

Appendix 9.10: Longtail Point

Written by Erin Giese and Dr. James Horn

Location (centroid)	Lat. 44.608582°, Lon. -87.997278° ¹ (NAD 1983, UTM Zone 16N)																					
Total Area (ha)	130.17 ha																					
Area Public Land (ha)	126.46 ha																					
Area of Habitat Types Present (ha) and Percent of Each Habitat Type	<p>Dominant Habitat Types: These habitat types were documented during a July 2015 habitat mapping effort led by the University of Wisconsin-Green Bay Cofrin Center for Biodiversity (CCB) across the Lower Green Bay and Fox River Area of Concern (LGB&FR AOC)⁵. Habitat types within Longtail Point are displayed as a static map at the bottom of this document. Note that the extent of submergent marsh was refined by the CCB's 2017 submerged aquatic vegetation field surveys. There is a total of 121.86 ha of natural habitat within Longtail Point.</p> <table border="1"> <thead> <tr> <th>Habitat Type</th> <th>Area (ha)</th> <th>Percent</th> </tr> </thead> <tbody> <tr> <td>Emergent Marsh (High Energy Coastal)</td> <td>61.38</td> <td>50.37</td> </tr> <tr> <td>Great Lakes Beach</td> <td>1.36</td> <td>1.12</td> </tr> <tr> <td>Green Bay Open Water</td> <td>0.24</td> <td>0.20</td> </tr> <tr> <td>Hardwood Swamp</td> <td>7.46</td> <td>6.12</td> </tr> <tr> <td>Other Forest</td> <td>2.62</td> <td>2.15</td> </tr> <tr> <td>Submergent Marsh</td> <td>48.80</td> <td>40.05</td> </tr> </tbody> </table> <p><i>Disclaimer!</i> Because this priority area is located within the Great Lakes coastal zone, the amount of habitat types can vary drastically across years and even within years (or months) due to changing Great Lakes water levels, precipitation, and seiche. Within this priority area specifically, the amounts of emergent and submergent marsh and Great Lakes beach are known to fluctuate significantly from year to year and within years. The habitat types listed above and mapped below are based on a field effort conducted in July 2015. Plants recorded in the "Natural Habitat Communities and Significant Plants" section were primarily documented in July 2015 and late summer/fall 2016 and 2017. Great Lakes water levels were much higher in 2016 and 2017 than in July 2015.</p>	Habitat Type	Area (ha)	Percent	Emergent Marsh (High Energy Coastal)	61.38	50.37	Great Lakes Beach	1.36	1.12	Green Bay Open Water	0.24	0.20	Hardwood Swamp	7.46	6.12	Other Forest	2.62	2.15	Submergent Marsh	48.80	40.05
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General Description	<p>Longtail Point is a peninsula that extends 5 km into lower Green Bay along the west shore in the Village of Suamico. It constitutes the LGB&FR AOC's northwestern-most border, and to the southwest of it in its wave shadow is Dead Horse Bay. Longtail Point largely consists of coastal emergent marsh, though there are thin slivers of hardwood swamp and Great Lakes beach along the northern edge^{2,5}. The entire peninsula is subject to the highly dynamic Great Lakes coastal system since it is mostly marsh and can largely be underwater during high Great Lake water levels or dry and sandy during low water years. Like most of the Bay's west shore, it primarily consists of Roscommon muck soils and otherwise standing water³. Suamico River empties directly to the peninsula's north side. Despite the fact that Longtail Point is invaded by <i>Phragmites australis</i> (common reed; hereafter referred to as "<i>Phragmites</i>") and the hybrid cattail (<i>Typha x glauca</i>), it is still an important migratory waterfowl stopover site, nursery habitat for many fish species, and breeding habitat for marsh birds. Although Longtail Point is publicly owned, it is not extremely well studied³⁸, perhaps because it is difficult</p>																					

¹ File "AOC_PriorityAreas.v09_20171212.shp"

² LGB&FR AOC comprehensive biota database: file "AOCBiota_DB_ShareableVersion_20171210.accdb"

³ Soil Survey Geographic (SSURGO) by the United States Department of Agriculture's Natural Resources Conservation Service. Published Dec 2010. Available: <http://uwgb.maps.arcgis.com/home/item.html?id=204d94c9b1374de9a21574c9efa31164>; accessed 17 Oct 2016.

	<p>to access and is best visited by boat. Because it is publicly owned, the quality and integrity of Longtail Point may be threatened by heavy recreational use (e.g., boating)⁷. However, there is great potential for this site to be enhanced in terms of the quality of its emergent marsh and other habitats. Within the past five years, the Wisconsin Department of Natural Resources has been proactive in terms of tackling the widespread issue of <i>Phragmites</i> in the Bay of Green Bay⁴. In 2011, 2012, and 2015, they conducted large-scale aerial and ground sprayings of <i>Phragmites</i> along the west shore and other areas, including Longtail Point⁴.</p>
<p>Special Features</p>	<ul style="list-style-type: none"> • Contains one of the largest undeveloped emergent marshes in the entire LGB&FR AOC and at least 4 km of undeveloped Great Lakes beach, a rare LGB&FR AOC and statewide habitat⁵. • Provides critical breeding habitat for marsh bird species, such as Forster's Tern (<i>Sterna forsteri</i>), a state endangered species and Wisconsin Wildlife Action Plan Species of Greatest Concern, and American Coot (<i>Fulica americana</i>), a state special concern species². • Provides spawning habitat and a nursery for yellow perch (<i>Perca flavescens</i>); nursery for walleye (<i>Sander vitreus</i>)⁶. • Important migratory bird stopover site, particularly for waterfowl and waterbirds⁷. • Large peninsula that extends outward into lower Green Bay. • Great Egret (<i>Ardea alba</i>) and Great Blue Heron (<i>Ardea herodias</i>) nesting rookery in trees near the tip of Longtail Point⁸. • Nesting location for Bald Eagle (<i>Haliaeetus leucocephalus</i>)⁸.
<p>Natural Habitat Communities and Significant Plants (ordered in terms of ecological importance and size/amount)</p>	<p>The vast majority of Longtail Point consists of emergent high energy marsh, which is largely dominated by <i>Phragmites</i> and hybrid cattail though there are a few native species⁵:</p> <ul style="list-style-type: none"> • River bulrush (<i>Bolboschoenus fluviatilis</i>), locally common⁵ • Joint rush (<i>Juncus nodosus</i>), moderately common⁹ • Giant bur-reed (<i>Sparganium eurycarpum</i>), rare⁹ • Monkey-flower (<i>Mimulus ringens</i>), rare⁹ • Ditch stonecrop (<i>Penthorum sedoides</i>), rare⁹ • Marsh bluegrass (<i>Poa palustris</i>), rare⁹ • Bebb's sedge (<i>Carex bebbii</i>), rare⁹ • Soft-stem bulrush (<i>Schoenoplectus tabernaemontani</i>), rare⁹ <p>A continuous band of submergent marsh in Dead Horse Bay flanks the western shore of the peninsula. Native submergent macrophyte species that are dominants are common bladderwort (<i>Utricularia vulgaris</i>), coontail (<i>Ceratophyllum demersum</i>), and sago pondweed (<i>Stuckenia pectinata</i>). Dense mats of forked duckweed (<i>Lemna trisulca</i>), floating just beneath the water surface, are moderately common in some areas. So too are beds of the rhizomatous perennial, water celery (<i>Vallisneria americana</i>). It is in this area of Dead Horse Bay that small beds of water celery are most common in the LGB&FR AOC. The invasive Eurasian water-milfoil (<i>Myriophyllum spicatum</i>) has a discontinuous distribution along the shore, and is moderately common in some areas. Submergent marsh also occurs within the central northern part of the peninsula in a small, relatively high quality area that contains many native emergent plants. Other native aquatic macrophytes include⁹:</p> <ul style="list-style-type: none"> • Small pondweed (<i>Potamogeton berchtoldii</i>), very locally moderately common⁹ • Turion duckweed (<i>Lemna turionifera</i>), rare throughout^{2,9}

⁴ Wisconsin Department of Natural Resources *Phragmites* management: "Aerial_2011_12.shp" and "GLFWRA_Phrag2015_16_aoc.shp"

⁵ LGB&FR AOC 2015 habitat field mapping effort:
<http://uwgb.maps.arcgis.com/home/item.html?id=df942b9dd224094b0841a08437f95f0>

⁶ Wisconsin Department of Natural Resources Fish Trawling Survey Data 1980-2015; sampling points located offshore to south of the Point.

⁷ Epstein et al. 2002

⁸ AOC Stakeholder's Meeting on 23 June 2015; notes from John Huff and Josh Martinez.

	<ul style="list-style-type: none"> • Great duckweed (<i>Spirodela polyrrhiza</i>), rare throughout • Nodding water-nymph (<i>Najas flexilis</i>), rare, mostly throughout⁹ • Leafy pondweed (<i>Potamogeton foliosus</i>), rare throughout • Common water-milfoil (<i>Myriophyllum sibiricum</i>), rare and somewhat local • Common waterweed (<i>Elodea canadensis</i>), rare, mostly throughout • Arum-leaved arrowhead (<i>Sagittaria cuneata</i>, submergent form), rare and local <p>The third most common habitat at Longtail Point is hardwood swamp^{5,9}, which contains both native and invasive plant species. It is primarily dominated by cottonwood (<i>Populus deltoides</i>) and box elder (<i>Acer negundo</i>), though it also has green ash (<i>Fraxinus pennsylvanica</i>), sandbar willow (<i>Salix interior</i>), and river bank grape (<i>Vitis riparia</i>)⁹.</p> <p>Great Lakes beach habitat extends along nearly the entire northern shoreline of the peninsula and primarily consists of sand and zebra/quagga mussels (<i>Dreissena</i> spp.), though they are also lined with some <i>Phragmites</i>⁵. Native plants that inhabit these shorelines include beach rocket (<i>Cakile edentula</i> ssp. <i>edentula</i> var. <i>lacustris</i>), a state special concern species, beach pea (<i>Lathyrus japonicus</i> var. <i>maritimus</i>), wild four o'clock (<i>Mirabilis nyctaginea</i>), and cottonwood⁹.</p>
<p>Significant Animals</p>	<p>Birds:</p> <ul style="list-style-type: none"> • Although there are 150-250 possible species, at least 50 bird species have been officially recorded across all seasons, including²: <ul style="list-style-type: none"> ○ One federal species of concern (Black Tern [<i>Chlidonias niger</i>])² ○ Four state endangered species (Caspian Tern [<i>Hydroprogne caspia</i>], Forster's Tern [<i>Sterna forsteri</i>], Common Tern [<i>Sterna hirundo</i>], and Black Tern)² <ul style="list-style-type: none"> ▪ Forster's Tern is listed as an "S1" state rank (critically imperiled) ○ One state threatened species (Great Egret)² <ul style="list-style-type: none"> ▪ Black Tern and Great Egret are state listed as imperiled ○ Seven Wisconsin Wildlife Action Plan Species of Greatest Concern (e.g., Caspian, Forster's, and Black Terns, Bald Eagle [<i>Haliaeetus leucocephalus</i>], Veery [<i>Catharus fuscescens</i>])² ○ Eleven state special concern species (e.g., Common Gallinule [<i>Gallinula galeata</i>], Yellow-headed Blackbird [<i>Xanthocephalus xanthocephalus</i>], Black-crowned Night-Heron [<i>Nycticorax nycticorax</i>], American White Pelican [<i>Pelecanus erythrorhynchos</i>], Bald Eagle)² <ul style="list-style-type: none"> ▪ Black-crowned Night-Heron also state listed as imperiled ▪ Common Gallinule, Yellow-headed Blackbird, and American White Pelican are listed as "S3" state rank (rare or uncommon) ○ Migratory gulls (e.g., Bonaparte's Gull [<i>Chroicocephalus philadelphia</i>]), diving ducks, dabbling ducks, and other waterbirds (e.g., American Coot) use the offshore waters of Longtail Point¹⁰ while raptors and landbirds use the forest and marsh habitats²¹ ○ Although not well documented, many species are known to breed at Longtail Point, especially marsh-nesting species^{2,11}: <ul style="list-style-type: none"> ▪ Forster's Tern, Bald Eagle⁸, American Coot, Common Gallinule, Wood Duck (<i>Aix sponsa</i>), Mallard (<i>Anas platyrhynchos</i>), Yellow-headed Blackbird, Red-winged Blackbird (<i>Agelaius phoeniceus</i>), Great Egret⁸, and Great Blue Heron⁸

⁹ LGB&FR AOC 2016 botanical surveys

¹⁰ LGB&FR AOC 2016 migratory waterfowl surveys

¹¹ Wisconsin Breeding Bird Atlas II Project (2015-2019):

http://ebird.org/ebird/atlaswi/block/4408758NW?atlasPeriod=EBIRD_ATL_WI_2015&rank=mrec&hs_sortBy=category&hs_o=desc (as of 19 Oct 2016) and http://ebird.org/ebird/atlaswi/block/4408851NE?atlasPeriod=EBIRD_ATL_WI_2015&rank=mrec&hs_sortBy=category&hs_o=desc (as of 19 Oct 2016)

- Longtail Point is officially a “Migratory Bird Concentration Site” according to the Wisconsin Department of Natural Resources¹²

Fish:

- >20 fish species have been recorded offshore near Longtail Point^{2,6}:
 - Gizzard shad (*Dorosoma cepedianum*)⁶
 - Trout perch (*Percopsis omiscomaycus*)⁶
 - White bass (*Morone chrysops*)⁶
 - Yellow perch (*Perca flavescens*)⁶
 - Sheepshead (*Aplodinotus grunniens*; aka freshwater drum)⁶
 - Walleye (*Sander vitreus*)⁶
 - Spottail shiner (*Notropis hudsonius*)⁶
 - Northern pike (*Esox lucius*)⁶
 - Spotted musky (*Esox masquinongy*; aka muskellunge)⁶
 - Banded killifish (*Fundulus diaphanous*), a state special concern species and Wisconsin Wildlife Action Plan Species of Greatest Concern²

Mammals:

- Although ~50 mammal species are known or are expected to occur along the west shore (as noted in Roznik 1979)¹³, four mammal species have been officially recorded in recent years: American mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), North American river otter (*Lontra canadensis*), coyote (*Canis latrans*)^{14,15}.

Anurans:

- Six anuran (frog/toad) species², many of whom likely breed at Longtail:
 - American bullfrog (*Lithobates catesbeianus*), American toad (*Bufo americanus*), eastern gray treefrog (*Hyla versicolor*), green frog (*Lithobates clamitans*), northern leopard frog (*Lithobates pipiens*), and spring peeper (*Pseudacris crucifer*)
 - Northern leopard frog is both a federal and state species of special concern. American bullfrog is a state species of special concern.
- Eastern tiger (*Ambystoma tigrinum*) and blue-spotted salamanders (*Ambystoma laterale*) are expected to occur along the west shore of Green Bay (as noted in Roznik 1979)¹³, though neither has been officially reported at Longtail Point.

Arthropods:

- Over 40 species of arthropods have been recorded at Longtail Point, including many important aquatic species, such as²:
 - Predaceous diving beetles (*Hydrovatus* sp., *Hygrotus* sp.)
 - Long-horn caddisfly (*Oecetis* sp.)
 - Microcaddisfly (*Oxyethira* sp., *Agraylea* sp.)
 - Small squaregilled mayfly (*Caenis* sp.)
 - Water boatmen (*Trichocorixa* sp.)
 - Pygmy backswimmer (*Neoplea* sp.)
 - Water beetle (*Laccophilus* sp.)
 - Amphipod (*Gammarus* sp.)
 - Whirligig beetle (*Dineutus* sp.)

Mollusks:

- Pea clams (Pisidiidae [family]) and a few groups of snails²:
 - Bladder snail (Physidae [family])

¹² Wisconsin Department of Natural Resources. 2009. Wisconsin Natural Heritage Working List. <http://dnr.wi.gov/topic/NHI/WLList.html>. (Accessed: 1 Nov 2014).

¹³ Green Bay West Shores Master Plan Concept Element 1979 by Roznik et al.

¹⁴ Wisconsin Department of Natural Resources Technical Report PUB-LF-073.

¹⁵ Wisconsin Department of Natural Resources 2015 muskrat house survey

	<ul style="list-style-type: none"> ○ Ramshorn snail (Planorbidae [family]) ○ Pond snails (<i>Pseudosuccinea</i> sp., <i>Stagnicola</i> sp.) <p>Reptiles:</p> <ul style="list-style-type: none"> ● Although not well studied, several reptiles are expected to occur along the west shore of Green Bay (as noted in Roznik 1979), including common garter snake (<i>Thamnophis sirtalis</i>) and eastern snapping turtle (<i>Chelydra serpentina</i>)¹³. Painted turtle (<i>Chrysemys picta</i>) has been officially recorded at Longtail Point².
Habitat Quality	<p>Overall, the ecological quality of Longtail Point is relatively low though there are pockets of higher quality areas depending on the habitat type.</p> <ol style="list-style-type: none"> 1. Emergent Marsh⁹ <ul style="list-style-type: none"> ○ Primarily invaded by <i>Phragmites</i>, with hybrid cattail and purple loosestrife also present in many areas, making the marsh habitat relatively low in ecological quality. Even so, there are still many smaller areas with native plants, such as joint rush and blue-joint grass, and pockets of submergent vegetation that includes many natives. 2. Submergent Marsh⁹ <ul style="list-style-type: none"> ○ Overall, in moderate to increasingly good quality northward toward the apex of Dead Horse Bay. The encroachment of Eurasian water-milfoil (<i>Myriophyllum spicatum</i>), the only invasive species present here, is locally moderately common. Includes the largest concentration of water celery (<i>Vallisneria americana</i>) beds in the LGB&FR AOC. Some areas (particularly southward) have vegetation heavily covered with a brown periphyton. 3. Hardwood Swamp⁹ <ul style="list-style-type: none"> ○ Dominated by cottonwood and box elder (<i>Acer negundo</i>), although invaded by <i>Phragmites</i>. 4. Great Lakes Beach⁹ <ul style="list-style-type: none"> ○ Overall, much of the beach habitat is low in quality because of encroachment by <i>Phragmites</i>. However, there is a narrow stretch of beach on the eastern-most third of the peninsula that, although largely barren of vegetation, has a few individuals of beach rocket. Beach habitat at the southeastern tip of the peninsula also has characteristic species. Such areas therefore partially resembles historical Great Lakes beach habitat.
Significant Invasive Species Issues	<p>Invasive Plant Species: Each of these species outcompetes and crowds out native plants:</p> <ul style="list-style-type: none"> ● Common reed (<i>Phragmites australis</i>)^{2,5,9} <ul style="list-style-type: none"> ○ Common and continuing problem; occurs along shoreline in Great Lakes beach, emergent marsh, and hardwood swamp; some management has occurred in recent years in open areas (2011-12, 2015-16) ● Hybrid cattail (<i>Typha × glauca</i>)^{2,5,9} <ul style="list-style-type: none"> ○ Somewhat common and continuing problem; occurs in emergent marsh; management unknown ● Eurasian water-milfoil (<i>Myriophyllum spicatum</i>)⁹ <ul style="list-style-type: none"> ○ Some occurs in submergent marsh; management unknown ● Purple loosestrife (<i>Lythrum salicaria</i>)⁹ <ul style="list-style-type: none"> ○ Some occurs in emergent marsh; management unknown ● Canada thistle (<i>Cirsium arvense</i>)^{2,9} <ul style="list-style-type: none"> ○ Very little occurs in emergent marsh; management unknown ● Common hemp-nettle (<i>Galeopsis tetrahit</i>)^{2,9} <ul style="list-style-type: none"> ○ Very little occurs in emergent marsh; management unknown ● Others have been reported at Longtail Point²: <ul style="list-style-type: none"> ○ Field bindweed (<i>Convolvulus arvensis</i>)

	<ul style="list-style-type: none"> ○ Lesser burdock (<i>Arctium minus</i>) ○ Orange hawkweed (<i>Hieracium aurantiacum</i>) <p>Exotic Plant Species²: Their presence has been documented though the extent to which they occur at Longtail Point is unknown.</p> <ul style="list-style-type: none"> ○ Bittersweet nightshade (<i>Solanum dulcamara</i>) ○ Butter-and-eggs (<i>Linaria vulgaris</i>) ○ Common dandelion (<i>Taraxacum officinale</i>) ○ Common dogmustard (<i>Erucastrum gallicum</i>) ○ Common mullein (<i>Verbascum thapsus</i>) <p>Invasive Animal Species:</p> <ul style="list-style-type: none"> ● <i>Birds</i> <ul style="list-style-type: none"> ○ European Starling (<i>Sturnus vulgaris</i>)² <ul style="list-style-type: none"> ▪ Poses some threat to native species, particularly cavity nesters (e.g., Tree Swallow), by outcompeting them and occupying potential nest sites; not currently being managed. ○ Other exotic or invasive bird species occur at Longtail Point^{2,11}, notably Brown-headed Cowbird (<i>Molothrus ater</i>), House Sparrow (<i>Passer domesticus</i>), and Rock Pigeon (<i>Columba livia</i>); however, these species generally do not significantly affect native birds at Longtail because they typically inhabit human-inhabited areas (e.g., developed or agricultural areas). ● <i>Fish</i>⁶ <ul style="list-style-type: none"> ○ Alewife (<i>Alosa pseudoharengus</i>)¹⁶ <ul style="list-style-type: none"> ▪ Poses a threat to native fish species by consuming zooplankton and disturbing the natural food web; not currently being managed ○ Common carp (<i>Cyprinus carpio</i>)¹⁷ <ul style="list-style-type: none"> ▪ Destroy vegetation by uprooting plants and increasing cloudiness of water; not currently being managed ○ Rainbow smelt (<i>Osmerus mordax</i>)¹⁸ <ul style="list-style-type: none"> ▪ Negatively affect uncommon to rare native fish species; not currently being managed ○ Round goby (<i>Neogobius melanostomus</i>)¹⁹ <ul style="list-style-type: none"> ▪ Prey on small native fish and eggs (e.g., darters) and outcompete similarly sized native fish; not currently being managed ○ White perch (<i>Morone americana</i>)²⁰ <ul style="list-style-type: none"> ▪ Prey on native fish eggs, such as walleye; not currently being managed
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¹⁶ Fuller, P., E. Maynard, D. Raikow, J. Larson, A. Fusaro, and M. Neilson. 2016. *Alosa pseudoharengus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=490> Revision Date: 9/25/2015. Accessed 17 Oct 2016.

¹⁷ Nico, L., E. Maynard, P.J. Schofield, M. Cannister, J. Larson, A. Fusaro, and M. Neilson. 2016. *Cyprinus carpio*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=4> Revision Date: 7/15/2015. Accessed 17 Oct 2016.

¹⁸ Fuller, P., E. Maynard, J. Larson, A. Fusaro, T.H. Makled, and M. Neilson. 2016. *Osmerus mordax*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=796> Revision Date: 9/29/2015. Accessed on 17 Oct 2016.

¹⁹ Fuller, P., A. Benson, E. Maynard, M. Neilson, J. Larson, and A. Fusaro. 2016. *Neogobius melanostomus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=713> Revision Date: 1/7/2016. Accessed on 17 Oct 2016.

²⁰ Fuller, P., E. Maynard, D. Raikow, J. Larson, A. Fusaro, and M. Neilson. 2016. *Morone americana*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=777> Revision Date: 1/15/2016. Accessed on 17 Oct 2016.

	<ul style="list-style-type: none"> • <i>Freshwater mussels</i> <ul style="list-style-type: none"> ○ Zebra mussel (<i>Dreissena polymorpha</i>)²¹ <ul style="list-style-type: none"> ▪ Poses threat to native freshwater mussels; not currently being managed
Management and Restoration Recommendations	<ul style="list-style-type: none"> • Continue current invasive plant species management efforts to control invasives noted above (e.g., <i>Phragmites</i>, hybrid cattail, purple loosestrife)¹⁴. • Ensure that native emergent (e.g., soft-stem bulrush [<i>Schoenoplectus tabernaemontani</i>]) and submergent plants replace their invasive counterparts to provide high quality fish and wildlife habitat. • Restore Great Lakes beach habitat by removing invasive plant species, which will improve shorebird habitat. <ul style="list-style-type: none"> ○ Recreate potential breeding habitat for the federally endangered Piping Plover (<i>Charadrius melodus</i>) by providing a few long stretches of Great Lakes beach with sand, cobble, or shells with little to no vegetation and preventing human recreation. Historically, Longtail Point was one of the best potential breeding sites for Piping Plovers²². • Improve substrate for freshwater mussels and crayfish, which help improve water quality and provide food for migratory waterfowl. • Plant native woody shrubs (e.g., river bank grape vine, raspberry [<i>Rubus idaeus</i>]) in the small hardwood swamp to provide food to migratory songbirds. • Continue existing sustainable forestry management practices to maintain a diversity of tree sizes and ages¹⁴. • Limit recreational use and boating during breeding bird season (May-August). • Conduct biotic inventories along AOC shoreline and if necessary re-establish populations of native turtle species and other beach specialists. • Identify critical buffer habitats and shorelines with potential den sites for mink, otter, and other shoreline wildlife species. • Continue efforts to re-establish nesting colonies of Forster's and Black Terns. • Designate and protect sensitive areas.
Reference Links and Documents	<p>Links:</p> <ul style="list-style-type: none"> • Background information on Longtail Point prepared by the Wisconsin Department of Natural Resources: http://dnr.wi.gov/topic/lands/GBWS/longtail.html. • History of Longtail Point and its Lighthouses prepared by the Lighthouse Friends Group: http://www.lighthousefriends.com/light.asp?ID=634. <p>Reference Documents:</p> <ul style="list-style-type: none"> • Disterhaft, K. 2013. Changes in fish assemblages of Lake Michigan's Green Bay following the introduction of Dreissenid mussels and round goby (<i>Neogobius melanostomus</i>) during 1980-2010. Master's thesis from the University of Wisconsin-Green Bay. • Epstein, E.J., E. Spencer, and D. Feldkirchner. 2002. A data compilation and assessment of coastal wetlands of Wisconsin's Great Lakes, final report. Natural Heritage Program, Bureau of Endangered Resources, Wisconsin Department of Natural Resources, Madison, WI, USA. PUBL ER-803 2002. <ul style="list-style-type: none"> ○ Available: http://dnr.wi.gov/files/pdf/pubs/er/er0803.pdf. • Frieswyk, C.B., C.A. Johnston, and J.B. Zedler. 2007. Identifying and characterizing dominant plants as an indicator of community condition. Journal of Great Lakes Research. 33(3):125-135. <ul style="list-style-type: none"> ○ Available: http://glei.nrri.umn.edu/default/documents/frieswyk_jglr_2007.pdf

²¹ Wisconsin Department of Natural Resources Technical Report PUBL ER-818 2010: file "WDNR2010_RapidEcologicalAssmtForGBWestShores WildlifeArea.pdf"

²² Personal communication with Thomas Erdman.

	<ul style="list-style-type: none"> • Harris, V.A. 1998. Waterfowl use of lower Green Bay before (1977-78) and after (1994-97) zebra mussel invasion. Master's thesis from the University of Wisconsin-Green Bay. • Mossman, M.J. 1989. Wisconsin Forster's Tern Recovery Plan. Passenger Pigeon 51(2):171-186. http://images.library.wisc.edu/EcoNatRes/EFacs/PassPigeon/ppv51no02/reference/econatres.pp51n02.mmossmann.pdf • Wisconsin Department of Natural Resources. 1979. Green Bay West Shores Master Plan Concept Element. Property Task Force: F. Roznik, J. Raber, D. Olson, L. Lintereur, and L. Kernen. • Wisconsin Department of Natural Resources' Natural Heritage Inventory Program (primary author: Christina Isenring). 2010. Rapid ecological assessment for the Green Bay West Shores State Wildlife Area: a summary of biodiversity values focusing on rare plants, selected rare animals, and high-quality natural communities in preparation for the development of a new property master plan. Technical Report PUBL ER-818 2010. • Wisconsin Department of Natural Resources. 2013. Regional and property analysis: Green Bay Planning Group. Technical Report PUB-LF-073. • Wisconsin Department of Natural Resources. 2014. Green Bay Planning Group Master Plan. Technical Report PUB-LF-075.
<p>Site History (e.g., original vegetation, past conservation projects)</p>	<p>In the early 1630s, Frenchman Jean Nicolet first arrived in lower Green Bay when it was primarily inhabited by Native American tribes²³. Two Native American camp sites were located on Longtail Point and were likely from the Menominee Tribe though there was a Potawatomi village near the mouth of the Big Suamico River on the north side of Longtail Point²⁴. Lower Green Bay consisted of large beds of wild rice (<i>Zizania</i> sp.) and wild celery (<i>Vallisneria americana</i>), extensive emergent marsh (<i>Schoenoplectus</i> sp., cattail), sedge meadows (<i>Calamagrostis canadensis</i>), shrub carr (e.g., <i>Cornus</i> spp., <i>Salix</i> spp.), swamps, and wet conifer forest (black spruce [<i>Picea mariana</i>], balsam fir [<i>Abies balsamea</i>])^{25,26,27,28,29}. Between the late 1600s and 1800s, European fur trade, duck hunting, fishing, logging, shipping, and agriculture were important early industries in lower Green Bay^{30,31,32}. In the early 1800s, there were a few small settlements and farms of Europeans and Native Americans in the lower bay³¹. In the 1840s, Longtail Point consisted of marsh (called "swamp" in Dorney 1975)²⁴.</p> <p>Many visitors to lower Green Bay arrived by ships from Lake Michigan since boats were a fast form of travel at the time. In the early 1800s, the importance of shipping was recognized; therefore, on 3 March 1837, Congress allotted \$5,000 for building a lighthouse in lower Green Bay to assist ships with navigation. Although the U.S. Navy</p>

²³ Jean Nicolet: French Explorer. By The Editors of Encyclopaedia Britannica. Available: <https://www.britannica.com/biography/Jean-Nicolet> (accessed on 24 Oct 2016).

²⁴ The vegetation pattern around Green Bay in the 1840s as related to geology, soils, and land use by Indians with a detailed look at the Townships of Scott, Green Bay, and Suamico by John Dorney, 1975. File "Dorney1975_VegetationPatternGreenBay1840s.pdf".

²⁵ Arthur C. Neville's Map of Historic Sites on Green Bay, Wisconsin 1669-1689. Available: <http://s3.amazonaws.com/labaye/data/Bay%20Settlement%20Map%20W1%20Historical%20Bulletin%201926.pdf> (accessed on 24 Oct 2016).

²⁶ Survey of the N.W. Lakes: East Shore of Green Bay 1843. Available: <http://s3.amazonaws.com/labaye/data/1843%20East%20Shore%20of%20Green%20Bay.jpg> (accessed on 24 Oct 2016).

²⁷ 1845 Chart of Green Bay. Available <http://s3.amazonaws.com/labaye/data/1845%20Chart%20of%20Green%20Bay.pdf> (accessed on 24 Oct 2016).

²⁸ 1820s Fox River Military Road Map to Ft. Crawford. Available: <http://s3.amazonaws.com/labaye/data/1820s%20Fox%20River%20Military%20Road%20Map%20to%20Ft.%20Crawford.pdf> (accessed on 24 Oct 2016).

²⁹ Personal communication with Thomas Erdman.

³⁰ City of Green Bay's History Webpage: <http://www.ci.green-bay.wi.us/history/1800s.html> (accessed on 20 Oct 2016).

³¹ Excerpt from "Recollections of Green Bay in 1816-17" by James W. Biddle. Available: <http://s3.amazonaws.com/labaye/data/Recollections%20of%20Green%20Bay%20in%201816-1817.pdf> (accessed on 24 Oct 2016).

³² The Early Outposts of Wisconsin: Green Bay for Two-Hundred Years, 1639-1839. Available: <http://labaye.org/item/70/2810> (accessed on 25 Oct 2016).

first considered putting a lighthouse on Grassy Island (later determined to be too small and unstable), Naval Lieutenant, James T. Homans, proposed building the lighthouse on Longtail Point. However, Congress did not provide funds until ten years later (c1847) and gave him just \$4,000 to build it. A 51.5 ft tall lighthouse made out of limestone was built with a large lantern used for providing ships with light, and a lighthouse keeper's home was also constructed. The Longtail Point lighthouse became active in 1848. A second lighthouse was erected in the late 1850s on higher ground due to high water levels and was more "house-like" in appearance for the lighthouse keeper to live. A third lighthouse was built off the pier near the tip of Longtail Point to be closer to the channel for viewing after a ship sunk in the late 1890s³³.

In 1936, the majority of Longtail Point officially joined the federal National Wildlife Refuge system and became known as the Longtail Point Migratory Waterfowl Refuge^{33,34}. In 1961, this refuge was given to the state, at which point it became a part of the Green Bay West Shores State Wildlife Areas, which was established in 1948 (starting with Sensiba through the 1960s and 1970s with other places like Peshtigo Harbor, Oconto Marsh, etc.)³⁵ The second lighthouse was removed around the time Longtail was a national wildlife refuge, and the third lighthouse was later destroyed by the 9 April 1973 storm^{33,22}. During these high water periods of the 1970s, Longtail Point became a series of barrier islands and was disconnected from the mainland³⁶. This is no surprise given that Longtail is a part of the highly dynamic Great Lakes coastal system. Interestingly, the first, original lighthouse still stands today³³.

Prior to the arrival of many invasive plants species in the late 1990s, the emergent marsh at Longtail Point consisted of soft-stem bulrush (*Schoenoplectus tabernaemontani*) and three-square bulrush (*Schoenoplectus pungens*). There also used to be a sedge meadow consisting of blue-joint grass (*Calamagrostis canadensis*) and cattails (*Typha* spp.), hardwood swamp, and a small amount of shrub carr³⁴. In the 1960s, Little Gulls (*Hydrocoloeus minutus*) and Forster's Terns regularly nested on floating mats of vegetation at Longtail Point²².

In 1999 and 2002, more land parcels were added to what now makes up Longtail Point State Wildlife Area. In the late 1990s and early 2000s, *Phragmites*, the hybrid cattail, and purple loosestrife arrived in lower Green Bay and invaded much of the area, including other west shore wetlands. Unfortunately, these aggressive species have now outcompeted many of the native plant species and dominate Longtail's emergent marshes⁹. In 2011 and 2012, the Wisconsin Department of Natural Resources (WDNR) acquired Great Lakes Restoration Initiative funding to conduct aerial herbicide spraying to combat the *Phragmites* and lyme grass (*Leymus arenarius*) across all of the Green Bay West Shores State Wildlife Areas, including Longtail Point. Since then, Ducks Unlimited and the WDNR have done follow-up *Phragmites* treatment as needed³⁴ at multiple sites, which includes a relatively large spraying effort in 2015 and 2016, at which point Longtail was sprayed^{4,34,37}. As with most state-owned properties, the WDNR also manages Longtail's forest by harvesting timber³⁴.

Today, Longtail Point is used heavily for recreational activities, such as hunting, boating, trapping, and fishing. Most hunt for waterfowl and white-tailed deer, trap for otter, mink, etc., and fish for perch and northern pike. During the summer months, many recreational boaters visit the sandy beaches at Longtail Point. Others kayak or canoe offshore. The WDNR maintains two small parking areas, boat launches, and

³³ Lighthouse Friends Webpage on Longtail Point: <http://www.lighthousefriends.com/light.asp?ID=634> (accessed on 20 Oct 2016).

³⁴ Wisconsin Department of Natural Resources Technical Report Technical Report PUB-LF-075

³⁵ Wisconsin Department of Natural Resources Technical Report Technical Report PUB-LF-073

³⁶ Brown County's Online GIS Portal (summer 1978 aerial imagery); <http://maps.gis.co.brown.wi.us/geoprime/> (accessed on 20 Oct 2016).

³⁷ Ducks Unlimited and Wisconsin Department of Natural Resources Phragmites Treatment 2015-16. File "DNR grant project descriptions.docx".

picnic area to provide recreational users with access to Longtail Point. The Village of Suamico is working with the WDNR to establish the remaining stone lighthouse as an important historical location³⁴.

In recent years, the WDNR has been conducting long-term monitoring of fish populations offshore Longtail Point since 1980⁶ as well as the extent of invasive plant species. There have been a few studies on breeding marsh birds, mammals (e.g., muskrats), fish, plants, and migratory waterfowl from 2011 to 2016 by many groups^{9,10,15,38}, and the WDNR monitors nesting terns and tracks waterfowl for hunting. For the past two years, the WDNR has constructed and placed artificial nesting platforms in protected emergent marsh at Longtail Point to try and attract Black and Forster's Terns to nest there. While Black Terns have been found in the LGB&FR AOC during the breeding season, they have not used these nesting platforms, and no one has confirmed breeding for this species yet in the lower bay in recent years³⁹. Adult and fledgling Forster's Terns, however, have utilized these Black Tern platforms for loafing³⁹, though Forster's Terns have not used these platforms for nesting either.

Since 1986, NEW Water has also been collecting long-term water quality data at two locations offshore Longtail (and other areas in Lower Green Bay), including parameters like dissolved oxygen, water clarity, pH, and conductivity³⁸. Dr. Jerry Kaster and Christopher Groff from UW-Milwaukee released 120 million mayfly (*Hexagenia* sp.) eggs into the bay of Green Bay, including at Longtail Point, between 2014 and 2016 in an attempt to reintroduce this important invertebrate back into the Green Bay ecosystem⁴⁰. In 2016, they witnessed the first *Hexagenia* emergence in over 60 years when they found adult exuviae at Longtail Point as well as in Door County and Little Tail Point⁴⁰. The U.S. Fish and Wildlife Service coordinate an early detection and monitoring program of aquatic invasive species in Lake Michigan, and many of their sampling locations are in the LGB&FR AOC, including along the outer edges of Dead Horse Bay by Longtail Point⁴⁰. They survey for ichthyoplankton, carp, macro-invertebrates, and nearshore fishes⁴⁰. Biologists from the Great Lakes Coastal Wetland Monitoring Program have surveyed Longtail Point for birds in 2011 and 2016-2017 and for fish, invertebrates, and vegetation in 2012 and 2017.

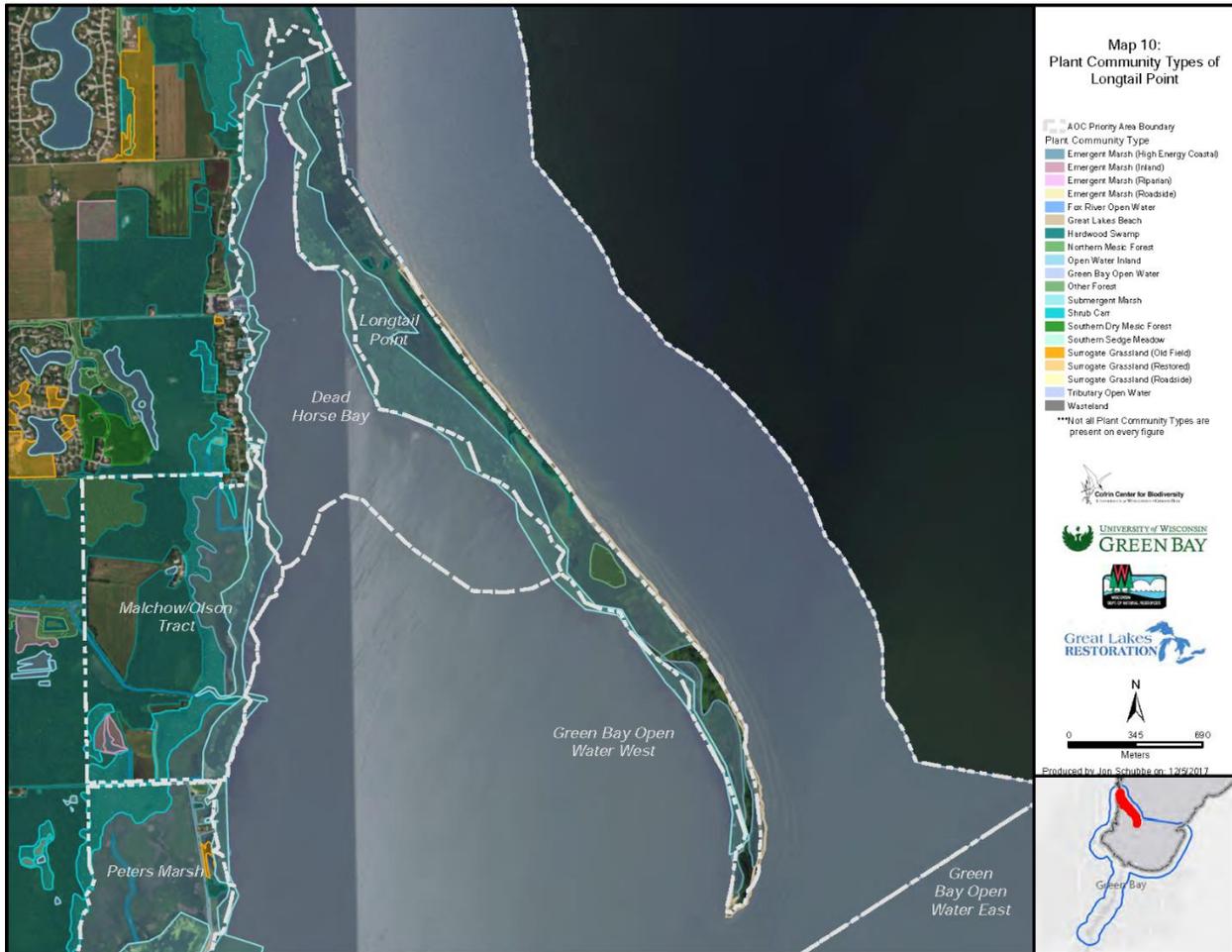
Still, more research is needed at Longtail Point; however, there is great potential for this site to have additional monitoring efforts and to enhance the quality of its emergent marsh and other habitats.

³⁸ LGB&FR AOC Comprehensive Conservation Project Catalogue

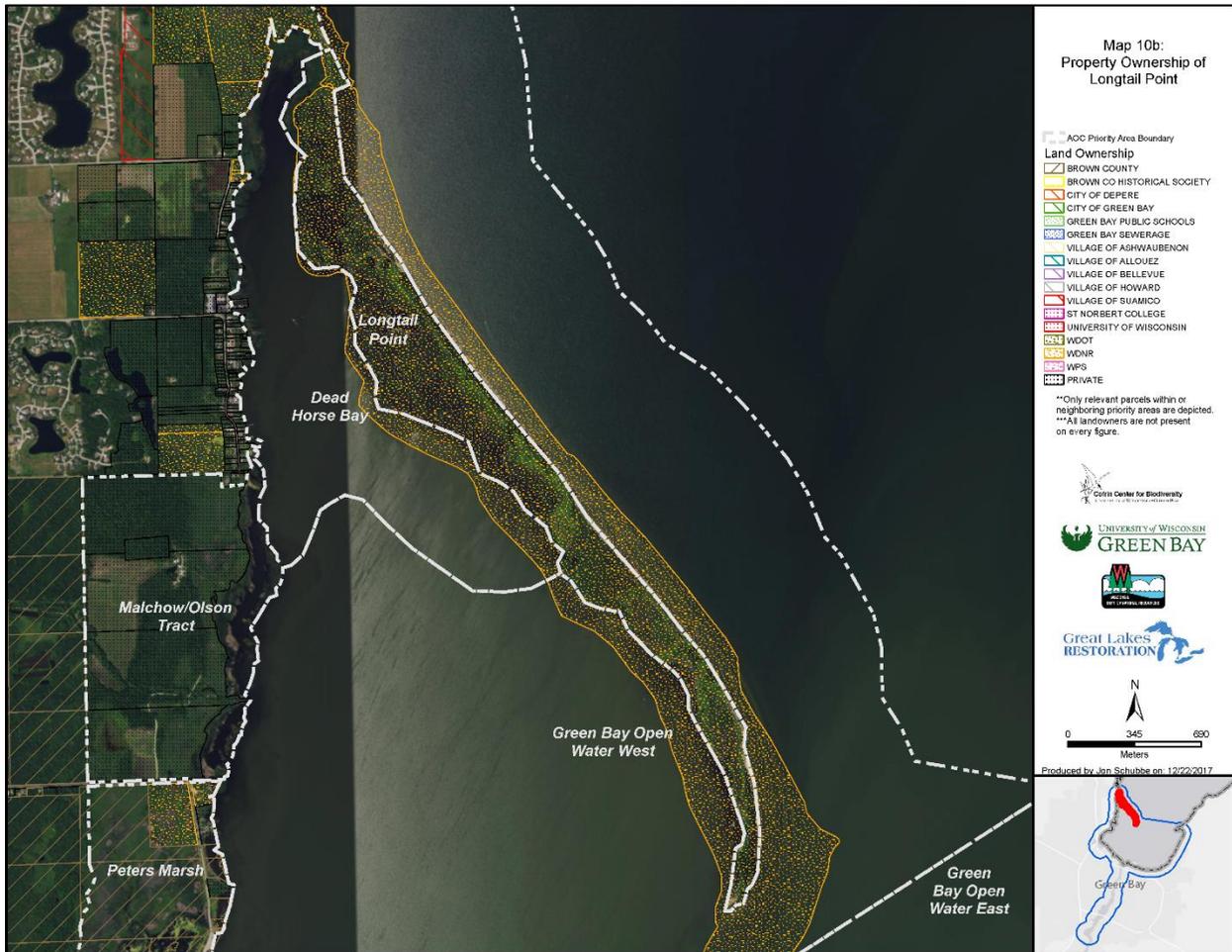
³⁹ Personal communication with Joshua Martinez

⁴⁰ Green Bay Fish Working Group Annual Meetings on 4 January 2017

Map of Longtail Point's plant communities, which are delineated based on the UW-Green Bay 2015 habitat mapping effort and 2017 submerged aquatic vegetation surveys. Map made by UW-Green Bay's Jon Schubbe.



Land ownership boundaries at Longtail Point. Map made by UW-Green Bay's Jon Schubbe.



Photograph of Longtail Point facing northwest. Photograph taken by Erin Giese on 2 December 2016.



Photograph of Longtail Point facing north. Photograph taken by Erin Giese on 2 December 2016.



Photograph of Longtail Point facing west. Photograph taken by Erin Giese on 2 December 2016.

