RESOLUTION of the
Greater Farallones National Marine Sanctuary Advisory Council

To support staff recommendations within the Bolinas Lagoon Topic Briefing

At its meeting on April 21, 2023, the Greater Farallones National Marine Sanctuary Advisory Council suggested edits to the staff recommendations within the Bolinas Lagoon Topic Briefing. The council passed a resolution to support the staff recommendations with the suggested edits.

Attachments: Bolinas Lagoon Topic Briefing

This resolution was passed with majority vote by a quorum of primary members (or alternate members serving in place of primary members) at a public meeting on April 21, 2023 held in Sausalito, CA and via Google Meet. Council discussion regarding this resolution can be found in Meeting Highlights documentation at https://farallones.noaa.gov/manage/sac_meetings.html.

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Briefing on Bolinas Lagoon in Greater Farallones National Marine Sanctuary

State of the Resource

Condition Report Data (in preparation)
In general, information on the condition of Bolinas Lagoon is minimal. However, regular water sampling just outside the lagoon indicates that water quality is good. There is a lack of data on other water quality parameters, contaminants, and habitat integrity inside the lagoon. Eelgrass is thought to be extremely limited in Bolinas Lagoon but has not been assessed recently, and non-native species are present. Two car crashes have occurred in Bolinas Lagoon that may have damaged habitat. Restoration activities have been working towards restoring hydrological function and removing invasive species.

Climate Vulnerability Assessment Findings

- Vulnerability is calculated from exposure to climate and non-climate stressors, sensitivity to those same stressors, and the resource's ability to adapt to the impacts. Ratings presented are from the original 2015 report and from 2023 revisions of some indicators.
- Estuaries have a **high vulnerability** score (second most vulnerable habitat in the sanctuaries) based on very high exposure to climate change stressors, namely increased water temperatures, wave action and sea level rise, and reduced dissolved oxygen, and high or moderate sensitivity to sea level rise, sea surface temperature, and precipitation; however, estuaries do exhibit high adaptive capacity due to high species diversity and value to people. Estuaries also have very high exposure to non-climate stressors such as land use impacts; disturbance from structures, vessels, or moorings; and invasive species. The vulnerability of estuaries did not change since the original assessment. Thorne et al. (2016)[1] indicate that Bolinas Lagoon will experience dramatic habitat transition due to sea level rise (SLR) by 2080 under mid-SLR projections and 2050 under high-SLR projections, with the complete loss of high and mid-marsh habitat.

Other science information
Bolinas Lagoon is an important shorebird, seabird and marine mammal habitat, and is monitored through Beach Watch. For more information, see previous Topic Briefings.

Pressures on Bolinas Lagoon

- Changing hydrological functions
- Invasive plant and invertebrate species

[1] Thorne, Karen M., et al. Effects of climate change on tidal marshes along a latitudinal gradient in California. No. 2016-1125. US Geological Survey, 2016.

- SLR, hardened shorelines, and loss of shoreline transitional habitat
- Human disturbance to wildlife

Summary of Relevant Regulations

All regulations related to discharge, seabed disturbance, wildlife take and possession, introduced species, and motorized personal watercraft. There is a Special Wildlife Protection Area that prohibits disturbing marine mammals and seabirds by flying aircraft below 1,000 feet above ground level throughout Bolinas Lagoon.

See full text, definition, and exemptions on the regulations page of the GFNMS website.

Summary of Relevant Sanctuary Projects

Conservation Science

- Beach Watch survey sites: one in Bolinas Lagoon, one at Seadrift outside of Lagoon, one at Bolinas Beach outside of Lagoon (includes monitoring mouth of lagoon).
- Habitat characterization, aerial mapping using Uncrewed Aerial System Structure from Motion (a type of 3D imaging), and sediment analysis, in partnership with Greater Farallones Association (GFA).
- Computer modeling to understand the impacts of SLR, erosion, and coastal flooding on ecological health, in partnership with the U.S. Geological Survey and GFA.

Resource Protection

- Review project proposals, including proposed actions from other agencies, that could potentially: 1) violate sanctuary regulations and impact Lagoon habitat, species, water quality and hydrological functions or 2) protect and restore the Lagoon's ecological function. For example, review of Marin County's North End Project to restore wetland connectivity and Caltrans culvert operations.
- Through permitting actions the sanctuary manages, reduces, or eliminates injury to Bolinas Lagoon.
- Work with NOAA's Office of Law Enforcement to document incidents that injure Bolinas Lagoon.
- In partnership with all agencies with jurisdiction in Bolinas lagoon, implement actions that protect and restore the ecological function of Bolinas Lagoon.
- In partnership with Marin County, remove invasive plant species at Kent Island to lower the profile of Kent Island.
- In partnership with GFA, The Seadrift Association, The Smithsonian, and Bodega Marine Laboratory, remove invasive green crabs at Seadrift Lagoon to prevent them from entering Bolinas Lagoon.
- Publish a permitting roadmap that provides tips and guidance to project planners to assist with navigating federal, state, and local permitting and regulatory requirements in order to avoid complications and delays to their projects.

Education and Outreach

- School programs:
    - West Marin School: Bay Watershed Education and Training (B-WET) Project that included a field trip to Bolinas Lagoon; At Your School Green Crab Program for Bolinas School District (3rd-5th grades); Invasive Green Crab Dissection Lab (3rd-6th grades)
- Community programs:
    - Bolinas Lagoon focused sanctuary explorations: Kent Island Restoration & Birding; Kayaking & Wildlife Viewing; Heron Rookery and Wildlife viewing hikes;
    - Marine Explorers Camp: Kent Island Restoration and Exploration Day
    - Sanctuary Naturalist Program training manual includes Bays & Wetlands chapter with an emphasis on Bolinas Lagoon and a six-hour class on Bolinas Lagoon and Kent Island
    - Town hall events and presentations with partners to inform progress on restoration actions
    - Volunteer opportunities to remove invasive species as part of Bolinas Lagoon Restoration project at Kent Island (plants) and/or Sea Drift Lagoon (green crabs)
- Exhibits/Signs:
    - Interpretive sign about Bolinas Lagoon at Audubon Canyon Ranch. The sign is an interpretive stop for their docent led school tours.
    - Bolinas Museum exhibits.
- Media & outreach activities:
    - Digital media & social media on marine life in Bolinas Lagoon (“Marine Life Mondays”)
    - Earth is Blue Video (*Restoring Bolinas Lagoon*)

Infrastructure and Vessels

Sanctuary infrastructure that supports research on, protection of, and education about Bolinas Lagoon include:

- Meeting space at the Crissy Field Campus for Sanctuary staff to collaborate with partners on Bolinas Lagoon projects.
- Government vehicles to transport staff to Bolinas Lagoon.
- The sanctuary relies on partners to provide kayaks for Green Crab removal in Bolinas Lagoon, and paddle boats for access to Kent Island.

Summary

Bolinas Lagoon is an important shorebird, seabird and marine mammal habitat with international, federal, state and local designations to protect the Lagoon. In general, information on the condition of Bolinas Lagoon is minimal. GFNMS, with partners, implements actions that protect and restore the ecological function of Bolinas Lagoon focusing on addressing sediment imbalances and invasive species removal. Education projects inform students and adults about the importance of Bolinas Lagoon through school programs, community programs, exhibits and

signs, and volunteer opportunities. The sanctuary supports projects in Bolinas Lagoon by providing meeting spaces, vehicles for staff, and partnerships for use of kayaks..

GFNMS Advisory Council Recommendations

These recommendations were provided during a GFNMS Advisory Council meeting on April 21, 2023. To view council discussion on this topic, please visit https://farallones.noaa.gov/manage/sac_meetings.html and view the meeting's highlights.

Conservation Science: Identify research needs, explore research partnerships, and conduct monitoring to understand the status and trends of species in Bolinas Lagoon and to understand the feasibility and effectiveness of restoration efforts in order to protect this United Nations (UN) Wetland of International Significance.

Resource Protection: Restore ecological functions by 1) managing invasive species that pose the greatest risk to native species; 2) restoring transitional shoreline habitat with a priority on high marsh habitat to support ecosystem health in the greater lagoon system and to allow for species migration upland during high tides, increasing storm surge, and SLR in order to maintain Bolinas Lagoon as a UN Wetland of International Significance for wildlife; 3) increased enforcement of existing regulations; 4) Consider regulations for mitigating disturbances during harbor seal pupping season

Education and Outreach: To increase awareness of the importance of Bolinas Lagoon as a UN Wetland of International Significance the sanctuary should 1) maintain community and school education programs about Bolinas Lagoon; 2) maintain and install additional wayside exhibits on the importance of Bolinas Lagoon; 3) work with partners to install exhibits about Bolinas Lagoon; 4) partner with College of Marin Bolinas Marine Lab on educational programming; and 5) incorporate messaging on the ecosystem services value of Bolinas Lagoon (e.g., blue carbon; nonpoint pollution filtration) into community education programming

Infrastructure: Maintain collaborative meeting space at the sanctuary offices in San Francisco and Point Reyes Station, enhance Crissy Field visitor center space for exhibits to include information on estuarine habitat, and continue partnerships to use very small vessels in Bolinas and Seadrift Lagoons to implement projects. Install toilet facilities or signage directing towards nearest restroom