

Caribou Bog Wetland Complex

Site Description:

Caribou Bog, Mud Pond, and the adjoining Pushaw Stream wetlands together form an expansive peatland ecosystem that extends from near Stillwater Avenue in Orono, northwest along the east shore of Pushaw Lake, to Whitten Bog in Alton. Covering nearly 6,000 acres, this complex comprises one of the largest wetland systems in Maine. Pushaw Lake supports an unusual number of rare plants and rare invertebrates. Further to the south, the Penjajawoc Marsh supports a variety of rare and uncommon wading birds. Important ecological features of this focus area are described below.



Secondary peatland pools in Caribou Bog



Muskeg darner

Natural Communities and Rare Plants

The Caribou Bog wetland complex contains one of the state's best examples of a **domed bog ecosystem**. Other natural community types within this system include a stream drainage fen, unpatterned open basin fen, and raised level bogs with secondary pools. In general, the geogenous areas of peatland (i.e., areas deriving nutrients from surface and groundwater) include wetlands around Mud Pond and Pushaw Stream and large areas between raised shrub bogs. Conversely, the ombrogenous areas of peatland (i.e., those deriving nutrients principally from precipitation) are the interior, domed and raised areas. Within Caribou Bog, Davis and Anderson (1982) found that in descending area of cover, the most dominant types are black spruce woodland bog (30%), red maple woodland swamp (29%), and dwarf shrub bog (22%).

Two rare plants are associated with these large peatlands. **Sparse-flowered sedge (*Carex tenuiflora*)** is a small boreal plant at the southern end of its range in Maine, and **swamp birch (*Betula pumila*)** is a small shrub restricted to bogs and fens. Both rare plants typically occur in peatlands that are more alkaline, or somewhat less acidic, than typical maine wetlands.

In addition to the large wetlands adjacent to Pushaw Lake, three other large peatlands occur within five miles of this complex: Call Bog in Hudson, Sargent Bog in Alton, and Alton Bog in Alton and Argyle Township. Along with other large peatlands of the Lower Penobscot Valley (e.g., Chemo Bog, Sunkhaze Meadows), these peatlands formed in the broad, flat, poorly drained glacial marine soils that underlie the area.

Pushaw Lake is a six-mile long lake that supports intermittent sections of **lacustrine shallow-bottom communities**, particularly on the shoreline of the Twin Islands. This community type is characterized by muck overlying gravel and sand, and dominant plants include bayonet rush (*Juncus*

militaris), pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), and narrow-leaved arrowhead (*Sagittaria graminea*). Rare plants in this location include **water stargrass (*Zosterella dubia*)** and **American shore-grass (*Littorella uniflora*)**. Habitat preferences of these plants suggest that the lake may be somewhat more alkaline than most Maine lakes.

Birds

The extensive wetlands along Pushaw Stream include graminoid and shrub dominated meadows that provide very good breeding habitat for wading and marsh birds. In addition to the rare **least bittern (*Ixobrychus exilis*)**, other uncommon species historically noted from Pushaw Stream wetlands include American bittern (*Botaurus lentiginosus*), sora (*Porzana carolina*), pied-billed grebe (*Podilymbus podiceps*), and Virginia rail (*Rallus limicola*). **Bald eagles (*Haliaeetus leucocephalus*)** have nested historically along the shore of Pushaw Lake.



Least bittern

Further to the south, Penjajawoc Marsh is a large (~300 acre) emergent freshwater marsh with expanses of cattail, sedges, and alder. The marsh was likely altered in the early 1800's when a railroad right-of-way was constructed. This right-of-way still exists today, yet the stream has breached a small section of the embankment. Rocks and fill have been placed in the narrow stream channel to facilitate the passage of farm equipment over the stream. This debris has served to impound the stream and maintain a large emergent wetland. In recent years, beaver have further impounded Penjajawoc Stream downstream from the old railway and effectively doubled the open water component of the wetland. Although the Bangor Mall can be seen from the marsh, most of the adjacent upland habitat surrounding the wetland is still in agriculture or forested habitats, buffering the wetland from nearby development and human activity.

Area bird watchers have frequented Penjajawoc Marsh for many years, and in 2001 MDIFW conducted additional surveys of the marsh. The following information is derived from MDIFW results of that and previous efforts. An impressive list of over 180 bird species has been recorded, including many rare species of wading and marsh birds. In addition to the rare species listed in the table below, other noteworthy species at the marsh include the pied-billed grebe, American bittern, Virginia rail, sora, green herons (*Butorides striatus*), and great blue herons (*Ardea herodias*). Bobolinks (*Dolichonyx oryzivorous*) and northern harriers (*Circus cyaneus*) have been observed in the surrounding uplands.



Penjajawoc Marsh, 1992 air photo

Observations by MDIFW staff over the past 14 years suggest that habitat on the lower, beaver-flooded portion of the marsh is changing, as many shrubs are dying, allowing emergent vegetation to become established. However, the existing live shrub habitat, especially from the beaver dam to Stillwater Avenue, appears to remain attractive to species like green herons and several species of waterfowl. The upper portion of the marsh has an interspersed mix of broad-leaved emergent vegetation (cattails) and open water. This mix of cattails and open water is attractive to

many different species such as **black terns (*Chlidonias niger*)** and **common moorhens (*Gallinula chloropus*)**. The cattail vegetation itself is especially attractive to least bitterns, marsh wrens, and other species.

The vegetation in Penjajawoc is close to a “hemi-marsh” condition. This means that emergent vegetation (like cattails) comprise about 50% of the area of the marsh and is highly channelized and interspersed by areas of open water. Several vegetative types are present, adding to the marsh’s structural diversity. These types include cattail, emergent grasses and sedges, open water with aquatic bed (floating leaved) species, shrub-scrub (live and recently flooded), wet meadow and forested wetland.

Habitat in the upper portion of the marsh also appears to be changing. Dense cattail growth has proliferated, covering some of the most valuable hemi marsh portions of the upper marsh in recent years. In the absence of water control structures, future marsh conditions will likely continue to change. Current vegetation trends suggest the lower marsh (beaver dam) will continue to improve in habitat quality and the upper marsh (above the railroad bed) may diminish in value for some birds that require open water or a high degree of interspersion.

The undeveloped uplands associated with the Penjajawoc Marsh are also very important and contribute greatly to the wildlife diversity present at the marsh. Several species of waterfowl, such as American black ducks (*Anas rubripes*), forage in the marsh itself, but may also nest in the upland forests and fields. American bitterns also use the uplands associated with the marsh and were regularly observed in the nearby hayfields. The undeveloped upland habitats around Penjajawoc buffer the marsh from human activity, noise and light. Finally, the associated uplands also provide habitat for several other species of management concern such as bobolinks and northern harriers.

Freshwater Mussels

Yellow lampmussels (*Lampsilis cariosa*) occur in Pushaw Stream, Dead Stream, and Pushaw Lake, and **tidewater muckets (*Leptodea ochracea*)** occur in Pushaw Lake, Little Pushaw Pond, and Mud Pond. Both rare species have very similar ranges in Maine, occurring in only three watersheds statewide (Penobscot, Kennebec, and St. George). They are often found together in the same locations, and it is very likely that both occur throughout the Pushaw Stream watershed wherever suitable habitat exists. Initial surveys found the yellow lampmussel to be relatively common at Pushaw Lake and the tidewater mucket to be very common at Mud Pond. The remaining observations were just a few live or dead individuals found during limited surveys. Very young individuals of the tidewater mucket were found in Mud Pond, indicating a likely healthy and reproducing population. There are a few historic records for both species in the watershed, so obviously they have persisted, but current population trends are not known. Given the state-threatened status of these two species, their limited range and distribution in Maine, and the declines experienced rangewide, protection of mussel habitat and water quality is critical to their conservation.

The **brook floater (*Alasmidonta varicosa*)** occurs in Dead Stream and may occur throughout the watershed where suitable habitat exists. Although this species has a broader distribution in Maine than the two listed species, it is consistently found only in very low numbers. It has declined throughout its entire range and was a former candidate for federal listing. Its restriction to clean flowing water makes it vulnerable to changes and degradations in the watershed. MDIFW has a strong level of concern for the brook floater, and encourages habitat conservation initiatives that will also benefit this species.

In addition to supporting two of the rare species listed above, Dead Stream is noteworthy for its overall high diversity of freshwater mussels - six of the ten species native to Maine occur here.

Dragonflies

Of Maine's five rare peatland-breeding dragonflies, three have been documented from Caribou Bog -- the muskeg darner (*Aeshna subarctica*), delicate emerald (*Somatochlora franklini*), and war-paint emerald (*Somatochlora incurvata*). Caribou Bog is one of only two sites in the state where all three of these dragonflies have been observed. Acidic peatlands with well-developed pool complexes and sphagnum hollows, such as those at Caribou Bog, provide ideal breeding habitat for these bog-dwelling specialists whose major distributions lie north of Maine. The muskeg darner is known from only three counties in eastern Maine, and it typically flies in August. The two emeralds are somewhat better distributed throughout Maine. The delicate emerald flies from mid-June through July, and the war-paint emerald flies primarily in August. Through the Maine Dragonfly and Damselfly Survey (MDDS) project, MDIFW continues to gain new information on these little known species, and future information may indicate that they are not as rare as once believed.

Rare Species/Natural Communities Summary Table:

Common Name	Scientific Name	State Status	G-Rank	S-Rank
Exemplary Natural Communities				
Domed Bog Ecosystem		NA	NA	S3
Lacustrine Shallow Bottom		NA	NA	S4
Rare Plants				
Swamp birch	<i>Betula pumila</i>	Sp. Concern	G5	S3
Spase-flowered sedge	<i>Carex tenuiflora</i>	Sp. Concern	G5	S2
Water star-grass	<i>Zosterella dubia</i>	Threatened	G5	S1
Orono sedge	<i>Carex oronensis</i>	Threatened	G2	S2
Threadfoot	<i>Podostemum ceratophyllum</i>	Sp. Concern	G5	S2
American shore-grass	<i>Littorella uniflora</i>	Sp. Concern	G5	S2
Rare Birds				
Bald eagle	<i>Haliaeetus leucocephalus</i>	Threatened	G4	S4
American coot	<i>Fulica americana</i>	Sp. Concern	G5	S2?
Least bittern	<i>Ixobrychus exilis</i>	Sp. Concern	G5	S2
Sedge wren	<i>Cistothorus platensis</i>	Endangered	G5	S1
Upland sandpiper	<i>Bartramia longicauda</i>	Threatened	G5	S3
Common moorhen	<i>Gallinula chloropus</i>	Sp. Concern	G5	S2?
Black tern	<i>Chlidonias niger</i>	Endangered	G4	S2
Black-crowned night heron	<i>Nycticorax nycticorax</i>	Sp. Concern	G5	S2
Rare Dragonflies				
Muskeg darner	<i>Aeshna subarctica</i>	Sp. Concern	G5	S?
War-paint emerald	<i>Somatochlora incurvata</i>	Sp. Concern	G3	S3?
Delicate emerald	<i>Somatochlora franklini</i>	Sp. Concern	G5	S?
Rare Mussels				
Brook floater	<i>Alasmidonta undulata</i>	Sp. Concern	S?	G4
Yellow lamp mussel	<i>Lampsilis cariosa</i>	Threatened	G3G4	S2S3
Tidewater mucket	<i>Leptodea ochracea</i>	Threatened	G4	S2

Other Significant Habitats Mapped by MDIFW:

Over 4,200 acres within this focus area are mapped as a Waterfowl and Wadingbird Habitat, and over 2,200 acres have been mapped as Deer Wintering Areas.

Conservation Considerations:

In general, impacts to wetlands include habitat loss, hydrologic alteration (from changes in water flow or impoundment of waterways), development of adjacent uplands and associated water quality impacts, invasive species such as purple loosestrife (*Lythrum salicaria*), and poor timber harvesting practices. A variety of conservation strategies may be appropriate within this focus area, depending on the specific parcel and activity. Possible strategies include outreach to lakeshore landowners, encouragement of tree growth and open space tax status, enforcement of shoreland zoning ordinances, and use of conservation easements and fee ownership. More specific considerations are listed below.

- Residential development has occurred along much of the southern and western shore of Pushaw Lake. Water quality issues are important for the two aquatic plant species in Pushaw Lake, and freshwater mussels are very sensitive to contaminants and changes in habitat. Maintenance and/or improvement of water quality and habitat integrity is essential. Any activities that may potentially degrade water quality or alter habitat type (including substrate and water levels) should be avoided. Likewise, because larval freshwater mussels require a specific fish host, activities that may result in changes to the fish community or prevent access by fish should be avoided. Another potential threat is introduction of exotic species, such as the zebra mussel, which can out-compete and decimate native mussel populations. Shoreland owners and the local public should be educated on how to prevent accidental introduction of this invasive species into the Pushaw Lake and Pushaw Stream watershed. Similarly, an outreach program for freshwater mussel conservation in the watershed could be beneficial to the conservation of these species. Finally, adherence to shoreland zoning ordinances should help to ensure that water quality is maintained.
- Wetlands may be vulnerable to degradation from adjacent development, and buffers can play a major role in protection. While different species can have different buffering requirements, wider buffers provide better protection for riparian and wetland-dependent species. The state shoreland zoning standards specify a minimum 75' buffer in which very little harvest or clearing is allowed, with less stringent restrictions specified within 250' of the wetland border. Better protection will be afforded to the wetlands and waterways if minimal alteration occurs within 250' of the wetland/upland border.
- Invasive, non-native plants such as purple loosestrife (*Lythrum salicaria*) can significantly alter the composition and function of open wetlands, particularly in urban or suburban areas where there has been some type of soil disturbance. Monitoring and prompt removal or treatment can limit the impact of such species.
- Timber harvesting in forested wetlands may alter vegetation composition, raise the water table, and cause soil compaction. At a minimum, harvesting should comply with Best Management Practices Maine Forest Service (eg., operate on frozen ground) and shoreland zoning ordinances. More formal protection of mature stands of forested bog could reduce or eliminate these sources of habitat degradation.
- Peat mining and/or conversion to cranberry bogs are both concerns, although neither appears to be an imminent threat.

- Recreational traffic (i.e., ATV use) on the peatland could seriously degrade portions of the bog; this has been a problem in some other bogs in southern Maine. Monitoring can play a major role in detecting such use and impact.
- Upland sandpipers have not been observed recently in the uplands surrounding the Penjajawoc Marsh, but they formerly (1980s) used the area for breeding, and potential habitat remains. Threats to upland sandpipers include habitat loss and alteration, nest and brood predators (particularly from house cats, skunks, and raccoons), and mowing during nesting and brood-rearing. Appropriate conservation strategies include traditional low-bush cultivation and other methods that incorporate periodic (e.g., biennial) pruning during the dormant season (May to early August).
- Bald eagles are slated for down-listing under the federal Endangered Species Act, and the state will likely re-classify the species in the next several years. Nonetheless a "safety net" of habitats in conservation ownership and an array of sites managed by cooperative landowner agreements are key safeguards to a lasting recovery of eagles. In coastal Maine, seabirds and waterfowl are prevalent in bald eagle diets. The adjacency of suitable foraging areas to eagle nesting habitat is an important consideration.

Protection Status: Over 1,700 acres northeast of Pushaw Lake, including significant frontage on Mud Pond and Pushaw Stream, are administered by the University of Maine as the Hirundo Wildlife Refuge. The University also owns a 224 acre parcel on the southeast side of Pushaw Lake and a 353-acre wetland parcel south of Stillwater Avenue. The city of Bangor owns 261 acres at Penjajawoc Marsh, nearly 1,600 acres further to the northeast, and about 60 acres further to the south.