Great Lakes Key Sites

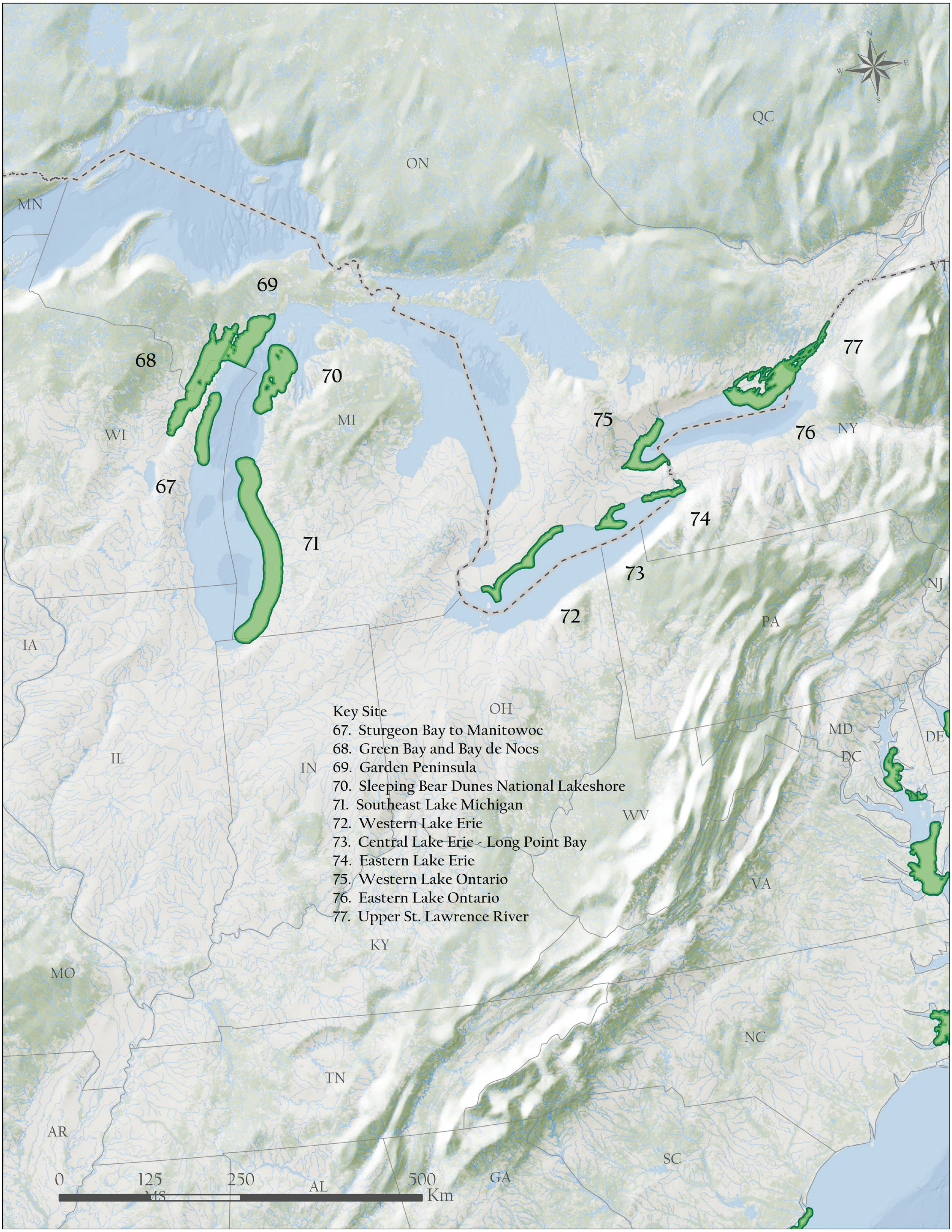


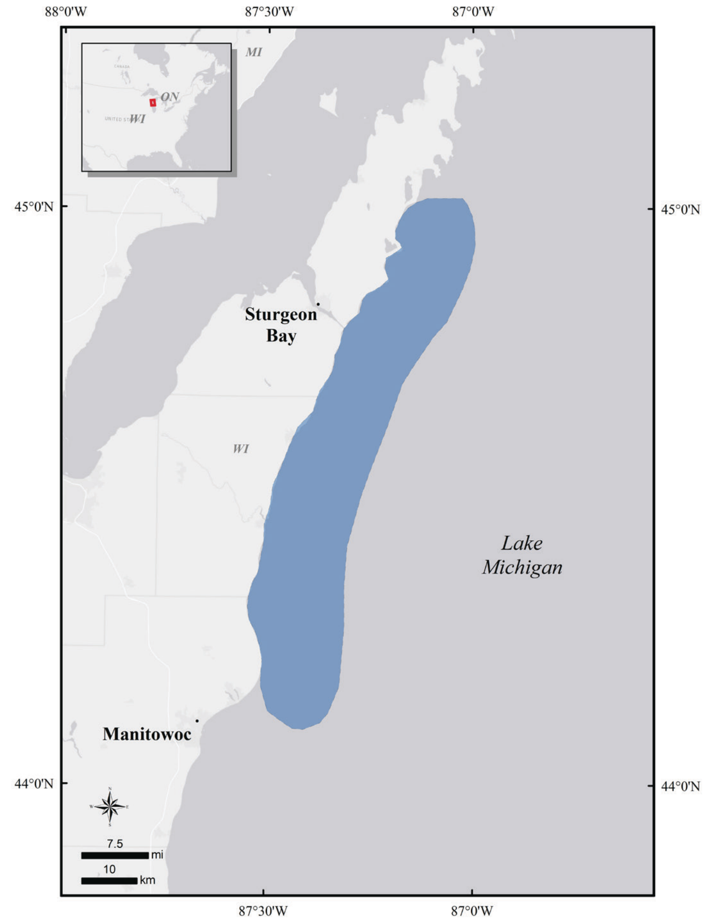
Figure 8. Key habitat sites for sea ducks in the Great Lakes.

Key Site 67: Sturgeon Bay to Manitowoc, Wisconsin

Location: 44°35'2"N, 87°19'11"W

Size: 1639 km^2

Description: This site extends 0 to 15 km offshore from Sturgeon Bay, Wisconsin, south to Manitowoc County, Wisconsin. Minor ports can be found at Algoma, Kewaunee, and Two Rivers, Wisconsin. Underwater reefs and drop-offs create a variety of feeding concentration areas for sea ducks and other diving waterfowl, and piscivorous diver species feed in the water column. Depths range from 0 to 120 m; prey species include a range of native freshwater fishes, plus introduced trout and salmon, and the exotic (introduced) round goby, crayfishes, and both zebra and quagga (*Dressenid*) mussels. Ice masses form in discontinuous aggregations between late December and March during the coldest winters.



Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on high numbers of any species of sea ducks observed during aerial surveys conducted from 2010 to 2015. Ongoing analyses are incomplete as of 2022, but abundance estimates are intended to illustrate the importance of the area to sea ducks during the fall-to-spring nonbreeding period. All birds were tallied and distance sampling was utilized, but because analyses have not been completed, for the purpose of this document we include no adjustment for counting error or detection probability, so estimates should be considered minimum indices. Bird distribution and abundance data were obtained by flying parallel transects, spaced 3.2 km apart, north and south along the west shore of Lake Michigan, 3.2 to 16 km offshore, from the Wisconsin–Illinois border to northern Door County, Wisconsin. A double-observer protocol (Conant and Groves 2005), with distance sampling—in bands of distance away from the centerline of the aircraft—was used to eliminate potential detectability concerns potentially affecting survey results.

Biological Value: During migration as well as during parts of most winters (i.e., from October through early May), the area hosts flocks of sea ducks, chiefly Long-tailed Duck (*Clangula hyemalis*), Common Goldeneye (*Bucephala clangula*), all three scoter species (*Melanitta* spp.), Red-breasted and Common Merganser (*Mergus serrator* and *M. merganser*), and Bufflehead (*Bucephala albeola*). Peak numbers of sea ducks in November can be >10,000 birds on individual days, with Long-tailed Duck peaking from early November to early December (Appendix 1) and Red-breasted Merganser peaking in October. In August through October 2013, a total of 52,704 sea ducks were tallied in this area.

More than 100,000 Red-breasted Mergansers pass though this offshore zone during both autumn and spring migration seasons. Use of distribution data from these surveys caused boundaries of a group of Wisconsin Important Bird Areas (Wisconsin Bird Conservation Initiative 2018) to be extended further from shore, as depicted in Appendix 2.

Sensitivities: Flocks of sea ducks are sensitive to disturbance by commercial shipping and offshore hunting. Extensive ice cover in some years has a strong effect on presence, survival, distribution, and movements of sea ducks and other divers in this offshore zone (Engel 2014, Washington Post 2014; see also Appendix 3). Ongoing invasive mussel concentrations (Dressenids) and invasive small fishes such as round goby form part of the diet of waterfowl both nearshore and offshore. Invasive mussels provide a feeding opportunity, but this opportunity comes along with the potential for sublethal effects from contaminants taken up by mussel species (Kimbrough et al. 2014). Some measured declines in formerly abundant native amphipods (*Diporeia* spp.) preferred by Long-tailed Ducks may have impacted the nonbreeding population present here (Nalepa et al. 2009), but data on nonbreeding numbers of Long-tailed Duck in the Great Lakes are not sufficient to establish trends. There has been concern in recent years regarding the sustainability of sport harvest for some sea duck species, chiefly Long-tailed Duck.

Potential Conflicts: Offshore wind power installations are being considered in some offshore areas, which could potentially displace waterfowl (Smith and Dwyer 2016) and pose a collision threat. Commercial vessels, including ore barges and other tankers, pass through this offshore zone. There was a proposal to increase mesh size of gill nets for commercial fishing in Wisconsin waters south of Bailey's Harbor (Eggold and Kalish 2017), with potential for by-catch of nontarget fish species (Wisconsin DNR 2017) and possibly diving birds. Long-tailed Ducks have been accidentally caught in gill nets (Robertson and Savard 2002).

Status: This key site encompasses or is partially within three Wisconsin state priority important bird areas (IBAs). Those IBAs are the Whitefish Dunes–Shivering Sands IBA (Audubon 2017a), Door-Kewaunee Lakeshore Migration Corridor IBA (Audubon 2017b), and Point Beach State Forest IBA (Audubon 2017c). The open waters of Lake Michigan and connecting waterbodies are managed by the State of Wisconsin for this key site, but oversight is provided by the United States government to regulate navigation, interstate commerce, access, pollution, and water quality and use. Due to their sovereignty from federal and state governments, tribal nations also provide input on the management and utilization of Lake Michigan resources, including governance through the Chippewa Ottawa Resource Authority and the Great Lakes Indian Fish and Wildlife Commission (Hall and Houston 2014). Uplands surrounding this key site are managed by a variety of parties including federal, state, county, city, and private land owners.

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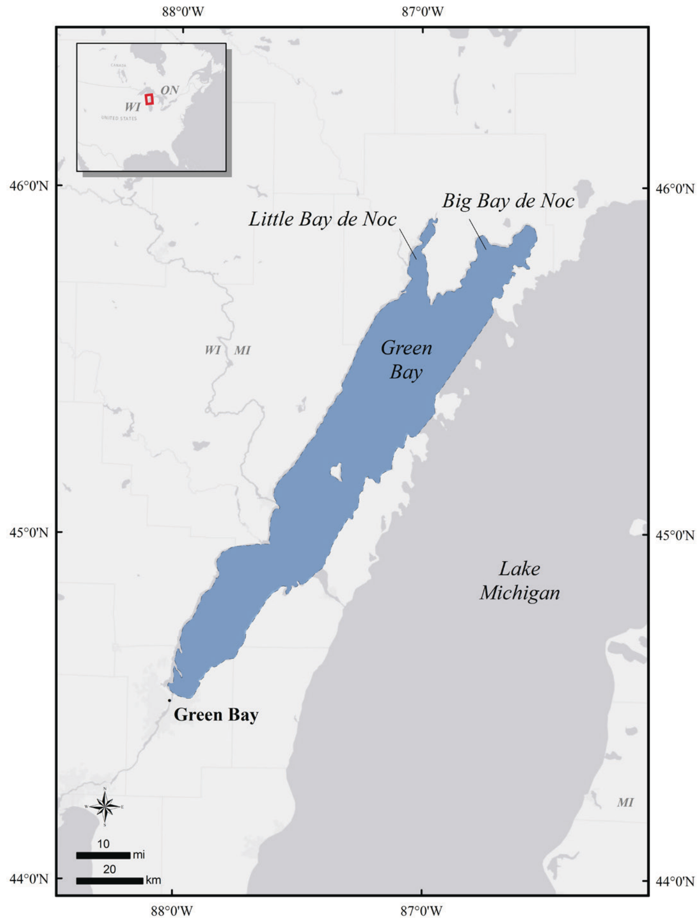
Key Site 68: Green Bay, Wisconsin, and Bay de Nocs, Michigan

Location: 45°15'25"N, 87°17'39"W

Size: 3934 km²

Description: Lake Michigan is one of the Laurentian Great Lakes and the only Great Lake located entirely within the United States, bounded by the states of Illinois, Indiana, Michigan, and Wisconsin, USA. Waters within Green Bay, Little Bay de Noc, and Big Bay de Noc constitute this key site. Major shipping ports within this key site include Green Bay, Sturgeon Bay, and Marinette, Wisconsin, and Menominee and Escanaba, Michigan. Smaller ports include Oconto, Suamico, Dyckesville, Little Sturgeon, Egg Harbor, Fish Creek, Ephraim, Sister Bay, Ellison Bay, Gills Rock, and Washington Island (four ports), Wisconsin, along with Gladstone and Nahma, Michigan. For more detailed information about waterfowl in the Great Lakes region and the benthic community, limnology, and geomorphology of Green Bay and Lake Michigan, see Prince et al. (1992), National Oceanic and Atmospheric Administration (2006), Nalepa et al. (2009), Madenjian et al. (2015), Yurista et al. (2015), Rowe et al. (2017), De Stasio et al. (2018), and Harris et al. (2018).



Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on the peak number of all species of sea duck observed during aerial surveys of waterbirds conducted during fall through spring (i.e., September–May) 2009–2014 (Kenow et al. 2021) and aerial surveys of waterfowl conducted during November and December 2017 and December 2018 by the Wisconsin Department of Natural Resources (DNR; Wisconsin DNR 2019). Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. Observed and visibility-adjusted abundance estimates, as well as distribution maps, by month, are included in Appendix 1.

Biological Value: This site is important for a variety of sea ducks during fall migration and likely during spring migration, with limited use during winter when habitat becomes limited or unavailable due to ice cover. Common Goldeneye (*Bucephala clangula*) constitutes the largest proportion of sea ducks within this key site, followed by merganser species (*Mergus* spp.) and Bufflehead (*Bucephala albeola*), with lesser numbers of Long-tailed Ducks (*Clangula hyemalis*) and scoter species (*Melanitta* spp.) observed during fall and early winter. Information regarding spring use of this site is lacking, but high use of this area was documented among radiomarked Long-tailed Ducks during April (Fara 2018).

Aerial survey data (Kenow et al. 2021, Wisconsin DNR 2019) indicate that Common Goldeneye was the most abundant species during fall migration, with total numbers estimated at roughly 33,000 birds (September–November, 2011–2018) when corrected for visibility (Hodges et al. 2008). Lesser numbers of fall migrating sea ducks included merganser species (~7500 est. birds), Bufflehead (~5900 est. birds), and Long-tailed Ducks (~2000 est. birds). White-winged Scoters (*Melanitta deglandi*) were infrequently encountered during fall surveys and were the only scoter species observed. The combined fall density estimate for all surveys in this key site was 26.4 sea ducks/km^2, with individual survey estimates ranging from 0 (September 12–13, 2011; Kenow et al. 2021) to 126.0 (November 3, 2017; Wisconsin DNR 2019) sea ducks/km^2 when adjusted for visibility (Hodges et al. 2008).

Aerial survey data (Wisconsin DNR 2019) indicate that Common Goldeneye was the most abundant species observed during winter within this site, with preliminary total numbers estimated at 11,500 birds (December 2017) when corrected for visibility (Hodges et al. 2008). Bufflehead (~3700 est. birds) was the only other species to exceed 1000 birds in total during winter. The estimated density for this survey was 57.8 sea ducks/km^2 when adjusted for visibility (Hodges et al. 2008).

Few sea ducks were present at this site during September, and only a few small concentrations were located near Big Bay de Noc, Michigan. Sea duck numbers increased in October and were widely distributed throughout the key site with no major concentrations apparent. Peak counts occurred in November with the largest concentrations of sea ducks occurring south of Marinette, Wisconsin, and Menominee, Michigan, with smaller concentrations evenly distributed throughout the rest of the key site. Sea duck counts decreased in December and it is likely that very few sea ducks remained at this site through winter due to ice cover. Without spring counts, it is difficult to determine how important this key site may be to spring migrating sea ducks; however, radiomarked Long-tailed Ducks used this site throughout April (Fara 2018), and anecdotal reports from fishermen and biologists indicate that many sea ducks use this site from ice-out through early May.

Sensitivities: Waterfowl and other waterbirds are sensitive to human disturbance, mostly small vessel and/or shipping traffic during migration and the wintering period on the Great Lakes (Prince et al. 1992). By-catch from commercial fishing operations is of concern, as Ellarson (1956) estimated that by-catch of Long-tailed Ducks in large mesh gill nets could reach 100,000 individuals (see also Baldassare 2014). Commercial fishing operations have declined dramatically over the last 50 years in Michigan (Michigan DNR 2019), but commercial and tribal fishing operations still occur north of Grand Haven, Michigan (Michigan Department of Technology, Management and Budget 2013). Commercial fishing operations in Wisconsin have also declined. The Wisconsin DNR has placed emphasis on supporting commercial operations through science and data, but by-catch estimates for Wisconsin waters of Lake Michigan are outdated (Wisconsin DNR 2017). Although entrapment methods have for the most part changed from gill nets to trap nets, there is still concern about by-catch of Common Loons (*Gavia immer*; Johnson et al. 2004), and perhaps other waterbirds including sea ducks.

Food resource availability and aquatic functions in Lake Michigan appear to be changing due to invasive and introduced species (Nalepa et al. 2009), and shifts in food web dynamics have had a negative effect on the health of predatory fish species (Pothoven et al. 2001, Madenjian et al. 2006, Nalepa et al. 2009, Mandenjian et al. 2015) and perhaps waterfowl. Food resource availability and quality could also be influenced by contamination from industrial activities, urban development, and agricultural practices that occur near the lakeshore or within the Lake Michigan watershed (U.S. Environmental Protection Agency 2008).

Type E botulism (*Clostridium botulinum*) outbreaks occur periodically in Lake Michigan and have been associated with the mortality of more than 100,000 birds throughout the Great Lakes since the 1960s, including sea ducks (Chipault et al. 2015). Outbreaks of type-E avian botulism have been a common occurrence in northern Lake Michigan since the early 2000s (Lafrancois et al. 2011, Chipault et al. 2015), in contrast to Green Bay where avian botulism outbreaks have not been documented in recent decades. Botulism outbreaks were last documented in Green Bay during 1964–1966 and in 1983 (Zuccarino-Crowe 2009) and occurred prior to dreissenid mussel (*Dreissena* spp.) and round goby (*Neogobius melanostomus*) invasions.

Lake Michigan, including Green Bay, has been identified as a suitable location, with above adequate wind resources, for nearshore and offshore wind energy development (Beiter et al. 2017). Although no offshore wind energy sites have been developed within the Lake Michigan basin, there is a potential for negative effects to sea ducks and other birds through displacement and/or direct mortality (Arnett et al. 2007).

Extensive ice cover during severe winters can have a strong effect on the presence, survival, distribution, and movements of sea ducks and waterbirds that winter on Lake Michigan (Ellarson 1956, Prince et al. 1992). Green Bay is completely ice covered during a typical winter (U.S. Department of Commerce 2020).

Potential Conflicts: Disturbance associated with small vessel and shipping traffic, potential for near-shore and offshore wind energy development, and effects from commercial fishing operations remain potential conflicts at this site.

Status: This key site encompasses nine state priority Important Bird Areas (IBAs). Areas within Michigan are the Snake Island (Big Bay de Noc) IBA (Audubon 2017a), Round Island (Bay de Noc) IBA (Audubon 2017b), St. Vital Island IBA (Audubon 2017c), Ogontz Bay Marshes IBA (Audubon 2017d), and Little Bay de Noc (including Portage Marsh and Aronson Island sandbar) IBA (Audubon 2017e). Areas within Wisconsin are the Seagull Bar IBA (Audubon 2017f), Lower Peshtigo River IBA (Audubon 2017g), Green Bay West Shore Wetlands IBA (Audubon 2017h), and Lower Green Bay Islands–Bay Beach Wildlife Sanctuary IBA (Audubon 2017i). The open waters of Lake Michigan, including Green Bay, Big and Little Bay de Nocs, and connecting waterbodies are managed by the states of Wisconsin and Michigan for this key site, but oversight is provided by the United States government to regulate navigation, interstate commerce, access, contamination, and water quality and use. Due to their sovereignty from federal and state governments, tribal nations also provide input on the management and utilization of Lake Michigan resources, including governance through the Chippewa Ottawa Resource Authority and the Great Lakes Indian Fish and Wildlife Commission (Hall and Houston 2014). Uplands surrounding this key site are managed by a variety of parties including federal, state, county, city, and private land owners.

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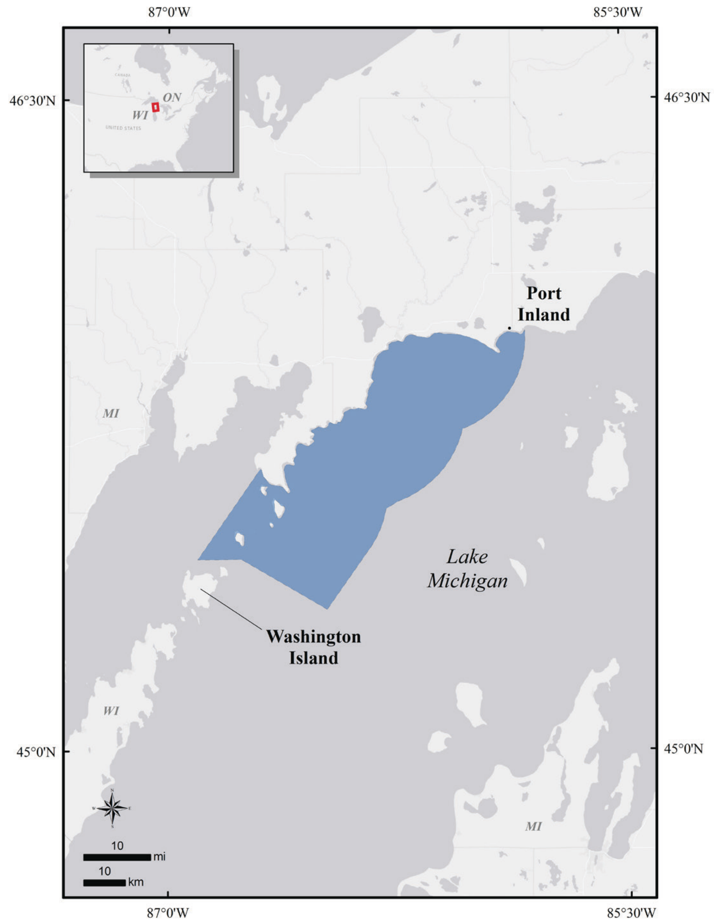
Common Goldeneyes. Photo: Tim Bowman.

Key Site 69: Garden Peninsula, Michigan

Location: 45°40'05"N, 86°20'37"W

Size: 2391 km²

Description: Lake Michigan is one of the Laurentian Great Lakes and the only Great Lake located entirely within the United States, bounded by the states of Illinois, Indiana, Michigan, and Wisconsin, USA. The Garden Peninsula, of Lake Michigan that constitutes this key site extends southwest along the shoreline from 3 km east of Port Inland, Michigan, to the Michigan–Wisconsin border (4 km north of Washington Island, Wisconsin) and extends 25 km offshore. The site encompasses islands and shoals in Michigan waters south of the Garden Peninsula. The only major port within the key site is Port Inland, Michigan, and minor ports can be found at Fairport and Manistique, Michigan. For more detailed information about waterfowl in the Great Lakes region and the benthic community, limnology, and geomorphology of Lake Michigan, see Prince et al. (1992), National Oceanic and Atmospheric Administration (2006), Nalepa et al. (2009), Madenjian et al. (2015), Yurista et al. (2015), and Rowe et al. (2017).



Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on the peak number of all species of sea duck observed during aerial surveys of waterbirds conducted during fall through spring (i.e., September–May) 2009–2014 (Kenow et al. 2021). Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. Observed and visibility-adjusted abundance estimates, as well as distribution maps by month, are included in Appendix 1.

Biological Value: This site is important for Long-tailed Ducks (*Clangula hyemalis*), but other sea ducks, such as Common Goldeneye (*Bucephala clangula*), Bufflehead (*Bucephala albeola*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Black Scoter (*Melanitta americana*), White-winged Scoter (*Melanitta deglandi*), and Surf Scoter (*Melanitta perspicillata*) migrate through and winter here in smaller numbers. High use of this area was documented among radiomarked Long-tailed Ducks during fall (November) and spring (March–May), with no observed use during the wintering months (December–February; Fara 2018). These Long-tailed Ducks exhibited diel movements, using shallower water closer to shore during the day and deeper water farther from shore at night.

Aerial survey data (Kenow et al. 2021) indicate that Long-tailed Ducks were the most abundant species during spring migration with total numbers estimated at least 33,000 birds (April, 2011–2012) when corrected for visibility (Hodges et al. 2008); nearly all these birds were encountered in 2011 and represented 92% of all sea ducks tallied during spring surveys. Total mergansers were estimated at slightly more than 1950 birds within the same period. Approximately three-quarters of all mergansers were identified as Common Mergansers. Numbers of most other sea duck species were generally considered low. The total spring density estimate for surveys in this key site was 66.9 sea ducks per km^2.

Aerial survey data (Kenow et al. 2021) indicate that Long-tailed Ducks were the most abundant species wintering within this site, with total numbers estimated at more than 12,000 birds (December–February, 2011–2012) when corrected for visibility (Hodges et al. 2008). Common Merganser numbers were estimated at slightly more than 4000 birds within the same period (92% of all mergansers tallied), and most other wintering sea ducks had species counts of less than 1000 birds each. Scoters, particularly White-winged, were infrequently detected during winter. The total winter density estimate for surveys in this key site was 22.6 sea ducks per km^2, with individual surveys ranging from 11.2 (February 14, 2012) to 26.5 (January 13, 2011) sea ducks per km^2.

Fall migration survey data indicate that the total number of Long-tailed Ducks was estimated at greater than 25,300 birds (September–November, 2010–2014) when corrected for visibility (Hodges et al. 2008). Common Mergansers (~1860 est. birds) represented at least 60% of total mergansers tallied during fall migration at this site. Most other sea duck species had fall counts totaling less than 600 birds over 11 surveys. The total fall density estimate for surveys in this key site was 10.6 sea ducks per km^2, with individual surveys ranging from 0.2 (October 5, 2011) to 90.4 (October 21, 2014) sea ducks per km^2.

Few sea ducks were present at this site during September, but large concentrations were observed during October surveys, with the highest concentrations located near Manistique, Michigan (Kenow et al. 2021). During November, sea ducks tended to occupy most of the key site and were evenly distributed throughout with no major concentrations. Sea duck concentrations decreased after November, and concentrations were generally lower from December through February. The one exception was a January 2011 flight that indicated large concentrations near Manistique, Michigan. Ice cover during winter likely forces birds out of this area from December through February. Surveys conducted in April indicate that sea duck numbers increased throughout the key site with the heaviest concentrations near Manistique, Michigan.

Sensitivities: Waterfowl and other waterbirds are sensitive to human disturbance, mostly small vessel and shipping traffic during migration and the wintering period on the Great Lakes (Prince et al. 1992). By-catch from commercial fishing operations is of concern: Ellarson (1956) estimated that by-catch of Long-tailed Ducks in large mesh gill nets could reach 100,000 (see also Baldassare 2014) individuals. Commercial fishing operations have declined dramatically over the last 50 years in Michigan (Michigan Department of Natural Resources 2019), but commercial and tribal fishing operations still occur north of Grand Haven, Michigan (Michigan Department of Technology, Management and Budget 2013). Although entrapment methods have for the most part changed from gill nets to trap nets, there is still concern about by-catch of Common Loons (*Gavia immer*; Johnson et al. 2004), and perhaps other waterbirds including sea ducks.

Food resource availability and aquatic functions in Lake Michigan appear to be changing due to invasive and introduced species (Nalepa et al. 2009), and shifts in food web dynamics have had a negative effect on the health of predatory fish species (Pothoven et al. 2001; Madenjian et al. 2006; Nalepa et al. 2009; Mandenjian et al. 2015) and perhaps waterfowl. Food resource availability and quality could also be influenced by contamination from industrial activities, urban development, and agricultural practices that occur near the lakeshore or within the Lake Michigan watershed (U.S. Environmental Protection Agency 2008).

Type E botulism (*Clostridium botulinum*) outbreaks occur periodically in Lake Michigan and have been associated with the mortality of more than 100,000 birds throughout the Great Lakes since the 1960s, including sea ducks (Chipault et al. 2015). Outbreaks of type E avian botulism have been a common occurrence in northern Lake Michigan since the early 2000s (Lafrancois et al. 2011, Chipault et al. 2015).

Lake Michigan has been identified as a suitable location, with above adequate wind resources, for nearshore and offshore wind energy development (Beiter et al. 2017) and although no offshore wind energy sites have been developed, there is a potential for negative effects to sea ducks and other birds through displacement and/or direct mortality (Arnett et al. 2007).

Extensive ice cover during severe winters can have a strong effect on the presence, survival, distribution, and movements of sea ducks and waterbirds that winter on Lake Michigan (Ellarson 1956; Prince et al. 1992). The Garden Peninsula area of Lake Michigan, representing this key site, experiences a range of ice coverages from limited ice coverage during mild winters to completely frozen during severe winters (U.S. Department of Commerce 2020).

Potential Conflicts: Disturbance associated with small vessel and shipping traffic, potential for nearshore and offshore wind energy development, and effects from commercial fishing operations remain potential conflicts at this site.

Status: This key site encompasses the Rocky Island (Lake Michigan) Important Bird Area (IBA) in Michigan (Audubon 2017). The open waters of Lake Michigan and connecting waterbodies are managed by the State of Michigan for this key site, but oversight is provided by the United States government to regulate navigation, interstate commerce, access, contamination, and water quality and use. Due to their sovereignty from federal and state governments, tribal nations also provide input on the management and utilization of Lake Michigan resources, including governance provided through the Chippewa Ottawa Resource Authority and the Great Lakes Indian Fish and Wildlife Commission (Hall and Houston 2014). Uplands surrounding this key site are managed by a variety of parties including federal, state, county, city, and private land owners.

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Key Site 70: Sleeping Bear Dunes National Lakeshore, Michigan

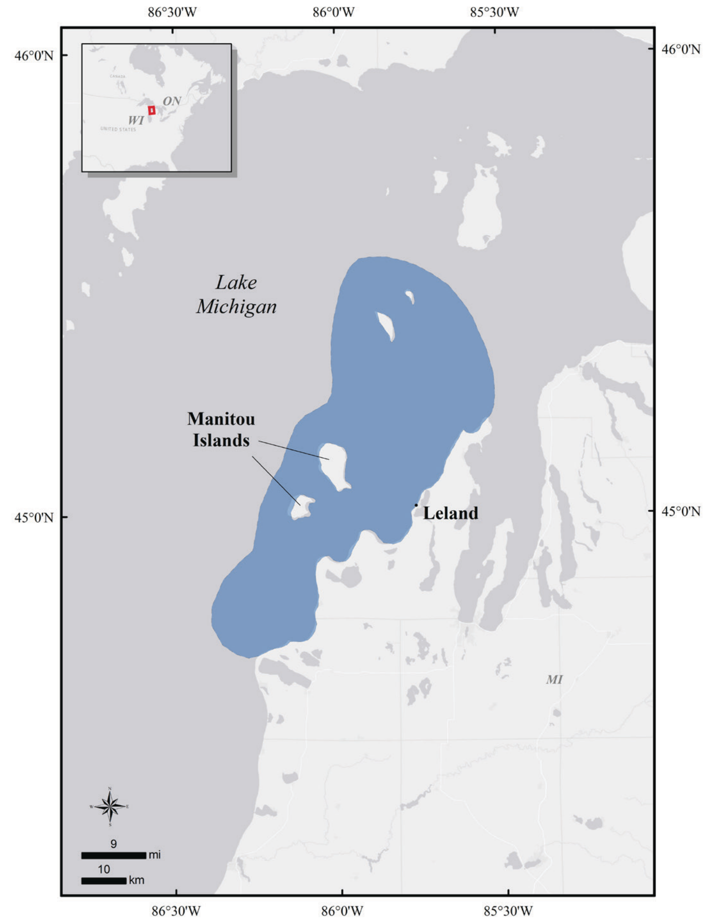
Location: 45°09'02"N, 85°55'47"W

Size: 2945 km²

Description: Lake Michigan is one of the Laurentian Great Lakes and the only Great Lake located entirely within the United States, bounded by the states of Illinois, Indiana, Michigan, and Wisconsin. The Sleeping Bear Dunes National Lakeshore portion of Lake Michigan that constitutes this key site extends north along the shoreline from Point Betsie Lighthouse (50 km southwest of Leland, Michigan) to Grand Traverse Lighthouse (25 km north-northeast of Leland, Michigan) and extends 15–50 km offshore, encompassing North Fox, South Fox, North Manitou, and South Manitou Islands. This area includes only one minor port at Leland, Michigan. For more detailed information about waterfowl in the Great Lakes region, Sleeping Bear Dunes National Lakeshore, and the benthic community, limnology, and geomorphology of Lake Michigan, see Prince et al. (1992), National Park Service (2019), National Oceanic and Atmospheric Administration (2006), Nalepa et al. (2009), Madenjian et al. (2015), Yurista et al. (2015), and Rowe et al. (2017).

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on the peak number of all species of sea duck observed during aerial surveys of waterbirds conducted during fall through spring (i.e., September–May) 2009–2014 (Kenow et al. 2021). Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. Observed and visibility-adjusted abundance estimates, as well as distribution maps by month, are included in Appendix 1.

Biological Value: This site is important for Long-tailed Ducks (*Clangula hyemalis*) but does support a good number of White-winged Scoters (*Melanitta deglandi*), Common Goldeneyes (*Bucephala clangula*), and Common Mergansers (*Mergus merganser*). Other sea ducks, such as Bufflehead (*Bucephala albeola*), Black Scoter (*Melanitta americana*), Surf Scoter (*Melanitta perspicillata*), and Red-breasted



Mergansers (*Mergus serrator*) migrate through and winter here in smaller numbers.

Use of this area was documented by one radiomarked Long-tailed Duck from December 2016 through May 2017 (Fara 2018). This duck exhibited diel movements, using shallower water closer to shore during the day and deeper water farther from shore at night. This record is consistent with the observed distribution of Long-tailed Ducks during aerial surveys in this region of Lake Michigan.

Aerial survey data (Kenow et al. 2021) indicate that Long-tailed Ducks were the most abundant species wintering within this site, with total numbers estimated at roughly 65,000 birds (December–February, 2010–2014) when corrected for visibility (Hodges et al. 2008). Lesser numbers of wintering sea ducks included White-winged Scoter (~12,000 est. birds), Common Goldeneye (~5000 est. birds), and Common Merganser (~3500 est. birds). White-winged Scoters and Common Mergansers each represented approximately 81% of total scoters and total mergansers tallied, respectively. Buffleheads were infrequently encountered. The total winter density estimate for surveys in this key site was 49.3 sea ducks/km^2, with individual surveys ranging from 18.3 (December 6, 2011) to 77.6 (December 1–2, 2009) sea ducks/km^2.

Aerial survey data (Kenow et al. 2021) indicate that Long-tailed Ducks were the most abundant species during fall migration, with total numbers estimated at roughly 35,000 birds (September–November, 2009–2014) when corrected for visibility (Hodges et al. 2008). White-winged Scoters represented at least 18% of total sea duck numbers counted within the same period at this site (~9200 est. birds). Other sea duck species tended to be more abundant during fall migration than during the spring season; however, there was greater survey effort during the fall months and sea duck numbers were generally much higher in years where survey data included late October to late November flights. Spring data were limited to the same calendar day in April between two consecutive years (2012–2013), with total numbers of Long-tailed Ducks estimated at approximately 3500 birds when corrected for visibility (Hodges et al. 2008). Merganser species, when combined, were the only other sea ducks to exceed 1000 birds in total for spring (~1700 est. birds), and White-winged Scoters were infrequently encountered by early April at this site. The total fall density estimate for surveys in this key site was 16.6 sea ducks/km^2, while the total spring density estimate was 12.8 sea ducks/km^2. Fall density estimates for individual surveys ranged from 0.1 (September 18–19, 2013) to 79.7 (November 28–29, 2012) sea ducks/km^2, and individual spring survey density estimates ranged from 5.4 (April 5, 2012) to 20.2 (April 5, 2013) sea ducks/km^2.

Few sea ducks were present at this site during September and the few concentrations present tended to be near the Fox Islands and Manitou Islands. Sea duck numbers increased during October and November, but concentrations were generally small and well-spaced, with only a few larger concentrations found southwest of South Manitou Island and near Pyramid Point, Michigan (~15 km southwest of Leland, Michigan). December provided the highest counts for this key site, and large concentrations of sea ducks were near the shoals of South Fox Island, around North and South Manitou Islands, within Sleeping Bear Bay (~25 km southwest of Leland, Michigan), and near Leland, Michigan. Sea duck numbers declined in January and concentrations present were reduced to the southern portion of the key site. Concentrations were smaller and more evenly distributed throughout the site during February and April. It is important to note that ice cover could greatly affect the distribution of birds within this site and even preclude sea duck use during severe winters.

Sensitivities: Waterfowl and other waterbirds are sensitive to human disturbance, mostly small vessel and/or shipping traffic during migration and the wintering period on the Great Lakes (Prince et al. 1992). By-catch from commercial fishing operations is of concern, as Ellarson (1956) estimated that by-catch of Long-tailed Ducks in large-mesh gill nets could reach 100,000 individuals (see also Baldassare 2014). Commercial fishing operations have declined dramatically over the last 50 years in Michigan (Michigan Department of Natural Resources 2019), but commercial and tribal fishing operations still occur north of Grand Haven, Michigan, and this area is subject to commercial operations from both state and tribal operations (Michigan Department of Technology, Management and Budget 2013). Although entrapment methods have for the most part changed from gill nets to trap nets, there is still concern about by-catch of Common Loons (*Gavia immer*; Johnson et al. 2004) and perhaps other waterbirds, including sea ducks.

Food resource availability and aquatic functions in Lake Michigan appear to be changing due to invasive and introduced species (Nalepa et al. 2009), and shifts in the energy balance have had a negative impact on the health of predatory fish species (Pothoven et al. 2001, Madenjian et al. 2006, Nalepa et al. 2009, Mandenjian et al. 2015) and perhaps waterfowl. Food resource availability and quality could also be influenced by pollution from industrial activities, urban development, and agricultural practices that occur near the lakeshore or within the Lake Michigan watershed (U.S. Environmental Protection Agency 2008).

Type E botulism (*Clostridium botulinum*) outbreaks occur periodically in Lake Michigan and have been associated with the mortality of more than 100,000 birds throughout the Great Lakes since the 1960s, including sea ducks (Chipault et al. 2015). Outbreaks of type E avian botulism have been a common occurrence in northern Lake Michigan since the early 2000's (Lafrancois et al. 2011, Chipault et al. 2015).

Lake Michigan has been identified as a suitable location, with above adequate wind resources, for nearshore and offshore wind energy development (Beiter et al. 2017) and although no offshore wind energy sites have been developed, there is potential for negative effects to sea ducks and other birds through displacement and/or direct mortality (Arnett et al. 2007).

Extensive ice cover during severe winters can have a strong effect on the presence, survival, distribution, and movements of sea ducks and waterbirds that winter on Lake Michigan (Ellarson 1956, Prince et al. 1992). The Sleeping Bear Dunes National Lakeshore area of Lake Michigan, representing this key site, experiences a range of ice coverages from limited ice coverage during mild winters to completely frozen during severe winters (U.S. Department of Commerce 2020).

Potential Conflicts: Disturbance associated with small vessel and shipping traffic, potential for nearshore and offshore wind energy development, and effects from commercial fishing operations remain potential conflicts at this site.

Status: The southern portion of this key site includes the northernmost portion of the Lake Michigan Long-tailed Duck Important Bird Area (IBA), a global priority, that extends along the eastern shore of Lake Michigan from Empire to South Haven, Michigan (Audubon 2017a). The key site also abuts the Sleeping Bear Dunes National Lakeshore IBA, which is considered a global priority (Audubon 2017b) and the Grand Traverse Bay basin IBA, which is considered a state priority (Audubon 2017c). The open waters of Lake Michigan and connecting waterbodies are managed by the state of Michigan for this key site, but oversight is provided by the United States government to regulate navigation, interstate commerce, access, contamination, and water quality and use. Due to their sovereignty from federal and state governments, tribal nations also provide input on the management and utilization of Lake Michigan resources, including governance provided through the Chippewa Ottawa Resource Authority and the Great Lakes Indian Fish and Wildlife Commission (Hall and Houston 2014). Uplands surrounding this key site are managed by a variety of parties including federal, state, county, city, and private land owners.

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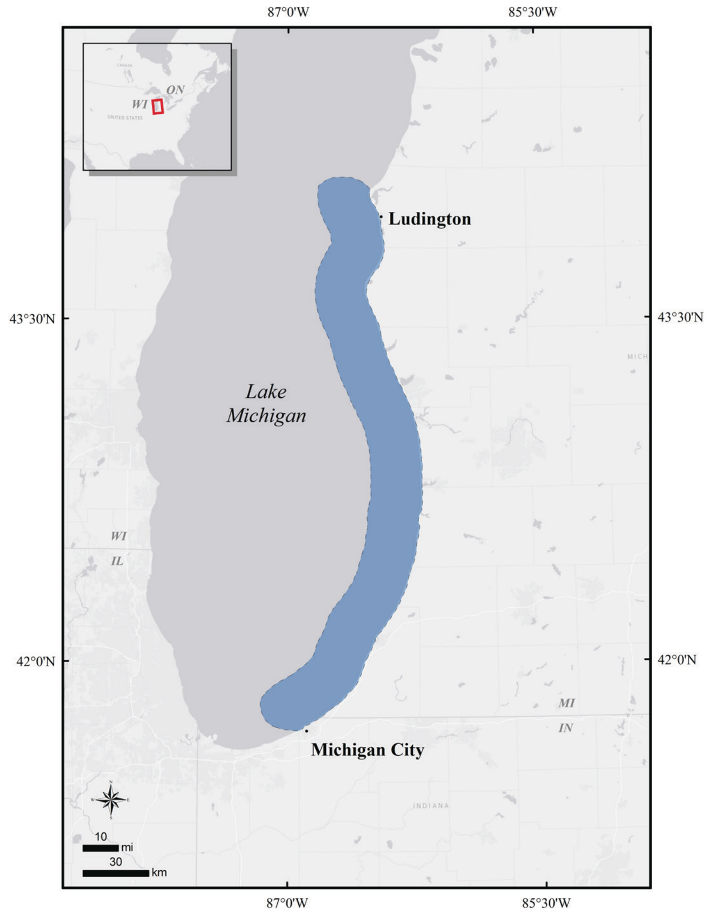
Key Site 71: Southeast Lake Michigan, Michigan and Indiana

Location: 42°52'43"N, 86°34'27"W

Size: 7337 km²

Description: Lake Michigan is one of the Laurentian Great Lakes and the only Great Lake located entirely within the United States, bounded by the states of Illinois, Indiana, Michigan, and Wisconsin. The southeastern portion of Lake Michigan that constitutes this key site extends south along the shoreline from Big Sable Point Lighthouse (15 km north-northwest of Ludington, Michigan) to Michigan City, Indiana, and extends 25 km offshore. Major shipping ports within this key site include Ludington, Muskegon, Grand Haven, Holland, and St. Joseph-Benton Harbor, Michigan. Smaller ports include Pentwater, Whitehall, Port Sheldon, Saugatuck, South Haven, and New Buffalo, Michigan, and Michigan City, Indiana. For more detailed information about waterfowl in the Great Lakes region and the benthic community, limnology, and geomorphology of Lake Michigan, see Prince et al. (1992), National Oceanic and Atmospheric Administration (2006), Nalepa et al. (2009), Madenjian et al. (2015), Yurista et al. (2015), and Rowe et al. (2017).



Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on the peak number of all species of sea ducks observed during aerial surveys of waterbirds conducted during fall through spring (i.e., September–May) 2009–2014 (Kenow et al. 2020). Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. Observed and visibility-adjusted abundance estimates, as well as distribution maps by month, are included in Appendix 1.

Biological Value: This site is important specifically for Long-tailed Ducks (*Clangula hyemalis*), but other sea ducks, such as Common Goldeneye (*Bucephala clangula*), Bufflehead (*Bucephala albeola*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Black Scoter (*Melanitta americana*), White-winged Scoter (*Melanitta deglandi*), and Surf Scoter (*Melanitta perspicillata*) migrate through and winter here in smaller numbers. High use of this area was documented among radiomarked Long-tailed Ducks during November through February (Fara 2018). These ducks exhibited diel movements, using shallower water closer to shore during the day and deeper water farther from shore at night.

Aerial survey data (Kenow et al. 2021) indicate that Long-tailed Ducks were the most abundant species wintering within this site, with total numbers estimated at 240,000 birds (December–February, 2010–2014) when corrected for visibility (Hodges et al. 2008). Lesser numbers of wintering sea ducks included Common Goldeneye (~16,000 est. birds), Common Merganser (~6000 est. birds), White-winged Scoter (~800 est. birds), and Red-breasted Merganser (~550 est. birds). Common Mergansers and White-winged Scoters represented approximately 71% and 31% of total mergansers and scoters tallied, respectively (most scoters were identified to genus). Buffleheads were infrequently encountered during surveys throughout any season. The total winter density estimate for surveys in this key site was 107.2 sea ducks/km^2, with individual survey density estimates ranging from 5.2 (December 8, 2011) to 566.0 (February 3, 2014) sea ducks/km^2 when adjusted for visibility (Hodges et al. 2008).

Aerial survey data (Kenow et al. 2020) indicate that Long-tailed Ducks were the most abundant species during spring and fall migration within this site, with total numbers estimated at slightly over 50,000 birds for each season (March–May, 2010–2014 and September–November, 2010–2013, respectively) when corrected for visibility (Hodges et al. 2008). Other sea duck species tended to be more abundant during spring migration than during the fall passage; however, overall numbers of each species within these seasons are generally considered low. Common Merganser (~1490 est. birds) was the only other species to exceed 1000 birds in total for either season. Fall and spring density estimates for all sea ducks when combined and adjusted for visibility (Hodges et al. 2008) was 26.2 sea ducks/km^2 in both seasons.

Few sea ducks were present at this site during September and October, and the small concentrations present were typically north of Grand Haven, Michigan. Sea duck concentrations started to build in November, with the largest concentrations occurring north of Grand Haven, Michigan, with smaller concentrations farther south. By December, large concentrations could be found as far south as Saugatuck, Michigan, whereas in January larger concentrations could be found as far south as St. Joseph–Benton Harbor, Michigan. Large concentrations of sea ducks were observed throughout this site in February. During March and April, the largest concentrations of sea ducks tended to be south of Grand Haven, Michigan, with smaller concentrations to the north. Only small concentrations of sea ducks were tallied at this site in May.

Sensitivities: Waterfowl and other waterbirds are sensitive to human disturbance, mostly small vessel and/or shipping traffic during migration and the wintering period on the Great Lakes (Prince et al. 1992). By-catch from commercial fishing operations is of concern, as Ellarson (1956) estimated that by-catch of Long-tailed Ducks in large mesh gill nets could reach 100,000 individuals (see also Baldassare 2014). Commercial fishing operations have declined dramatically over the last 50 years in Michigan (Michigan Department of Natural Resources 2019), but commercial and tribal fishing operations still occur north of Grand Haven, Michigan (Michigan Department of Technology, Management and Budget 2013). Although entrapment methods have for the most part changed from gill nets to trap nets, there is still concern about by-catch of Common Loons (*Gavia immer*; Johnson et al. 2004) and perhaps other waterbirds, including sea ducks.

Food resource availability and aquatic functions in Lake Michigan appear to be changing due to invasive and introduced species (Nalepa et al. 2009) and shifts in the energy balance have had a negative impact on the health of predatory fish species (Pothoven et al. 2001, Madenjian et al. 2006, Nalepa et al. 2009, Mandenjian et al. 2015) and perhaps waterfowl. Food resource availability and quality could also be influenced by contamination from industrial activities, urban development, and agricultural practices that occur near the lakeshore or within the Lake Michigan watershed (U.S. Environmental Protection Agency 2008).

Type E botulism (*Clostridium botulinum*) outbreaks occur periodically in Lake Michigan and have been associated with the mortality of more than 100,000 birds throughout the Great Lakes since the 1960s, including sea ducks (Chipault et al. 2015). Outbreaks of type-E avian botulism have been a common occurrence in northern Lake Michigan since the early 2000s (Lafrancois et al. 2011, Chipault et al. 2015).

Lake Michigan has been identified as a suitable location, with above adequate wind resources, for nearshore and offshore wind energy development (Beiter et al. 2017) and although no offshore wind energy sites have been developed, there is a potential for negative effects to sea ducks and other birds through displacement and/or direct mortality (Arnett et al. 2007).

Extensive ice cover during severe winters can have a strong effect on the presence, survival, distribution, and movements of sea ducks and waterbirds that winter on Lake Michigan (Ellarson 1956, Prince et al. 1992). The southeast Lake Michigan area of Lake Michigan, representing this key site, experiences a range of ice coverages from limited ice coverage during mild winters to completely frozen during severe winters (U.S. Department of Commerce 2020).

Potential Conflicts: Disturbance associated with small vessel and shipping traffic, potential for nearshore and offshore wind energy development, and effects from commercial fishing operations remain potential conflicts at this site.

Status: This key site encompasses a major portion of the Lake Michigan Long-tailed Duck Important Bird Area (IBA), a global priority, that extends along the eastern shore of Lake Michigan from Empire to South Haven, Michigan (Audubon 2017a). State priority IBAs along the Michigan shoreline adjacent to this key site include Lake Macatawa near Holland (Audubon 2017b), and Warren Dunes State Park south of St. Joseph (Audubon 2017c). The open waters of Lake Michigan and connecting waterbodies are managed by the states of Indiana and Michigan for this key site, but oversight is provided by the United States government to regulate navigation, interstate commerce, access, pollution, and water quality and use. Due to their sovereignty from federal and state governments, tribal nations also provide input on the management and utilization of Lake Michigan resources, including governance provided through the Chippewa Ottawa Resource Authority and the Great Lakes Indian Fish and Wildlife Commission (Hall and Houston 2014). Uplands surrounding this key site are managed by a variety of parties including state, county, city, and private land owners.

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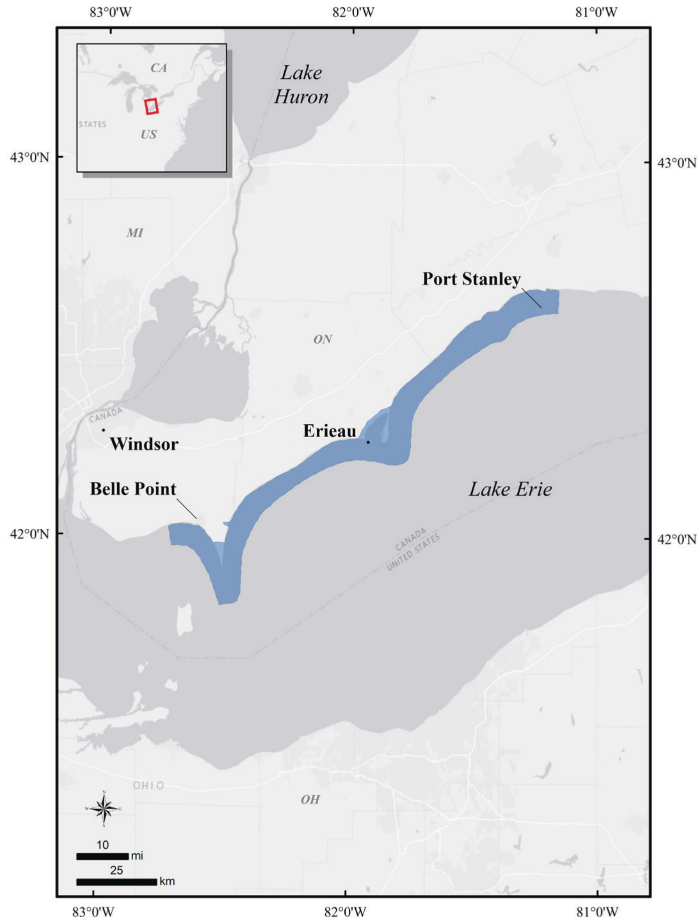
Key Site 72: Western Lake Erie, Ontario

Location: 42°16'59"N, 81°48'6"W

Size: 1332 km²

Description: Lake Erie is one of the lower Laurentian Great Lakes, located between the province of Ontario, Canada, and the states of New York, Pennsylvania, Ohio, and Michigan, USA. The western portion of the Canadian side of Lake Erie that constitutes this site extends west from the harbor at Port Stanley, Ontario, to Belle Point/Leamington, Ontario, and includes Rondeau Bay, Hillman Marsh, and Point Pelee. For more detailed information about waterfowl and wetland habitats in the Great Lakes region, and the benthic community, limnology, and geomorphology of this part of Lake Erie, see Prince et al. (1992), Bolsenga and Herdendorf (1993), Makarewicz et al. (2000), and Holcombe et al. (2005).



Precision and Correction of Abundance Estimates Presented: Abundance values are based on several sources: (1) Shoreline surveys conducted as part of the Mid-Winter Waterfowl Survey (MWS) (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario) and the Lower Great Lakes Migrant Waterfowl Survey (LGLMWS) (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario. Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. (2) Ground-based estimates made during Christmas bird counts (CBC) (National Audubon Society 2015) from 1997 to 2015. Observed counts (not adjusted for incomplete detection) were derived from summing annual data from CBC circles included within the key site boundaries.

Biological Value: This site is important to several species of sea ducks during spring, fall, and winter seasons. Long-tailed Duck (*Clangula hyemalis*), White-winged Scoter (*Melanitta deglandi*), Black Scoter (*Melanitta americana*), Surf Scoter (*Melanitta perspicillata*), Hooded Merganser (*Lophodytes cucullatis*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Common Goldeneye (*Bucephala clangula*), and Bufflehead (*Bucephala albeola*) have been commonly observed in varying abundances since the 1990s at this site (Appendix 1). Sea duck numbers at this and other sites across the lower Great Lakes have increased substantially since the mid-1980s and the early 1990s (Petrie and Schummer 2002). The establishment of dreissenid (zebra) musssels at Lake Erie in the mid-1980s provided an abundant food source for sea ducks and other diving duck species (Custer and Custer 1996, Schummer et al. 2008a, b). Dreissenid mussels also may provide favorable microhabitats for other important aquatic invertebrate prey items, such as amphipods and chironomids, and may have improved water quality and clarity that benefits forage fish species, such as gizzard shad (*Dorosoma cepedianum*), emerald shiner (*Notropis antherinoides*), and round goby (*Neogobius melanostomus*) and improved the foraging efficiency of many sea ducks (Wisden and Bailey 1995, Ross et al. 2005, Bur et al. 2008, Schummer et al. 2008b).

Spring: During aerial surveys of the lower Great Lakes shorelines of Ontario conducted during 2002 and 2011, the maximum peak abundance of sea ducks at this site was estimated at 44,300 birds (Environment and Climate Change Canada/ Canadian Wildlife Service unpublished data [LGLMWS]). Mergansers, primarily Common Merganser and Red-breasted Merganser, were the most common species at this site, with maximum estimated peak numbers of 30,700 and 14,800 birds, respectively. Other sea duck species observed at lower maximum estimated peak abundances within this site included Common Goldeneye (5,500), Bufflehead (4,100), Long-tailed Duck (1,100), and Hooded Merganser (100).

Fall: During aerial surveys of the Ontario shorelines of the lower Great Lakes conducted during 2001 and 2011, maximum peak abundances of sea ducks at this site were estimated to be as high as 34,000 (Environment and Climate Change Canada/ Canadian Wildlife Service unpublished data [LGLMWS]). Common Goldeneye (maximum estimated peak abundance 17,800), Common Merganser (11,700), Red-breasted Merganser (13,800), Bufflehead (2,000), and Long-tailed Duck (300) were the most common species at this site during fall.

Winter: During annual aerial waterfowl surveys of the Ontario shorelines of the lower Great Lakes conducted during January 2002 through 2018, the maximum peak sea duck abundance at this site was estimated at 46,400 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [MWS]). CBC circles surveyed annually within this site reported a maximum count of 50,600 sea ducks between 1997 and 2015 (National Audubon Society and Bird Studies Canada unpublished data [CBC]). Common Goldeneye (maximum estimated peak abundance 11,300 [MWS]), Bufflehead (7,200 [MWS]), Common Merganser (9,200 [MWS]), Red-breasted Merganser (47,400 [CBC]) were the most abundant species at this site during winter. Other species observed during winter, typically at much lower abundances relative to other sea ducks, included Long-tailed Duck (maximum estimated peak abundance 400) as well as Black Scoter (9,500) and White-winged Scoter (4,000).

Sensitivities: Waterfowl are sensitive to human disturbance, mostly small vessel and/or shipping traffic, during migration and winter periods. Food resource availability and quality could be influenced by industrial, urban or cottage development, agricultural pollution, and invasive and other problematic species. Type E botulism (*Clostridium botulinum*) outbreaks that can kill large numbers of sea ducks and waterbirds occur periodically at the lower Great Lakes (Canadian Cooperative Wildlife Health Centre 2003, 2005), particularly during fall migration, as well as other epizootic disease outbreaks that can occur where large numbers of waterfowl congregate.

Potential Conflicts: Disturbance associated with small vessel and shipping traffic remains a potential conflict at this site. Chemical and oil spills and water contamination from several sources, including shipping, urban, industry, and agriculture can impact sea ducks. There is potential for offshore wind development within high sea-duck use areas throughout the lower Great Lakes region.

Status: Several important bird areas have been designated within this area (http://www.ibacanada.ca/mapviewer.jsp) including the Southwest Elgin Forest Complex, Clear Creek, Greater Rondeau Area, and Point Pelee.

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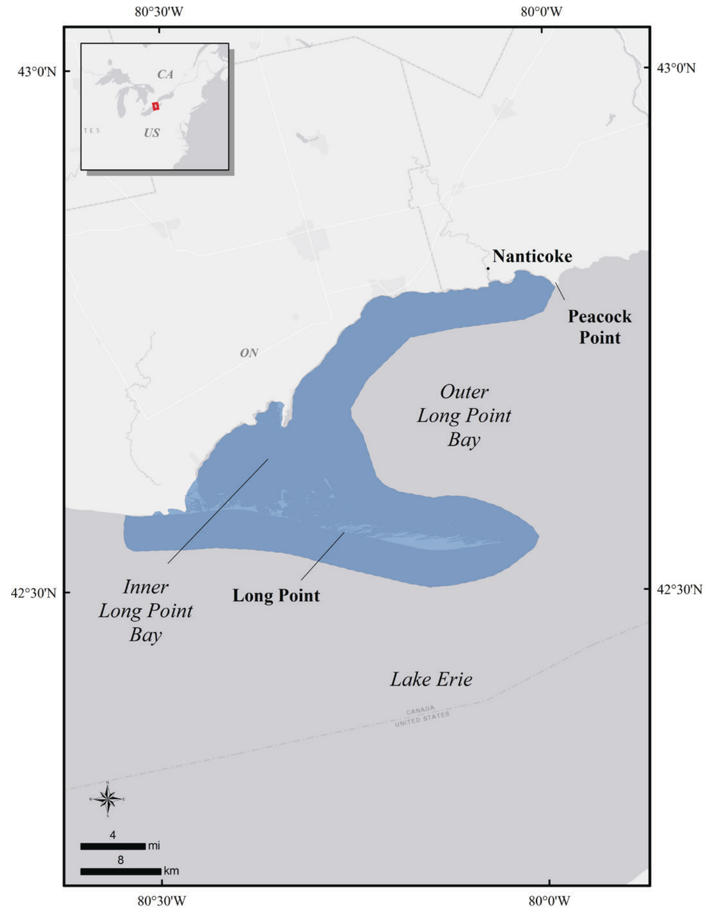
Key Site 73: Central Lake Erie–Long Point Bay, Ontario

Location: 42°37'9"N, 80°17'37"W

Size: 585 km²



Description: Lake Erie is one of the lower Laurentian Great Lakes, located between the province of Ontario, Canada, and the states of New York, Pennsylvania, Ohio, and Michigan, USA. Long Point Bay is in the central portion of the Canadian side of Lake Erie. This site extends west from Peacock Point near Nanticoke, Ontario, to the base of the Long Point peninsula near Clear Creek, Ontario. Several creeks flow into the area, including Nanticoke Creek, Black Creek, Hay Creek, Young's Creek, Fisher's Creek, Normandale Creek, Dedrick's Creek, and Big Creek. Outer Long Point Bay is an open, deep water embayment with extensive emergent marsh habitat predominantly along the north side of the Long Point peninsula from Pottohawk Point to its tip. Inner Long Point Bay, located south of the Pottohawk sand bar between Turkey Point and Pottohawk Point, is a shallow embayment that contains extensive beds of submerged aquatic plants bordered by extensive emergent marsh habitats, including the Long Point Company Marsh, Long Point National Wildlife Area Thoroughfare and Crown Marsh units (south), Big Creek National Wildlife Area (west), and Turkey Point Marsh (north). The south shoreline of the Long Point peninsula is exposed to prevailing winds and associated wave action so this area is predominantly an open, deep water habitat with little emergent marsh or submerged aquatic vegetation. For more detailed information about waterfowl and wetland habitats in the Great Lakes region and the benthic community, limnology, and geomorphology of this part of Lake Erie, see Prince et al. (1992), Bolsenga and Herdendorf (1993), Petrie (1998), Makarewicz et al. (2000), and Holcombe et al. (2005).

Precision and Correction of Abundance Estimates Presented: Abundance values are based on several sources: (1) Shoreline surveys conducted as part of the Mid-Winter Waterfowl Survey [MWS] (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario), Lower Great Lakes Migrant Waterfowl Survey [LGLMWS] (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario), and Long Point Waterfowl Surveys [LPWS] (Bird Studies Canada/Long Point Waterfowl and Wetlands Research Program). Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. (2) Ground-based estimates made during Christmas bird counts (CBC) (National Audubon Society 2015) from 1997 to 2015 and from Canadian Migration Monitoring Network Daily Estimated Totals (CMMN-DET) (Bird Studies Canada/Long Point Bird Observatory). Observed counts (not adjusted for incomplete detection) were derived from summing annual data from CBC circles included within the key site boundaries or summing the daily total estimated counts from the three banding stations located along the Long Point peninsula.

Biological Value: This site is important to several species of sea ducks during spring, fall, and winter. Long-tailed Duck (*Clangula hyemalis*), White-winged Scoter (*Melanitta deglandi*), Black Scoter (*Melanitta americana*), Surf Scoter (*Melanitta* *perspicillata*), Hooded Merganser (*Lophodytes cucullatis*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Common Goldeneye (*Bucephala clangula*), and Bufflehead (*Bucephala albeola*) have been observed in varying abundances since the 1990s at this site (Appendix 1). Sea duck numbers at this site and others across the lower Great Lakes have increased substantially since the mid-1980s and the early 1990s (Petrie and Schummer 2002). The establishment of dreissenid (zebra) mussels at Lake Erie in the mid-1980s provided an abundant food source for sea ducks and other diving duck species (Custer and Custer 1996, Schummer et al. 2008a, b). Dreissenid mussels also may provide favorable microhabitats for other important aquatic invertebrates eaten by waterfowl, such as amphipods and chironomids, and may have improved water quality and clarity that benefits merganser forage fish species, such as gizzard shad (*Dorosoma cepedianum*), emerald shiner (*Notropis antherinoides*), and round goby (*Neogobius melanostomus*) and that improves the foraging efficiency of many sea ducks (Wisden and Bailey 1995, Ross et al. 2005, Bur et al. 2008, Schummer et al. 2008b).

Spring: During aerial surveys of the lower Great Lakes shorelines of Ontario conducted during 1999, 2001, 2009, and 2010, the maximum peak abundance of sea ducks at this site has been estimated at 16,900 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Aerial surveys conducted during migration from 1998 to 2006 annually by Long Point Waterfowl/Bird Studies Canada have generated an estimated maximum peak abundance of 20,608 sea ducks (Bird Studies Canada unpublished data [LPWS]). Ground-based estimates of daily total numbers of sea ducks observed at three bird banding stations along the Long Point peninsula during spring migration (1997–2017) has provided a maximum peak abundance estimate of 16,500 birds (Long Point Bird Observatory/Bird Studies Canada unpublished data, Canadian Migration Monitoring Network, Daily Estimated Totals [CMMN-DET]). Red-breasted Merganser (max. estimated peak abundance: 14,500 [CMMN-DET]), Common Merganser (10,000 [LPMWS]), Common Goldeneye (8,500 [LPWS]), Bufflehead (7,700 [LPWS]), and Long-tailed Duck (2,100 [CMMN-DET] were among the most abundant species at this site. Hooded Merganser (200 [LGLMWS]), Black Scoter (40 [CMMN-DET]), Surf Scoter (800 [CMMN-DET]), and White-winged Scoter (400 [CMMN-DET]) were other sea duck species observed at lower maximum estimated peak abundances.

Fall: Maximum peak abundances of sea ducks at this site were estimated to be 9400, 14,800 and 24,100, respectively, from LGLMWS (1999, 2000, 2009, 2010), LPWS (1998–2006), and CMMN-DET (1997–2017) data collected within this site. Red-breasted Merganser (max. estimated peak abundance 23,400 [CMMN-DET]), Common Merganser (3000 [LGLMWS]), Bufflehead (7500 [LPWS]), Common Goldeneye (1,800 [LPWS]), and Long-tailed Duck (1,400 [LGLMWS]) were the most common and abundant species at this site during winter. Hooded Merganser (300 [LGLMWS]), Black Scoter (700 [CMMN-DET]), Surf Scoter (1,000 [CMMN-DET]), and White-winged Scoter (800 [CMMN-DET]) were other sea duck species observed at lower maximum estimated peak abundances.

Winter: During annual aerial waterfowl surveys of the Ontario shorelines of the lower Great Lakes conducted during January 2002–2018, the maximum peak sea duck abundance at this site was estimated at 32,400 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [MWS]). CBC circles surveyed annually within this site reported a maximum count of 11,500 sea ducks between 1997 and 2015 (National Audubon Society and Bird Studies Canada unpublished data [CBC]). Red-breasted Merganser (max. estimated peak abundance 30,800 [MWS]), Common Merganser (5,900 [CBC]), Bufflehead (3,700 [MWS]), and Common Goldeneye (1,900 [MWS]) were among the most common species at this site during winter. Other species commonly observed at lower maximum estimated peak abundances at this site during winter included Hooded Merganser (100 [CBC] Long-tailed Duck (600 [MWS]), Black Scoter (70 [MWS]), Surf Scoter (1 [CBC]), and White-winged Scoter (800 [MWS]).

Sensitivities: Waterfowl are sensitive to human disturbance, mostly small vessel and/or shipping traffic, during migration and winter periods. Food resource availability and quality could be influenced by industrial, urban or cottage development, and agricultural pollution and invasive and other problematic species. Type E botulism (*Clostridium botulinum*) outbreaks that can kill large numbers of sea ducks and/or waterbirds occur periodically at the lower Great Lakes (Canadian Cooperative Wildlife Health Centre 2003, 2005), particularly during fall migration. Other epizootic disease outbreaks can also occur where large numbers of waterfowl congregate.

Potential Conflicts: Disturbance associated with small vessel and shipping traffic remains a potential conflict at this site. Chemical and oil spills, water contamination, and eutrophication from several sources, including shipping, urban or cottage development, industry, and agriculture can also impact waterfowl. There is potential for offshore wind development within high sea duck use areas throughout the lower Great Lakes region.

Status: Two Important Bird Areas (IBA) have been designated within this area (http://www.ibacanada.ca/mapviewer.jsp), including the Norfolk Forest Complex (located along the shoreline of Outer Long Point Bay between Fisher's Glen and Turkey Point) and the Long Point Peninsula and Marshes. The Long Point peninsula and marshes are also designated as an International Monarch Butterfly Reserve, a Ramsar Site (Wetland of International Significance), and a World Biosphere Reserve. The area also contains Long Point Provincial Park, the Long Point National Wildlife Area (Thoroughfare and Long Point units), and the Big Creek National Wildlife Area (Big Creek and Hahn Marsh units).

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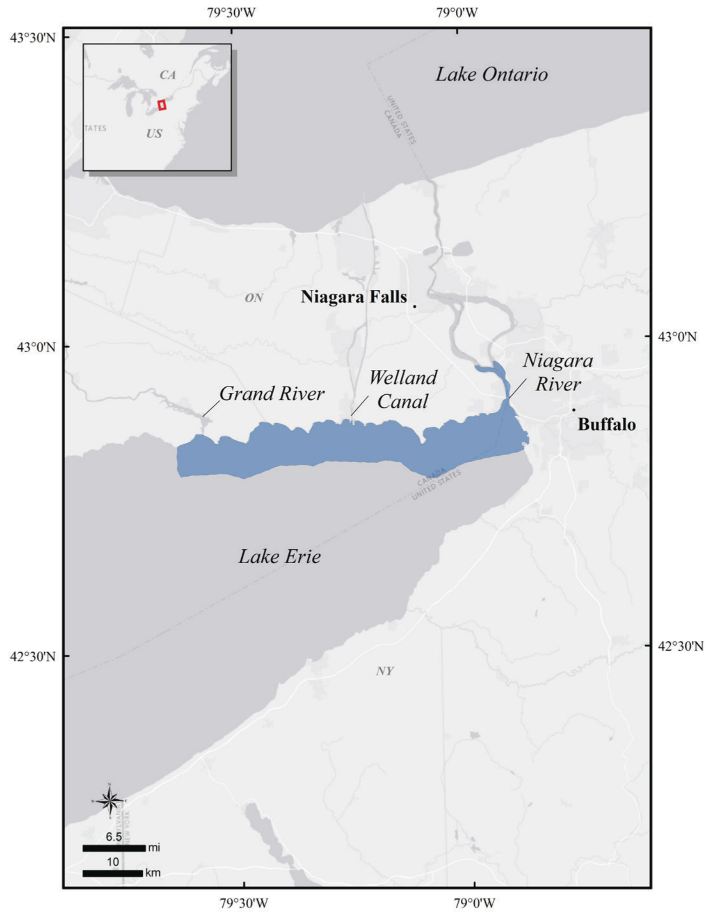
Red-breasted Mergansers. Photo: William Larned.

Key Site 74: Eastern Lake Erie, Ontario

Location: 42°50'15"N, 79°10'47"W

Size: 464 km²

Description: Lake Erie is one of the lower Laurentian Great Lakes, located between the province of Ontario, Canada, and the states of New York, Pennsylvania, Ohio, and Michigan, USA. The eastern portion of the Canadian side of Lake Erie that constitutes this site extends west from the inflow of the Niagara River at Fort Erie, Ontario, to the outflow of the Grand River near Dunnville, Ontario. The Welland Canal is located in the middle of this area and connects Lake Erie to Lake Ontario, allowing ships to travel between the Great Lakes. For more detailed information about waterfowl and wetland habitats in the Great Lakes region and the benthic community, limnology, and geomorphology of this part of Lake Erie, see Prince et al. (1992), Bolsenga and Herdendorf (1993), Makarewicz et al. (2000), and Holcombe et al. (2005).



Precision and Correction of Abundance Estimates presented: Abundance values are based on several sources: (1) Shoreline surveys conducted as part of the Mid-Winter Waterfowl Survey (MWS) (Environment and Climate Change Canada/ Canadian Wildlife Service, Ontario) and the Lower Great Lakes Migrant Waterfowl Survey (LGLMWS) (Environment and Climate Change Canada/ Canadian Wildlife Service, Ontario. Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. (2) Ground-based estimates made during Christmas bird counts (CBC) (National Audubon Society 2015) from 1997 to 2015. Observed counts (not adjusted for incomplete detection) were derived by summing annual data from Christmas bird count circles included within the key site boundaries.

Biological Value: This site is important to several species of sea ducks during spring, fall, and winter. Long-tailed Duck (*Clangula hyemalis*), White-winged Scoter (*Melanitta deglandi*), Black Scoter (*Melanitta americana*), Surf Scoter (*Melanitta perspicillata*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Common Goldeneye (*Bucephala clangula*), and Bufflehead (*Bucephala albeola*) have been observed in varying abundances since the 1990s at this site (Appendix 1). Sea duck numbers at this site and others across the lower Great Lakes have increased substantially since the mid-1980s and the early 1990s (Petrie and Schummer 2002). The establishment of dreissenid (zebra) mussels at Lake Erie in the mid-1980s provided an abundant food source for sea ducks and other diving duck species (Custer and Custer 1996, Schummer et al. 2008a, b). Dreissenid mussels also may provide favorable microhabitats for other important aquatic invertebrate prey items, such as amphipods and chironomids, and may have improved water quality and clarity that benefits merganser forage fish species, such as gizzard shad (*Dorosoma cepedianum*), emerald shiner (*Notropis antherinoides*), and round goby (*Neogobius melanostomus*), and that improves the foraging efficiency of many sea ducks (Wisden and Bailey 1995, Ross et al. 2005, Bur et al. 2008, Schummer et al. 2008b).

Spring: During aerial surveys of the lower Great Lakes shorelines of Ontario in 2001 and 2010, the maximum peak abundance of sea ducks at this site was estimated at approximately 34,800 birds (Environment and Climate Change Canada/ Canadian Wildlife Service unpublished data [LGLMWS]). Mergansers, primarily Common Mergansers, were the most abundant species at this site, with a maximum average estimated peak abundance of approximately 17,400 birds. Other sea duck species commonly observed at lower maximum peak abundances included Bufflehead (10,200), Common Goldeneye (8,400), and Red-breasted Merganser (2,500).

Fall: During aerial surveys of the Ontario shorelines of the lower Great Lakes in 2000 and 2010, the maximum peak abundance of sea ducks at this site was estimated to be 109,700 (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Estimated maximum peak abundances varied considerably among species between surveys, with Bufflehead (39,800), Long-tailed Duck (33,700), Red-breasted Merganser (18,400), Common Goldeneye (17,100), and Common Merganser (4,700) being among the most abundant species. No Black Scoter or Surf Scoter and only relatively few White-winged Scoters (80) were observed during fall aerial surveys.

Winter: During annual aerial waterfowl surveys along the Ontario shorelines of the lower Great Lakes during January 2002 to 2018, the maximum peak sea duck abundance at this site was estimated at 22,900 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [MWS]). CBC circles within this site reported a maximum count of 16,500 sea ducks between 1997 and 2015 (National Audubon Society and Bird Studies Canada unpublished data [CBC]). Bufflehead (11,100 [MWS]), Common Goldeneye (9,700 [MWS]), Common Merganser (7,900 [CBC]), Red-breasted Merganser (6,700 [MWS]), and Long-tailed Duck (2,200 [MWS]) were among the most common species at this site during winter. Scoter species were observed at this site but at relatively low maximum estimated peak numbers (White-winged Scoter = 221 [MWS], Black Scoter = 122 [MWS], and Surf Scoter = 1 [CBC]).

Sensitivities: Waterfowl are sensitive to human disturbance, mostly small vessel and/or shipping traffic, during migration and winter periods. Food resource availability and quality could be influenced by industrial activities, urban or cottage development, agricultural pollution, and invasive and/or other problematic species. Type E botulism (*Clostridium botulinum*) outbreaks that can kill large numbers of sea ducks and/or waterbirds occur periodically in the lower Great Lakes (Canadian Cooperative Wildlife Health Centre 2003, 2005), particularly during fall migration. Other epizootic disease outbreaks can also occur where large numbers of waterfowl congregate.

Potential Conflicts: Disturbance associated with small vessel and shipping traffic remains a potential conflict at this site. Chemical and oil spills, water contamination, and eutrophication from several sources, including shipping, urban or cottage development, industry, and agriculture could also impact waterfowl. There is potential for offshore wind development within areas of high sea-duck use throughout the lower Great Lakes region.

Status: Several Important Bird Areas (IBA) have been designated within this area (http://www.ibacanada.ca/mapviewer.jsp), including the Niagara River Corridor (south section), Point Abino, and Port Colbourne (breakwater and mainland).

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Key Site 75: Western Lake Ontario, Ontario

Location: 43°20'21"N, 79°37'8W

Size: 1346 km²

Description: Lake Ontario is one of the lower Laurentian Great Lakes, located between the province of Ontario, Canada, and the state of New York, USA. The western portion of the Canadian side of Lake Ontario that constitutes this site extends west from downtown Toronto, Ontario, at Ashbridges Bay Park/Toronto Harbour to the outflow of the Niagara River near Niagara-on-the-Lake, Ontario, and includes Hamilton Harbour at Hamilton, Ontario. Several rivers and creeks flow into the area, including the Don River, Humber River, Credit River, Etobicoke Creek, Sixteen Mile Creek, Bronte Creek, Fifteen Mile Creek, Twelve Mile Creek, and the Niagara River at the extreme eastern part of the area. The Welland Canal also is located in the middle of this area and connects Lake Erie to Lake Ontario, allowing ships to travel among the Great Lakes. For more detailed information about waterfowl and wetland habitats in the Great Lakes region and the benthic community, limnology, and geomorphology of this part of Lake Ontario, see Barton (1986), Prince et al. (1992), Mills et al. (2003), Schummer (2005), Wilson et al. (2006), and Remiz (2012).

Precision and Correction of Abundance Estimates Presented: Abundance values are based on several sources: (1) Shoreline surveys conducted as part of the Mid-Winter Waterfowl Survey (MWS) (Environment and Climate Change Canada/ Canadian Wildlife Service, Ontario) and the Lower Great Lakes Migrant Waterfowl Survey (LGLMWS) (Environment and Climate Change Canada/ Canadian Wildlife Service, Ontario. Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. (2) Ground-based estimates made during Christmas bird counts (CBC) (National Audubon Society 2015) from 1997 to 2015. Observed counts (not adjusted for incomplete detection) were derived from summing annual data from CBC circles included within the key site boundaries.

Biological Value: This site is important to several species of sea ducks during spring, fall, and winter seasons. Long-tailed Duck (*Clangula hyemalis*), White-winged Scoter (*Melanitta deglandi*), Black Scoter (*Melanitta americana*), Surf Scoter (*Melanitta perspicillata*), Hooded Merganser (*Lophodytes cucullatis*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Common Goldeneye (*Bucephala clangula*), and Bufflehead (*Bucephala albeola*) have been observed in varying abundances since the 1990s at this site (Appendix 1). Sea duck numbers at this site and others across the lower Great Lakes have increased substantially since the mid-1980s and the early 1990s (Petrie and Schummer 2002). The establishment of dreissenid (zebra) musssels at Lake Ontario in the early 1990s provided an abundant food source for sea ducks and other diving duck species (Custer and Custer 1996, Schummer et al. 2008a, b). Dreissenid mussels also may provide favorable microhabitats for other important aquatic invertebrate prey items, such as amphipods and chironomids, and may have improved water quality and clarity that benefits merganser forage fish species, such as gizzard shad (*Dorosoma cepedianum*), emerald shiner (*Notropis* *antherinoides*), and round goby (*Neogobius melanostomus*) and improves the foraging efficiency of many sea ducks (Wisden and Bailey 1995, Ross et al. 2005, Bur et al. 2008, Schummer et al. 2008b).

Spring: During aerial surveys of the lower Great Lakes shorelines of Ontario conducted during 2001 and 2010, the estimated maximum peak abundance of sea ducks at this site was 68,800 (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Long-tailed Duck was among the most common and abundant species at this site, with an estimated maximum peak abundance of 35,500, which represents about 4% of the estimated continental population (1,000,000 birds) for this species (NAWMP 2012). Other sea duck species commonly observed in lower maximum estimated peak abundances at this site during spring included Bufflehead (18,600), Common Goldeneye (5,200), Common Merganser (4,100), Red-breasted Merganser (1,500), Surf Scoter (6,000), and White-winged Scoter (2,800).

Fall: During aerial surveys of the Ontario shorelines of the lower Great Lakes conducted during 2000 and 2010, the maximum sea duck peak abundance at this site was estimated to be as high as 262,500 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Long-tailed Duck was the most abundant species, with a maximum estimated peak number of 216,300, which represents about 22% of the estimated continental population (NAWMP 2012). White-winged Scoter were also a relatively abundant species at this site, with a maximum estimated peak number of 31,600 birds, representing about 8% of the estimated continental population (NAWMP 2012). Other species commonly observed at lower maximum estimated peak abundance included Bufflehead (17,100), Common Merganser (18,900), Common Goldeneye (6,400), and Red-breasted Merganser (850).

Winter: During annual aerial waterfowl surveys of the Ontario shorelines of the lower Great Lakes conducted during January 2002 to 2018, the maximum peak sea duck abundance at this site was estimated at 244,800 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [MWS]). CBC circles surveyed annually within this site reported a maximum count of 55,300 sea ducks between 1997 and 2015 (National Audubon Society and Bird Studies Canada unpublished data [CBC]). Long-tailed Duck was the most abundant species at this site during winter, with a maximum estimated peak abundance of 228,000, which represents about 23% of the estimated continental population (NAWMP 2012). White-winged Scoter, Black Scoter, and Surf Scoter all have occurred at this site in varying estimated peak abundances from 2001 to 2015, but White-winged Scoter consistently was the most abundant of the three species. The maximum estimated peak abundance of White-winged Scoter was about 21,900 birds, representing about 6% of the estimated continental population (NAWMP 2012). Other species commonly observed at lower maximum estimated peak abundances included Bufflehead (14,800), Common Goldeneye (12,400), Common Merganser (20,100), Red-breasted Merganser (3,500), Black Scoter (1,000), and Surf Scoter (200).

Sensitivities: Waterfowl are sensitive to human disturbance, mostly small vessel and/or shipping traffic, during migration and winter periods. Food resource availability and quality could be influenced by industrial, urban or cottage development, agricultural pollution, and invasive and/or other problematic species. Type E botulism (*Clostridium botulinum*) outbreaks that can kill large numbers of sea ducks and/or waterbirds occur periodically at the lower Great Lakes (Canadian Cooperative Wildlife Health Centre 2003, 2005), particularly during fall migration. Other epizootic disease outbreaks can occur where large numbers of waterfowl congregate.

Potential Conflicts: Disturbance associated with small vessel and shipping traffic remains a potential conflict at this site. The possible expansion of transportation services, such as airports and high speed boat ferries, is also a potential conflict in the future. Chemical and oil spills and water contamination from several sources, including shipping, urban, industry, and agriculture, are also potential conflicts. Offshore wind development is a concern within this site, which has been identified as a wind turbine candidate area.

Status: Several important bird areas have been designated within this area (http://www.ibacanada.ca/mapviewer.jsp) including the Leslie Street Spit, the west end of Lake Ontario, and the Niagara River corridor (north section).

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Key Site 76: Eastern Lake Ontario, Ontario

Location: 43°49'33"N, 77°04'56"W

Size: 2510 km^2

Description: Lake Ontario is one of the lower Laurentian Great Lakes, located between the province of Ontario, Canada, and the state of New York, USA. The eastern portion of the Canadian side of Lake Ontario that constitutes this site extends west from the St. Lawrence River outflow near Kingston, Ontario, includes the Bay of Quinte and the Prince Edward County south shoreline, to Popham Bay/Spenser Point located approximately 5 km west of Presqu'ile Provincial Park. Several rivers flow into the area, including the Napanee River, Salmon River, Moira River, and the Trent River; the St. Lawrence River flows out from the extreme eastern part of the area. This site includes several islands, including Wolfe Island, Pigeon Island, Amherst Island, Waupoos Island, Timber Island, False Duck Island, and Nicholson Island, as well as numerous shoals, such as the Gull Bar Shoal. For more detailed information about waterfowl and wetland habitats in the Great Lakes region and the benthic community, limnology, and geomorphology of this part of Lake Ontario see Barton (1986), Prince et al. (1992), Mills et al. (2003), Schummer (2005), Wilson et al. (2006), and Remiz (2012).

Precision and Correction of Abundance Estimates Presented: Abundance values are based on several sources: (1) Shoreline surveys conducted as part of the Mid-Winter Waterfowl Survey [MWS] (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario) and the Lower Great Lakes Migrant Waterfowl Survey [LGLMWS] (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario. Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. (2) Ground-based estimates made during Christmas bird counts (CBC) (National Audubon Society 2015) from 1997 to 2015; observed counts (not adjusted for incomplete detection) were derived from summing annual data from CBC circles included within the key site boundaries.

Biological Value: This site is important to several species of sea ducks during spring, fall, and winter. Long-tailed Duck (*Clangula hyemalis*), White-winged Scoter (*Melanitta deglandi*), Black Scoter (*Melanitta americana*), Surf Scoter (*Melanitta perspicillata*), Hooded Merganser (*Lophodytes cucullatus*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Common Goldeneye (*Bucephala clangula*), and Bufflehead (*Bucephala albeola*) have been observed in varying abundances since the 1990s at this site (Appendix 1). Sea duck numbers at this site and others across the lower Great Lakes have increased substantially since the mid-1980s and the 1990s (Petrie and Schummer 2002). The establishment of dreissenid (zebra) mussels in Lake Ontario in the early 1990s provided an abundant food source for sea ducks and other diving duck species (Custer and Custer 1996, Schummer et al. 2008a, b). Dreissenid mussels also may provide favorable microhabitats for other important aquatic invertebrate prey items, such as amphipods and chironomids, and may have improved water quality and clarity that benefits merganser forage fish species, such as gizzard shad (*Dorosoma cepedianum*), emerald shiner (*Notropis antherinoides*), round goby (*Neogobius melanostomus*), and that improves the foraging efficiency of many sea ducks ability to locate and capture prey (Wisden and Bailey 1995, Ross et al. 2005, Bur et al. 2008, Schummer et al. 2008b). This site has an abundance of sea duck prey species, which ducks use to acquire nutrients and fat for surviving winters at Lake Ontario or fueling migration during spring and fall (Ross et al. 2005, Schummer et al. 2008a, b, Schummer et al. 2012).

Spring: During aerial surveys of the lower Great Lakes shorelines of Ontario conducted during 1999 and 2009, the maximum peak abundance of sea ducks at this site was estimated at 117,300 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Long-tailed Duck was among the most common species at this site, with an estimated maximum peak number of 95,500, which represents about 10% of the estimated continental population for this species (NAWMP 2012). Other sea duck species commonly observed at lower estimated maximum peak abundances at this site during spring included Common Goldeneye (10,400), Common Merganser (5,400), Red-breasted Merganser (3,800), Bufflehead (6,900), and White-winged Scoter (460).

Fall: During aerial surveys of the Ontario shorelines of the lower Great Lakes conducted during 1999 and 2009, maximum peak abundance of sea ducks at this site was estimated to be 192,800 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Long-tailed Duck was the most common and abundant species at this site during fall, with an estimated maximum peak abundance of 122,000 birds, which represents about 13% of the estimated continental population (NAWMP 2012). Other species commonly observed at lower maximum estimated peak abundances at this site during fall included White-winged Scoter (23,600), Bufflehead (15,200), Common Goldeneye (12,200), Common Merganser (7,800), and Red-breasted Merganser (3,600).

Winter: During annual aerial waterfowl surveys of the Ontario shorelines of the lower Great Lakes conducted during January 2002–2018, the maximum peak sea duck abundance at this site was estimated to be 156,000 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [MWS]). CBC circles within this site reported a maximum count of 155,200 sea ducks between 1997 and 2015 (National Audubon Society and Bird Studies Canada unpublished data [CBC]). Long-tailed Duck was the most common and abundant species at this site during winter, with a maximum peak abundance of about 148,900 birds counted during the 2002 CBC, representing 15% of the estimated continental population (NAWMP 2012). Other species commonly observed at lower maximum peak abundances at this site during winter included Bufflehead (10,300 [MWS]), Common Goldeneye (7,300 [MWS]), Common Merganser (8,400 [MWS]), Red-breasted Merganser (3,200 [MWS]), and White-winged Scoter (2,600 [MWS and CBC]).

Sensitivities: Waterfowl are sensitive to human disturbance, mostly related to small vessel and/or shipping traffic, during migration and winter periods. Food resource availability and quality could be influenced by industrial, urban, and agricultural pollution and invasive and/or other problematic species. Type E botulism (*Clostridium botulinum*) outbreaks that can kill large numbers of sea ducks and/or waterbirds occur periodically in the lower Great Lakes (Canadian Cooperative Wildlife Health Centre 2003, 2005), particularly during fall migration. Other epizootic disease outbreaks can also occur where large numbers of waterfowl congregate.

Potential Conflicts: Disturbance associated with small vessel and shipping traffic remains a potential conflict at this site. Chemical and oil spills, water contamination, and eutrophication from several sources, including shipping, urban or cottage development, industry, and agriculture can also impact waterfowl. This site has been identified as a candidate area for offshore wind development.

Status: Several Important Bird Areas (IBA) have been designated within this area (http://www.ibacanada.ca/mapviewer.jsp), including Wolfe Island, Pigeon Island, Amherst Island, the Prince Edward County South Shore, and Presqu'ile Provincial Park. The area also includes the Prince Edward Point National Wildlife Area and the Scotch Bonnet and Weller's Bay National Wildlife Areas.

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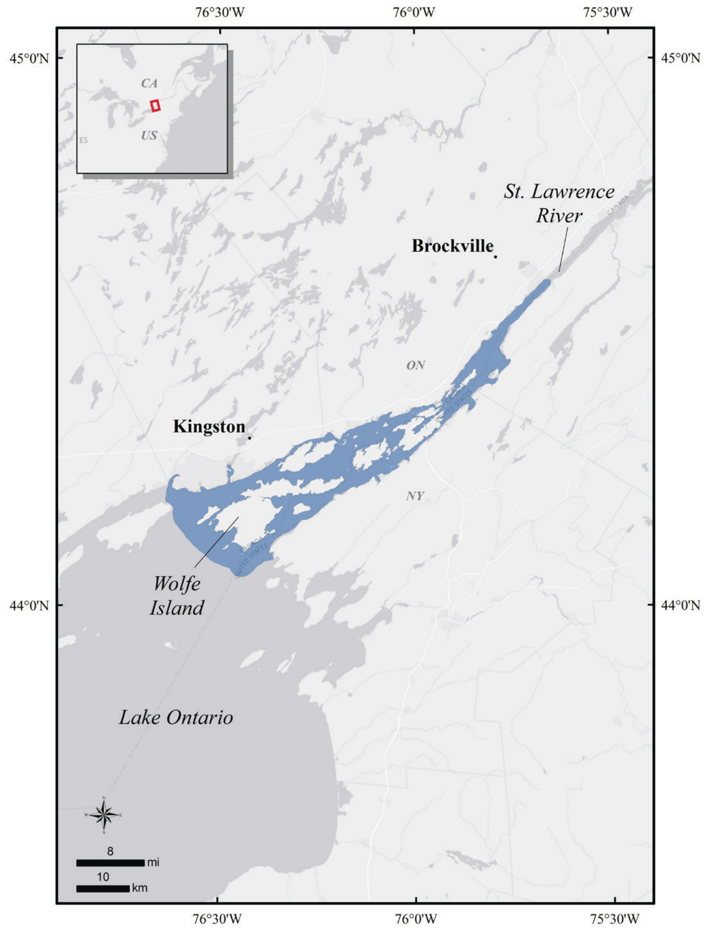
Key Site 77: Upper St. Lawrence River, Ontario



Location: 44°19'19"N, 76°1'26"W

Size: 602 km²

Description: The St. Lawrence River flows northeast from Lake Ontario to the Atlantic Ocean, a distance of about 1200 km, where it forms the Gulf of St. Lawrence. This large river connects the Great Lakes with the Atlantic Ocean and is an important international shipping route. This site is located in the upper portion of the river known as the Thousand Islands – Frontenac Arch region. The Thousand Islands are an archipelago of approximately 1800 islands and numerous shoals within the first 80 km of Canada-U.S. international waters where the river emerges from the northeast corner of Lake Ontario near Wolfe Island and Kingston, Ontario. Specifically, this site includes the Canadian waters of the river extending from the Wolfe Island/Kingston area to Brockville, Ontario. For more detailed information about waterfowl and wetland habitats in the Great Lakes region and the benthic community, limnology, and geomorphology of this part of the St. Lawrence River, see Prince et al. (1992), Lean (2000), Twiss (2007), Farrell et al. (2010), and Marty et al. (2010).

Precision and Correction of Abundance Estimates Presented: Abundance values are based on several sources: (1) Shoreline surveys conducted as part of the Mid-Winter Waterfowl Survey (MWS) (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario) and the Lower Great Lakes Migrant Waterfowl Survey (LGLMWS) (Environment and Climate Change Canada/Canadian Wildlife Service, Ontario. Observed counts were adjusted by species-specific or species group detection rates estimated for aerial fixed-wing surveys by Hodges et al. (2008) for coastal surveys in Alaska. (2) Ground-based estimates made during Christmas bird counts (CBC) (National Audubon Society 2015) from 1997 to 2015. Observed counts (not adjusted for incomplete detection) were derived from summing annual data from CBC circles included within the key site boundaries.

Biological Value: This site is important to several species of sea ducks during spring and fall, but particularly during winter. Long-tailed Duck (*Clangula hyemalis*), White-winged Scoter (*Melanitta deglandi*), Surf Scoter (*Melanitta perspicillata*), Hooded Merganser (*Lophodytes cucullatis*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), Common Goldeneye (*Buecephala clangula*), and Bufflehead (*Buecephala albeola*) have been observed in varying abundances since the 1990s at this site (Appendix 1). Sea duck numbers at this site and others across the lower Great Lakes have increased substantially since the mid-1980s and the early 1990s (Petrie and Schummer 2002). The establishment of dreissenid (zebra) musssels at Lake Erie in the mid-1980s and at Lake Ontario in the early 1990s provided an abundant food source for sea ducks and other diving duck species (Custer and Custer 1996, Schummer et al. 2008a, b). Dreissenid mussels also may provide favorable microhabitats for other important aquatic invertebrate prey items, such as amphipods and chironomids, and they may have improved water quality and clarity that benefits merganser forage fish species, such as gizzard shad (*Dorosoma cepedianum*), emerald shiner (*Notropis antherinoides*), and round goby

(*Neogobius melanostomus*) and improved the foraging efficiency of many sea ducks (Wisden and Bailey 1995, Ross et al. 2005, Bur et al. 2008, Schummer et al. 2008b).

Spring: During aerial surveys of the lower Great Lakes shorelines of Ontario during 1999 and 2000, the maximum peak abundance of sea ducks at this site has been estimated at 12,200 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Common Goldeneye, Common Merganser, and Bufflehead were the most common species at this site; the estimated maximum peak number of each species, respectively, was 5700, 3600, and 2800 individuals. Other sea duck species observed in lower maximum peak estimated abundances at this site during spring included Red-breasted Merganser, Long-tailed Duck, Hooded Merganser, and White-winged Scoter.

Fall: During aerial surveys of the lower Great Lakes shorelines of Ontario during 1999 and 2000, sea duck estimated maximum peak abundance at this site was 9000 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [LGLMWS]). Common Goldeneye and Common Merganser were the most common and abundant species at this site during fall, with estimated maximum peak numbers of about 4800 goldeneyes and 2100 mergansers. Other species commonly observed at lower abundances at this site during fall surveys included Bufflehead, Red-breasted Merganser, Long-tailed Duck, and Hooded Merganser.

Winter: During annual aerial waterfowl surveys of the Ontario shorelines of the lower Great Lakes conducted during January 2002 through 2018, the maximum peak sea duck abundance at this site was estimated at 43,000 birds (Environment and Climate Change Canada/Canadian Wildlife Service unpublished data [MWS]). CBC circles surveyed annually within this site reported a maximum count of about 18,100 sea ducks between 1997 and 2015 (National Audubon Society and Bird Studies Canada unpublished data [CBC]). The largest concentrations of sea ducks, particularly in years when much of the river is frozen, typically occur closest to Lake Ontario where the river originates. Common Merganser, Common Goldeneye, Bufflehead, and Red-Breasted Merganser are among the most common species during this season; maximum peak abundances of those species, respectively, have been estimated at 40,300 (MWS), 4900 (MWS), 2600 (MWS), and 8500 (National Audubon Society and Bird Studies Canada unpublished data [CBC]). Other species observed less regularly on an annual basis and typically at lower maximum peak abundances during winter included Long-tailed Duck (12,200 [MWS]), Hooded Merganser (250 [CBC]), White-winged Scoter (75 [CBC]), Surf Scoter (15 [CBC]), and Black Scoter (26 [MWS]).

Sensitivities: Sea ducks are sensitive to human disturbance, mostly related to small vessel and/or shipping traffic, during migration and winter periods. Food resource availability and quality could be influenced by industrial, urban or cottage development, agricultural pollution, and invasive and/or other problematic species. Type E botulism (*Clostridium botulinum*) outbreaks that can kill large numbers of sea ducks and/or waterbirds occur periodically at the lower Great Lakes (Canadian Cooperative Wildlife Health Centre 2003, 2005), particularly during fall migration. Other epizootic disease outbreaks may be possible where large numbers of waterfowl congregate.

Potential Conflicts: Disturbance associated with small vessel and ship traffic is a potential conflict during spring and fall at this site. Chemical and oil spills and water contamination are possible from several sources, including shipping, urban, industry, and agriculture. Hydroelectric generating capacity/technologies could also be a future potential conflict at this site.

Status: Two areas with conservation designation are located within this site, the Frontenac Arch Biosphere Reserve (part of the UNESCO World Biosphere Reserve program) and St. Lawrence Islands National Park.

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