

Information Sheet on Ramsar Wetlands

1. Date this sheet was complete/updated:

08/26/98

2. Country:

United States

3. Name of Wetlands:

Bolinas Lagoon

4. Geographical coordinates:

Latitude 37°55' north, Longitude 122°41' west. See also Bolinas Lagoon Management Plan Update 1996, pages 8-9.

5. Altitude:

sea level

6. Area:

445 hectares

7. Overview:

Bolinas Lagoon is an Open Space Preserve managed by the Marin County Open Space District (MCOSD). It is a tidal embayment located at the south end of the Point Reyes peninsula and is one of Marin's most significant natural resources. Bolinas Lagoon provides an important coastal environment for fish, birds, and mammals that is unparalleled along the northern California coast between San Francisco and Humboldt Bays. Open water, mudflat, and marsh provide productive and diverse habitats for marine fishes, waterbirds, and marine mammals. It is also unique in that it is part of a much larger protected natural habitat complex that is part of or adjoins the Gulf of the Farallones National Marine Sanctuary, Pt. Reyes National Seashore, Golden Gate National Recreation Area, Central California Coast Biosphere Reserve, and Mount Tamalpais State Park, and Audubon Canyon Ranch. Few other places in California offer such opportunity for natural resource management to encompass so many species and habitat types.

8. Wetland type:

Marine-Coastal: A **B** C D E F G H I J K
inland: L M N O P Q R Sp Ss Tp Ts
U Va Vt W Xf Xp Y Zg Zk
man-made: 1 2 3 4 5 6 7 8 9

Please now rank these wetland types by listing them from the most to the least dominant:

B, G, H, E, M

9. Ramsar Criteria:

1a 1b 1c 1d / 2a 2b 2c 2d / 3a 3b 3c / 4a 4b

please specify the most significant criterion applicable to the site:

1b, 3a, 4b

10. Map of site included? Please tick Yes or No

See maps in Management Plan Update (1996).

11. Name and address of the compiler of this form:

Ron Miska, Planning and Acquisition Manager
Marin County Open Space District
3501 Civic Center Drive
Marin Civic Center
San Rafael, California 94903 USA

12. Justification of the criteria selected under point 9, on previous page.

1b. The latitudinal position of Bolinas Lagoon is approximately 38°N; this position with coastal marine influence provides a temperate climate with little variation between summer and winter temperatures and few days below freezing. The geographical location along the Pacific Flyway makes the Lagoon an ideal staging ground and stopover site for migratory birds and the equitable climate provides wintering habitat for a wide array of waterfowl and shorebirds. Nutrients and fish and other nektonic species enter and leave the Lagoon with each tidal cycle.

The Lagoon's biological diversity is enhanced due to its proximity to San Francisco Bay (the largest estuary on the Pacific Coast) and its location on the outer coast adjacent to the upwelling, nutrient rich waters of the Gulf of the Farallones. In addition, the relative proximity of Bodega Bay (51.5 kilometers), Estero de San Antonio and Estero Americano (42 km), Limantour and Drake's Esteros (22 km), and Tomales Bay (19 km) place Bolinas Lagoon within a network of coastal estuaries that share biological similarities and which, *in toto*, provide foraging, breeding, nursery, and roosting grounds for a wide variety of estuarine and marine species.

3a. Bolinas Lagoon is used primarily as a wintering destination by waterbirds, secondarily as a migrant stop, and relatively little by year-round or summer residents and local breeders (Shuford *et al.* 1989). Shuford *et al.* (1989) classified the 70 most numerous species using the Lagoon into five primary use patterns and found that two-thirds of those species occurred as winter residents. An exception to this general overall pattern is the importance of Bolinas Lagoon as a staging area for abundant western sandpipers in spring (Shuford *et al.* 1989), a breeding site for great egrets and great blue herons (Pratt 1983), a roosting site for dispersing brown pelicans and elegant terns, and a foraging area for the large breeding osprey population in the area. Table 3, page 26, of the attached Management Plan Update (1996), provides information on the particular species and habitat use of birds at the Lagoon.

4b. Table 4, page 29, of the Management Plan Update (1996), provides a list of fish species found in Bolinas Lagoon in the late 1960's and early 1970's (Gustafson 1968, Ciguere 1970, Chan and Hansen 1972). The most abundant species detected in Gustafson's (1968) year-long study of the Lagoon were surf smelt, jack smelt, shiner surfperch, staghorn sculpin, topsmelt, speckled sanddab, English sole, Pacific herring, dwarf surfperch, cabazon, and leopard shark. The Gustafson study found that "the data clearly indicate that an enormous number of juvenile fish utilize the Lagoon." This finding supports the observation that the Lagoon serves as an important nursery ground or juvenile flatfish; in Gustafson's study speckled sanddab and English sole were the two most abundant species.

Resident fish species at Bolinas Lagoon probably include arrow goby, staghorn sculpin, shiner surf perch and other small, channel dwelling species. Some of the schooling, surface-feeding fish like jacksmelt and topsmelt may enter on tidal cycles during most months, while other species (anchovies, herring) are episodic and seasonal. Vast umbers of juvenile anchovies migrating northward (Richardson 1980) sometimes enter the Lagoon. These fish are often followed by flocks of brown pelicans and elegant terns. These episodic events are determined by oceanographic conditions, occurring in warm water periods in late summer and early fall. Pacific herring are seasonal visitors, but Bolinas Lagoon is not considered a spawning ground for this species (Spratt 1981, Suer 1987). Juvenile leopard sharks and bat rays occur on the tidal flats and adults of both species enter the Lagoon regularly to forage on large clams and probably to breed. Concentrations of leopard sharks in summer occur on channel edges and sandier tidal flats where they are likely depositing egg.

Anadromous salmonids pass through the Lagoon en route to Pine Gulch Creek, McKennan Creek, and Easkoot Creek. Juvenile striped bass, coho salmon (although they have not been seen in recent surveys), and steelhead are found in all the creeks that feed the Lagoon (J. Churchman, pers. Comm.). Three freshwater species [threespine stickleback (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), and California roach (*Hesperoleucus symmertricus*)], are found in Pine Gulch Creek. The configuration of the mouth of the creek has changed considerably since Gustafson's work and the use of Pine Gulch by those more estuarine species has likely declined or been restricted downstream to the mouth of the creek. Small rainbow trout and steelhead are still found upstream (D. Gallagher, pers. Comm.), but there is some question about the ability of these to grow to full size given the dual constraints of drought and water diversion associated with the mid-reaches of the creek (J. O'Connor, pers. comm.).

13. General Location:

Bolinas Lagoon is situated on the California coast about 19.3 kilometers northwest of the Golden Gate and San Francisco Bay.

14. Physical Features:

Bolinas Lagoon is approximately 445 hectares and its tidal channels, mudflats and marshes support a rich diversity of marine and estuarine life. Triangular in shape, the Lagoon is about 5.6 kilometers long on a north-south axis and no more than 1.6 kilometers across at its widest axis. It is surrounded by the Bolinas Ridge rising nearly 609.6 meters to the east and by the Point Reyes Peninsula on the west. Urban development is concentrated in the nearby communities of Stinson Beach and Bolinas. Access to Bolinas Lagoon is provided by State Highway 1, the Bolinas/Olema Road, Wharf Road, Seadrift and Dipsea Roads. The most prominent topographic feature east of the Lagoon is Bolinas Ridge, which runs northwest from Bolinas Lagoon to Tomales Bay. Bolinas Mesa is a broad, elevated marine terrace forming the western margin of the Lagoon. Stinson Beach, in part a narrow sandspit, forms the southern boundary of the Lagoon.

The Lagoon watershed is approximately 43 square kilometers and has maximum dimensions of 4.8 kilometers in width by 14.5 km in length (Ritter 1973). Pine Gulch Creek, draining about half of the basin, is the only perennial and significant tributary to enter the Lagoon from the west. The intermittent, eastern tributaries are short and steep, and have drainage basins of less than 2.6 square km, and small deltas (Ritter 1973). Easkoot Creek now flows into the south end of the Lagoon but historically drained into the ocean. The two major channels in the Lagoon are Bolinas channel and the main (unnamed) channel that has numerous tributary channels.

Bolinas Lagoon was formed at least 7,700 years ago when rising sea level invaded the graben that forms the southern end of San Andreas Rift Valley and a sandspit formed across the mouth of the drowned valley separating the Lagoon from Bolinas Bay. From 9,000 B.P. (Before present) to 5,000 B.P. sea level rise averaged 20 mm/yr but slowed to about 1 to 2 mm/yr from 5,000 B.P. to the present (Atwater 1978). Sea level rise has caused the barrier beach to move inland and to extend the Lagoon northwards into the San Andreas Rift Valley. During this evolution the lagoon probably maintained its present triangular shape.

Bergquist (1978) used soil borings to examine Lagoon conditions and depositional history from approximately 8,000 B.P. to the present. Bergquist extracted soil cores from different locations in the Lagoon and examined types and sequences of soil, invertebrates and pollen in each core. The Bergquist results indicate that from 8,000 B.P. to the early 1800's, there was a dynamic equilibrium in the lagoon's depth and configuration: marsh deposits and Lagoonal deposits occurred in sequences, indicating a shifting balance between sea level rise, sediment accumulations and tectonic subsidence. Sediment accumulation during the pre-1850 period averaged 3 mm/yr whereas tectonic subsidence averaged 1.6 mm/yr and sea level rise 1.5 mm/yr. Bergquist's results indicate that the lagoon was never a deep-water embayment and that, viewed over the long-term, it was predominantly intertidal mudflat and shallow subtidal habitat as shown in the first accurate map (1854) of the Lagoon.

The morphology of the southwestern portion of the Lagoon was created by the deposition of sand carried into the lagoon on the flood current that formed a tidal delta (Kent Island). This island in turn protected the area in its lee from wave action, allowing mudflat sedimentation to reach elevations suitable for colonization by salt marsh vegetation, thereby creating a marsh plain that extends into the Lagoon.

At present, almost all of the 43 square kilometer watershed of Bolinas Lagoon is in public ownership. The watershed is steep, rising to about 549 meters, and is susceptible to high erosion rates due to landsliding and debris flows during sustained intense winter rain storms. The potential for erosion is high due to unstable Franciscan melange bedrock in the eastern half of the watershed, the highly erodible Monterey Shale on the west, and the watershed's location within the San Andreas Rift Valley. See also the Management Plan Update (1996).

15. Hydrological values:

Bolinas Lagoon has a diversity of habitat types. The principal estuarine habitats are subtidal channels, intertidal flats, and emergent salt marsh, all of which are undergoing significant changes in total area and relative amounts. Between 1968 and 1988, the rate of sediment accumulation and loss of tidal prism resulted in conversion of subtidal to intertidal habitat, and intertidal to emergent marsh and upland habitat as shown in Table 2, page 20 of the Management Plan Update (1996). Between 1968 and 1988, subtidal habitat decreased by 60 percent and intertidal flat and emergent marsh habitat increased by 37 percent and 100 percent, respectively. Overall, the total area of the three core estuarine habitats has begun to decrease as the higher marsh areas convert to upland habitat (total estuarine habitat decreased by 7 percent in the 1968-88 period). The three principal habitats are bordered by sand bars, beaches and riparian forest. In close proximity are grasslands, coastal scrub, chaparral, and mixed evergreen forest. Coastal rocky intertidal reef, pebble beach, and open ocean are found nearby.

16. Ecological Features:

Each of the Lagoon's habitat types is described in the Management Plan Update (1996) from a community perspective. Obvious, strong links exist among subtidal, intertidal mudflat and salt marsh habitats such as the twice daily tidal flow and shared species of benthic microflora, invertebrates and fish. Generally, the intertidal flats and shallow subtidal habitats are major sites of primary production and predation. Filter and deposit feeders in these flats use the primary production of benthic algae and diatoms, as well as detrital inputs from marsh and terrestrial sources. Surface feeding and probing shorebirds dominate the bird communities associated with these areas. The major prey of these birds are the soft bodied invertebrates and small crustaceans and gastropods. The primary food of the dominant fish are found in these subtidal shallows and intertidal flats. Therefore, the food webs associated with the subtidal shallows and intertidal flats would appear to be the most important within the Lagoon. See also the Management Plan Update (1996).

17. Noteworthy flora:

Lagoon proper - No noteworthy flora. Typical of open water and salt marsh in the area: Pacific cordgrass (*Spartina foliosa*), salt grass (*Distichlis spicata*), pickleweed (*Salicornia virginica*), phytoplankton, benthic diatoms, eelgrass, maiden's hair (*Gracilaria* spp.), *Enteromorpha* spp., *Ulva* spp., *Microcoleus* spp., *Schizothrix* spp., etc. See pp. 24-25, 37-40 of the Management Plan Update (1996).

Non-tidal lands adjoining lagoon - No noteworthy flora. See pages 41 and 43 of the Management Plan Update (1996).

18. Noteworthy fauna:

See lists on pages 26-36 of the Management Plan Update (1996).

19. Social and Cultural values:

Recreational use of Bolinas Lagoon includes bird watching, nature photography, fishing, clamming, shrimping, boating, use of manually-powered craft (e.g. kayaks, canoes, sailboards), bicycling, walking, jogging, and picnicking. The coliform quarantine established in the 1970's has reduced clamming activity in the Lagoon, but has not restricted the harvesting of shrimp for use as bait. It might be expected that clamming would again become a popular activity if the quarantine is lifted; however, clam populations may have declined since the time in the 1960's when several hundred clammers per season used the Lagoon.

Canoeing, kayaking, motorboating, and jet-skiing have been the subject of much controversy. The main concern is their disturbance to harbor seals hauled-out on Kent and Pickleweed Islands. Studies have indicated that the approach of manually-powered craft and motorboats disturbs the seals. However, the seals generally haulout during low tides, when there is reduced boating activity. Because of the shallowness of the Lagoon even in the main channels and the prominence of a sandbar at the mouth, boating and kayaking/canoeing occurs mainly during high tides. At low tides, kayaks/canoes are forced into the channels bringing them into close proximity to seal haul-out sites. See also Management Pan Update (1996).

20. Land tenure/ownership of: (a) site (b) surrounding area

- a. The majority of Bolinas Lagoon is held in public ownership, either by the County of Marin or Golden Gate National Recreation Area. Although the Gulf of Farallones National Marine Sanctuary does not hold title to the Lagoon or the submerged tidelands, management authority flows from federal legislation which regulates some uses and activities as defined in the Sanctuary Regulations (See also Appendix A, Management Plan Update 1996), FEIS and the Sanctuary Management Plan. Smaller public holdings are those of the College of Marin, which maintains a marine biology station (on Wharf Road in Bolinas), the Bolinas Public Utility District and the Bolinas-Stinson Beach School District.
- b. Various lands in and around the Lagoon are privately owned as well. An extensive area on the east side of the Lagoon including a redwood grove with a major heron and egret rookery, is owned by Audubon Canyon Ranch (ACR), a private, non-profit environmental

protection, education and research organization. Other private holdings include the Seadrift subdivision, lands near Pine Gulch Creek, and lands along the entrance to the lagoon in Bolinas.

21. Current land use: (a) site (b) surroundings/catchment

- a. Public open space, recreational use (boating, horseback riding, wildlife viewing, camping, fishing)
- b. Agricultural, Public Utility District, Seadrift Subdivision, public open space, private nature preserve

22. Factors (past, present, or potential adversely affecting the site's ecological character, including changes in land use and development projects): (a) site (b) around the site

- a. Trail use by Equestrian and Bicycle--trail use, particularly along the Pine Gulch Creek delta and other sensitive areas, damage trails and cause erosion.
- b. Oil spill contamination--In 1971 a large oil spill caused considerable damage to the coastal ecosystems on Stinson and Bolinas Beaches. Fortunately, the oil spill did not cause much damage to the Lagoon, but it did show that the Lagoon is vulnerable to such events.
- c. Old Bolinas Dump--the old Bolinas Dump at Glass Beach has the potential to contain toxic materials. Whereas the Stinson Beach Dump (recently removed as part of the CalTrans mitigation for the Lone Tree Slide) had some toxics from automobile, road construction, and household materials, the Bolinas Dump may have received materials from old industrial sources such as the former tinnery (canning factory).
- d. Bolinas Public Utility District and the Stinson each County Water District--Some concerns remain that sewage spills may occur and pollute the lagoon. Such spills and discharges into the Lagoon, in conjunction with a hepatitis epidemic, led to the shellfish quarantine established in the early 1970's. BPUD re-engineered the Wharf Road pump station and designed sewage treatment ponds for the downtown sewered area. BPUD is still working to solve the Bolinas Mesa drainage and onsite systems management problems. New onsite systems and failing systems are still the responsibility of the Marin County Department of Environmental Health. Although the probability of effluent contamination is now remote, it is always a possibility.
- e. Removal of sunken dredge and tires--
- f. Boat Moorings, alternative boat haul-outs, speed limits--
- g. Wildlife disturbance from muscle-powered/sail and motorized craft
- h. Ghost-shrimping--
- i. Water diversion for Agricultural Practices, Runoff, Channelization of Creeks--
- j. Sedimentation--

23. Conservation measures taken:

Updating the 1981 Bolinas Lagoon Resource Management Plan. The updated 1996 Plan considers information collected since the last plan, the success of activities and policies enacted during this period, and the application of new federal, state and County regulations

affecting Lagoon water quality and habitat protection. In addition to this update of the prior plan, significant portions of this report discuss (1) the physical and ecological changes that have occurred in the Lagoon as a result of sediment accumulation, (2) projected future changes, and (3) management alternatives and remedial actions to preserve the unique estuarine habitats within the Lagoon. See also Management Plan Update (1996).

24. Conservation measures proposed but not yet implemented:

1. Watershed management geared toward reducing sediment inputs;
 2. Dredging to remove accumulated sediment and to promote sediment removal from the Lagoon via tidal scouring;
 3. Pine Gulch Creek restoration;
 4. Fill removal; and
 5. Restoring tidal prism at Seadrift Lagoon.
- See also Management Plan Update (1996)

25. Current scientific research and facilities:

The Bolinas Lagoon ecosystem is complex, combining unusual geological conditions with rich biological resources. The Lagoon has therefore been the subject of numerous amateur and professional studies. The behavior and habitats of harbor seals have been extensively studied in the Lagoon, as well as aspects of the ecology of shorebirds. Pt. Reyes Bird Observatory has studied and monitored the number of birds using the Lagoon since the 1970's. New studies of clam and other benthic invertebrate populations in Bolinas Lagoon are needed to update studies from the 1970's. The Lagoon has also been the subject of hydrological studies over the years; however, additional studies with consistent methodologies are in progress.

26. Current conservation education:

Of the public agencies with an interest in Bolinas Lagoon, the MCOSD staff has the most contact with Lagoon visitors. During patrols, scheduled walks, or in the course of performing land management activities, the MCOSD rangers and naturalists work to educate the public about the fragility of the Lagoon's resources in an effort to encourage respect for and minimize abuse of those resources. On occasion, the MCOSD has prepared and distributed educational brochures to inform the public of the harbor seal population's sensitivity to disturbance. A historical collection of studies and plans related to the Lagoon and its resources is archived in the District's administrative offices in San Rafael. On weekdays at ACR's 1,000 acre Bolinas Lagoon Preserve, nature tours of the ranch led by trained docents are offered free of charge to classes from Bay Area Schools.

27. Current recreation and tourism:

As a public Open Space Preserve, Bolinas Lagoon is visited and enjoyed by thousands of people annually, though exact visitation figures are not available.

Members of the public may also visit the privately owned and managed Audubon Canyon Ranch Bolinas Lagoon Preserve (upland acreage adjoining the Lagoon not to be confused with the public Bolinas Lagoon Open Space Preserve) on weekends and holidays during mid-March through mid-July. Pamphlets describing self-guiding tours are also available at the ranch. The Ranch maintains an extensive permanent exhibit which features the ecology, geology, and history of the Bolinas Basin. Other facilities include a bookstore, picnic area, and restrooms. One of the great natural attractions at ACR's Bolinas Lagoon Preserve is a nesting colony of approximately 100 pairs of great blue herons and great and snowy egrets which can be observed nesting in the tops of redwood trees. There are no current facilities available within the Ramsar nominated area of Bolinas Lagoon.

28. Jurisdiction:

The Marin County Open Space District has the primary role in managing the natural resources of the Lagoon. The Bolinas Lagoon Technical Advisory Committee, which serves as the technical advisor to the MCOSD for all matters potentially affecting the Lagoon, has provided a forum for discussing issues relating to the Lagoon and for coordinating management efforts. The BLTAC consists of representatives from government, interested groups, and local communities. The previous plan (Madrone Assoc. 1981) recommended that the role and function of the BLTAC be expanded and formalized. The BLTAC has continued to serve and protect the Lagoon through the volunteer efforts of its members. See also Management Plan Update(1996) for list of agencies and groups represented on the BLTAC.

29. Management authority:

Marin County Open Space District
3501 Civic Center Drive
Marin Civic Center
San Rafael, California 94903 USA

30. Bibliographical references:

See Management Plan Update (1996)