

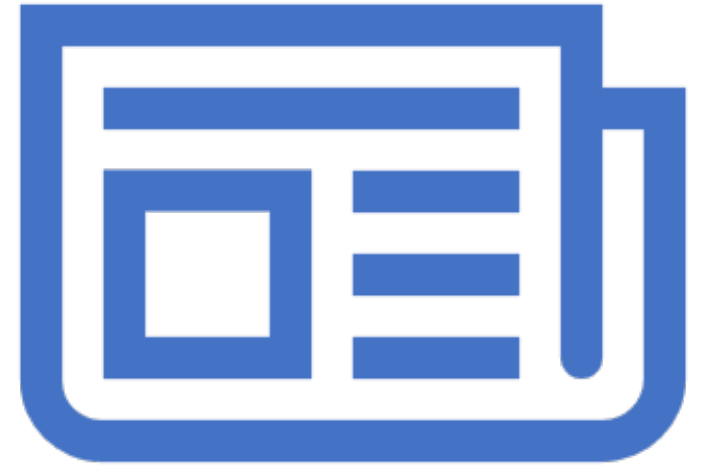
Connections on the San Francisco Bay and the Greater Farallones National Marine Sanctuary

Alyssa Ells

November 7th 2019

Objective

- Write a white paper on the connections between the San Francisco Bay and Greater Farallones National Marine Sanctuary
 - Introduction
 - Chapters: Symposium Topics
 - Overall threats
 - Conclusion
 - Advisory council recommendations summaries in the conclusion



Greater Farallones National Marine Sanctuary



Symposium

Wildlife

Oceanography

Human Activities



Harbor Porpoises

Wildlife

Cetaceans



(naturepl.com)

Harbor Porpoises



(montereybayaquarium.org)

Bottlenose Dolphins

Wildlife

Cetaceans



(naturepl.com)

Harbor Porpoises



(montereybayaquarium.org)

Bottlenose Dolphins

Wildlife

Cetaceans



(us.whales.org)

Grey Whales



(naturepl.com)

Harbor Porpoises



(montereybayaquarium.org)

Bottlenose Dolphins

Wildlife

Cetaceans



(us.whales.org)

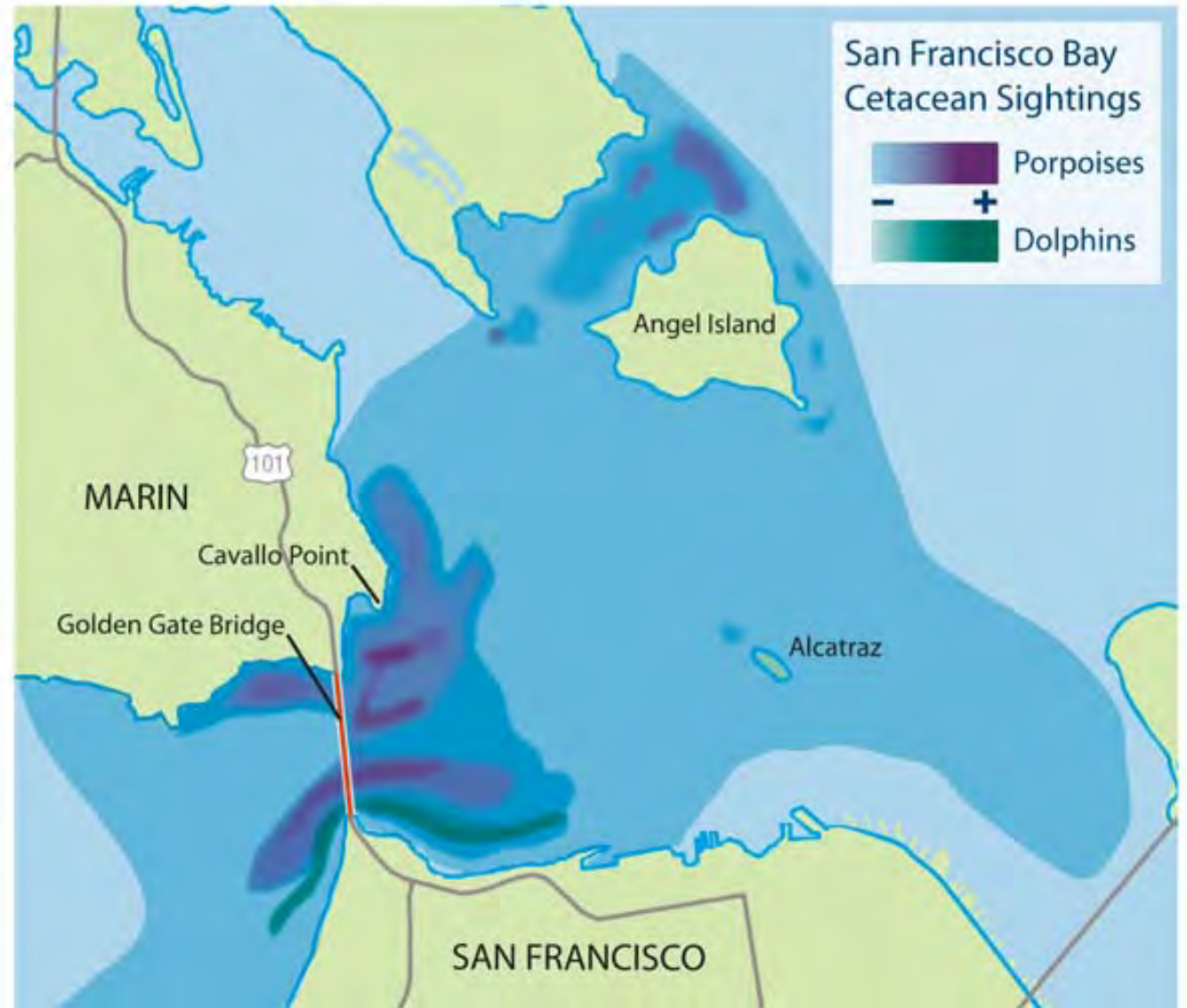
Grey Whales

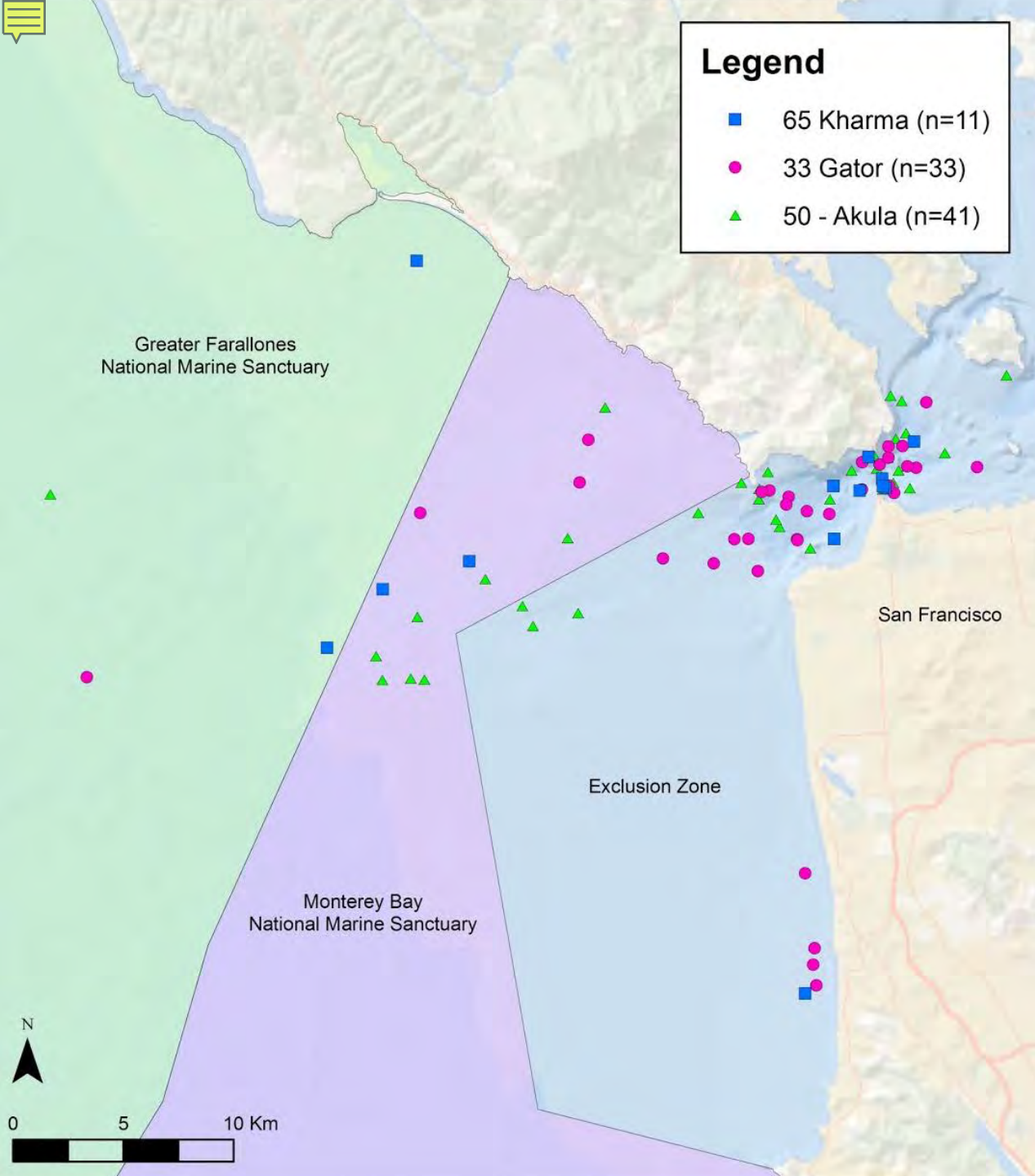


(sfgate.com)

Humpback Whales

Cetacean sightings between the San Francisco Bay and Gulf of the Farallones





65 Kharma



33 Gator



50 Akula



Wildlife

Pinnipeds



(baynature.org)

Harbor Seals



(Sea-Lion Center)

California Sea Lions



Common Murres



Surf Scoter

Wildlife

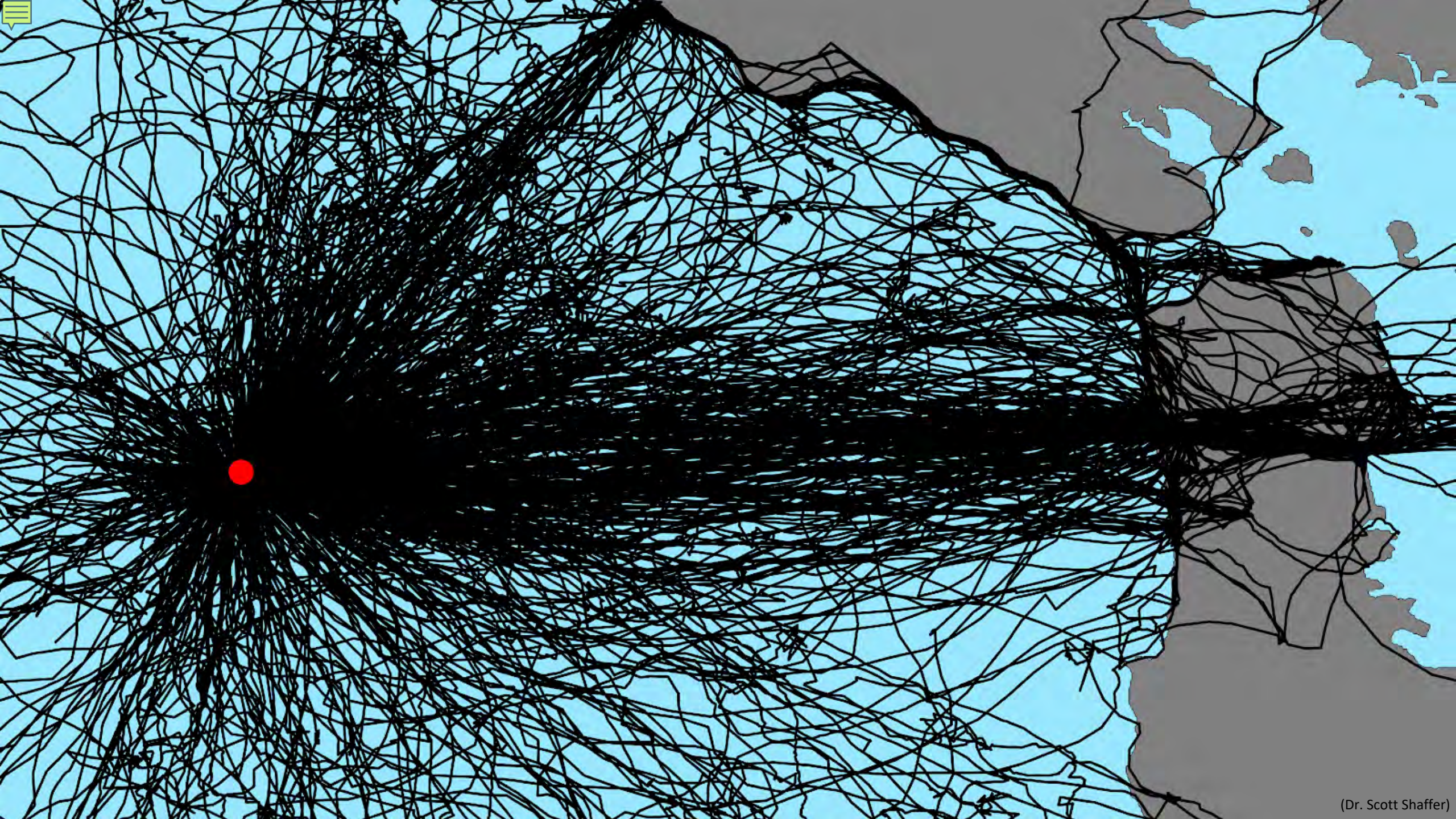
Sea Birds



Brandt's Cormorant



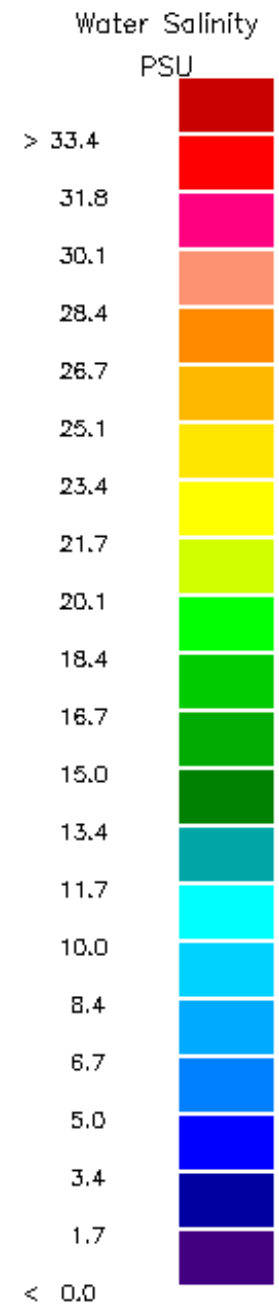
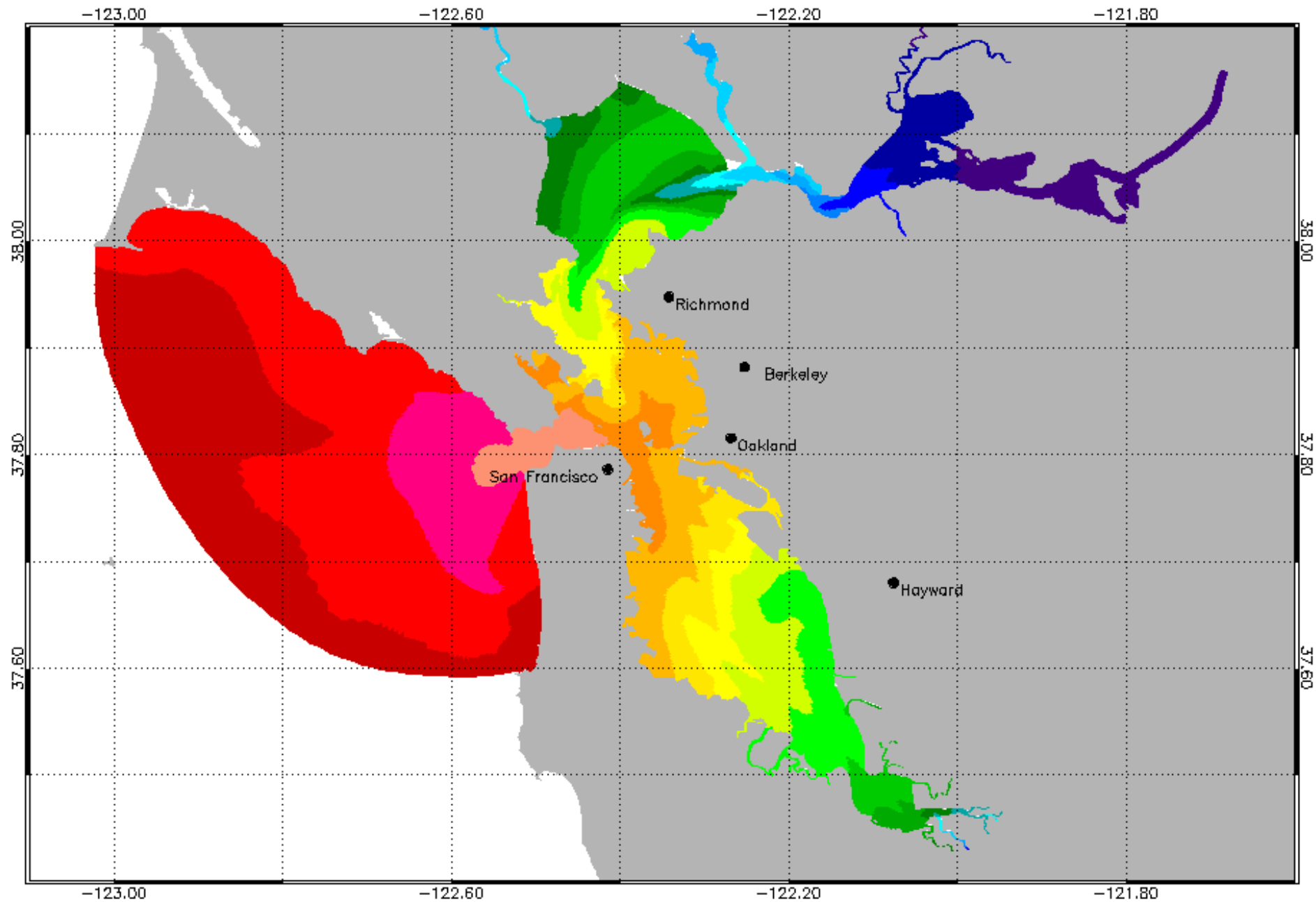
Western Gulls



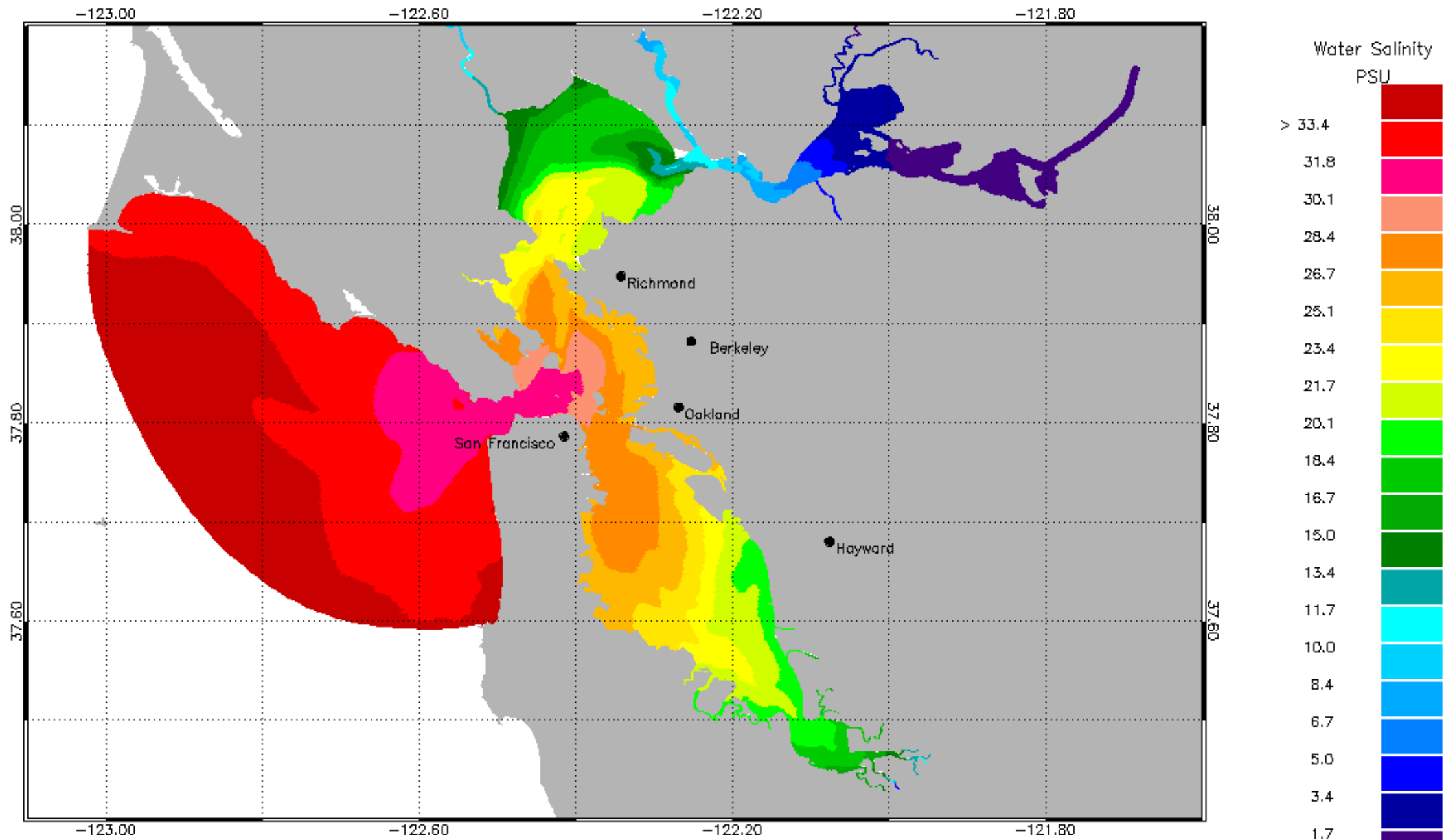


Wildlife Threats

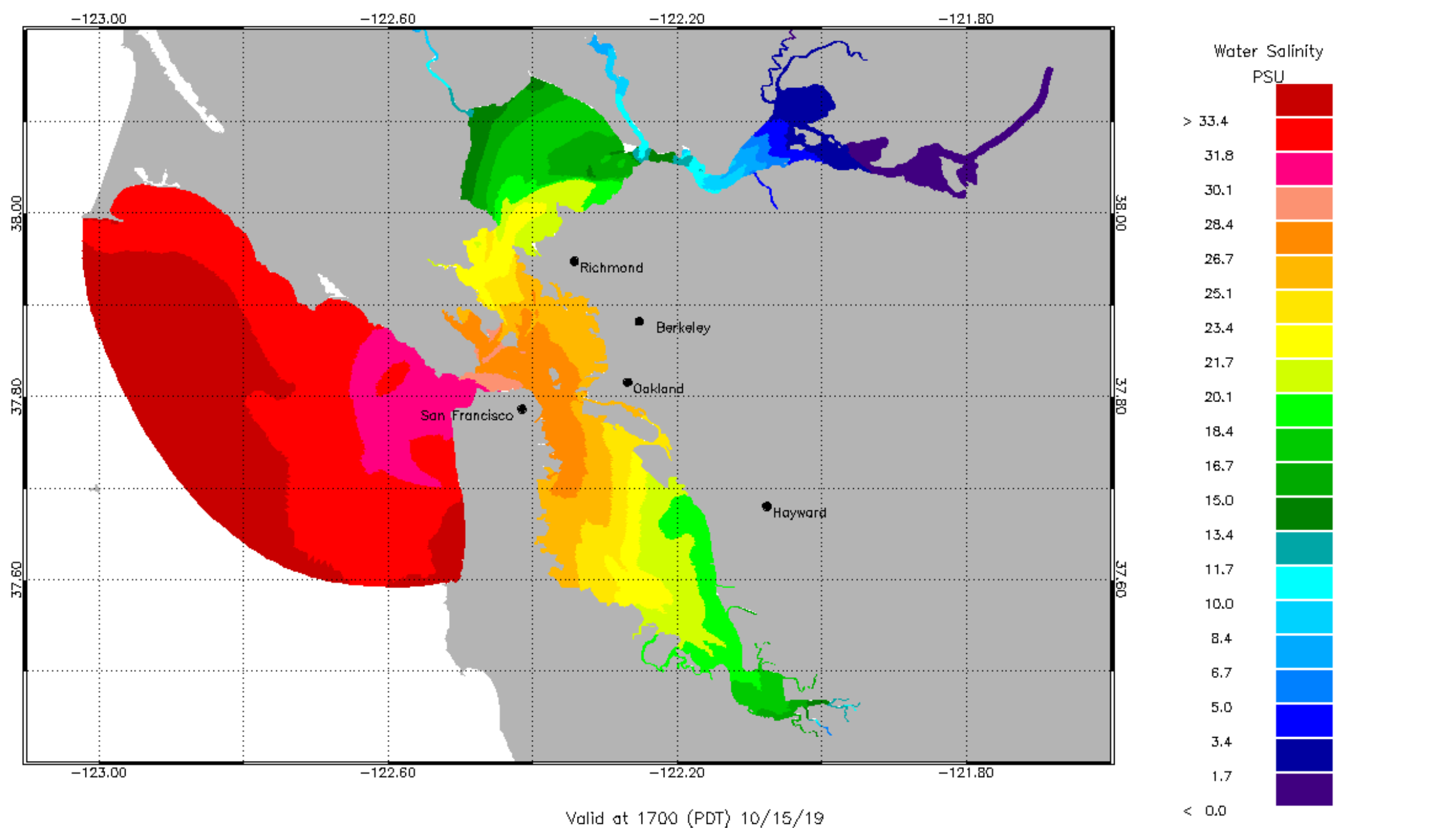
- Pollution
- Domoic Acid
- Sea level rise
- Marine heat waves
- Ship Strikes
- Habitat alteration
- Shifting prey populations



Valid at 0900 (PDT) 10/15/19



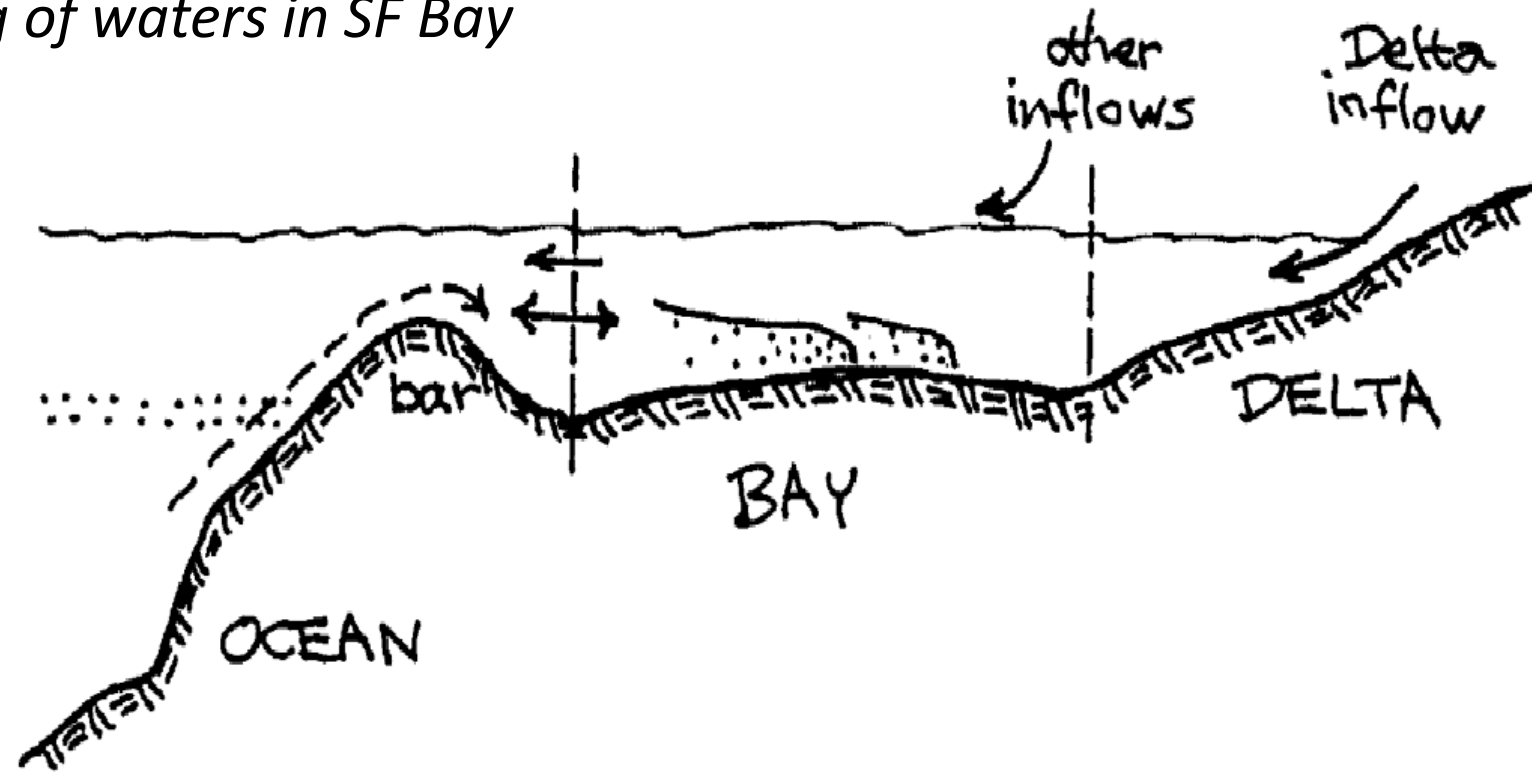
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Oceanography

Cartoon conceptual model

tidal mixing of waters in SF Bay



Oceanography

- River Plumes
 - Transports:
 - Freshwater
 - Nutrients
 - Pollutants
 - Plankton
 - Sediment
 - Etc
 - Preliminary results from Dr. Piero Mazzini showed the plume leaving the bay and traveling north.





Oceanography

- Nutrients and Phytoplankton
 - Gulf of the Farallones is a productivity hot spot
 - Nutrient Sources:
 - Coastal Upwelling
 - Outflow from the San Francisco Bay
 - There is very few studies on nutrient/productivity in the Gulf of the Farallones and San Francisco Bay outflow.

Oceanography

- Ocean Acidification (OA)
 - Negatively effects calcifying organisms
 - Two sources of OA are upwelling and atmospheric sources.
 - OA is hard to measure



Oceanography Threats

Harmful
Algal Blooms

Stratification

Climate
Change



Human Activities

- Vessel Traffic and Ship Strikes
 - Monitored using Marine Monitor (M2)
 - Results showed vessels (barges and ferries) traveled over 15 knots (the voluntary speed limit in the bay).
 - High migration zones outside of the bay within the sanctuary



Human Activities

- Fishing
 - 40% of Salmon caught in Oregon is from the Sacramento River
- Invasive Species/ Fouling
 - Come via ballast water or attached to ships
 - Push out native species
 - Alter habitats



Human Activities Threats



Climate Change (Anthropogenic)



Invasive Species



Vessel Noise



Ship Strikes



Pollution

Overall Threats

Ship Strikes

Pollution

Climate Change

- Anthropogenic
- Marine Heat Waves
- Domoic Acid
- Sea level rise
- Habitat alteration
- Shifting prey populations
- Harmful Algal Blooms
- Stratification

Recommendations from Symposium

Sanctuary to Bay voluntary vessel speed reduction to eliminate ship strikes

Need for additional research on connections between the bay and GFNMS.

Coating Strategies for ships to reduce fouling

Sanctuary Expansion to close the exclusion zone and into the San Francisco Bay (Important habitat for Humpback Whales)



Sanctuary Advisory Council Discussions and Recommendations