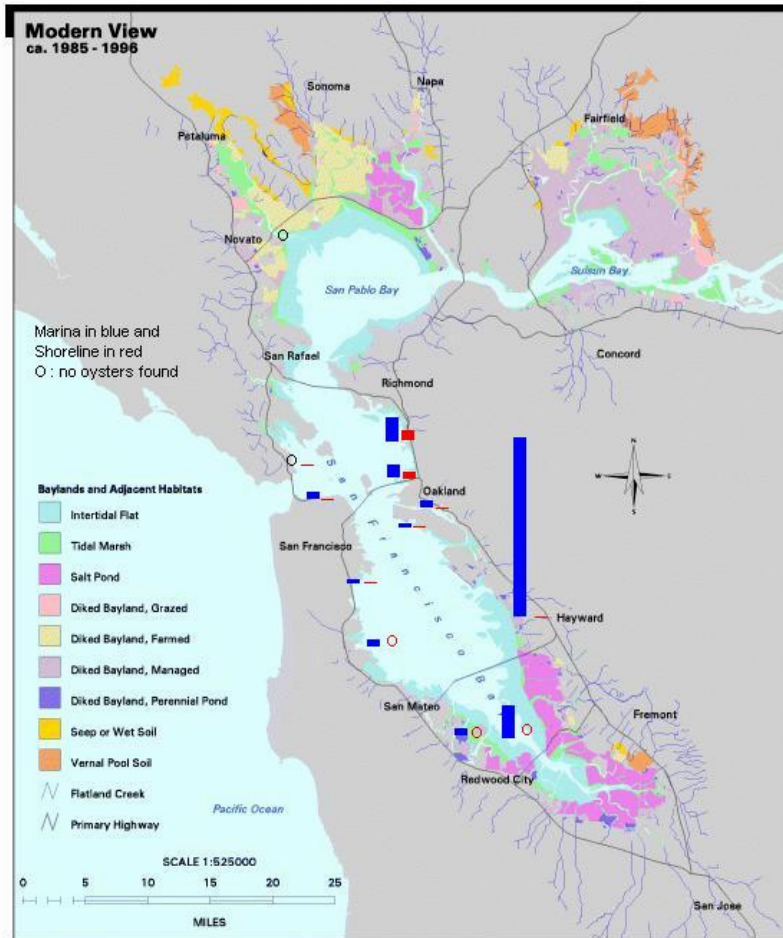
Methods: Marina dock vs. nearby shoreline intertidal habitat

- Abundance measured per square meter on transects along the shoreline and on the dock at 12 marinas
- Predators, salinity, and substrate noted
- Pairwise statistical comparison of abundance done with the non-parametric sign test

Dock and Shoreline Intertidal Sampling by Bay Region

Location	Number of samples
San Pablo Bay	1
Richardson Bay	1
Central Bay	7
South Bay	3
Total	12

Results: Marina dock vs. Intertidal sampling



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and Space Administration, and local experts.

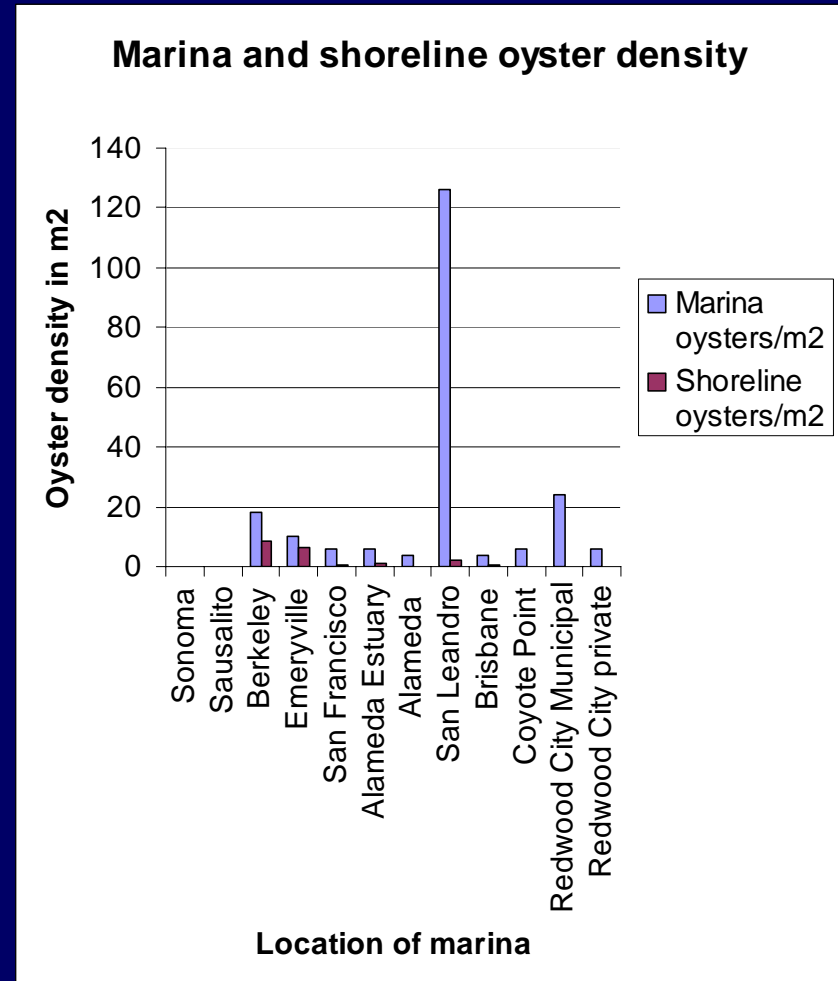
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- Dock densities higher than shoreline densities
- Salinities ranged from 11 to 26 psu
- *U. cinerea* found in four locations on shore

Discussion: Marina dock vs. nearby intertidal habitat comparisons

- Higher density on docks with few drills and low sediment
- San Leandro marina had highest density
- No oysters found on Clipper Yacht harbor dock or in Sonoma (rubber/plastic docks, low salinity)



Conclusions

- Oysters were found in a rocky subtidal area free of fine sediment
- Oysters are widespread throughout bay
- Oyster density was significantly higher on marina docks than on the nearby shore
- Substrate and perhaps predation by non-native drills are important limiting factors
- Estuarine salinity was related to oyster abundance but confounded with other factors

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