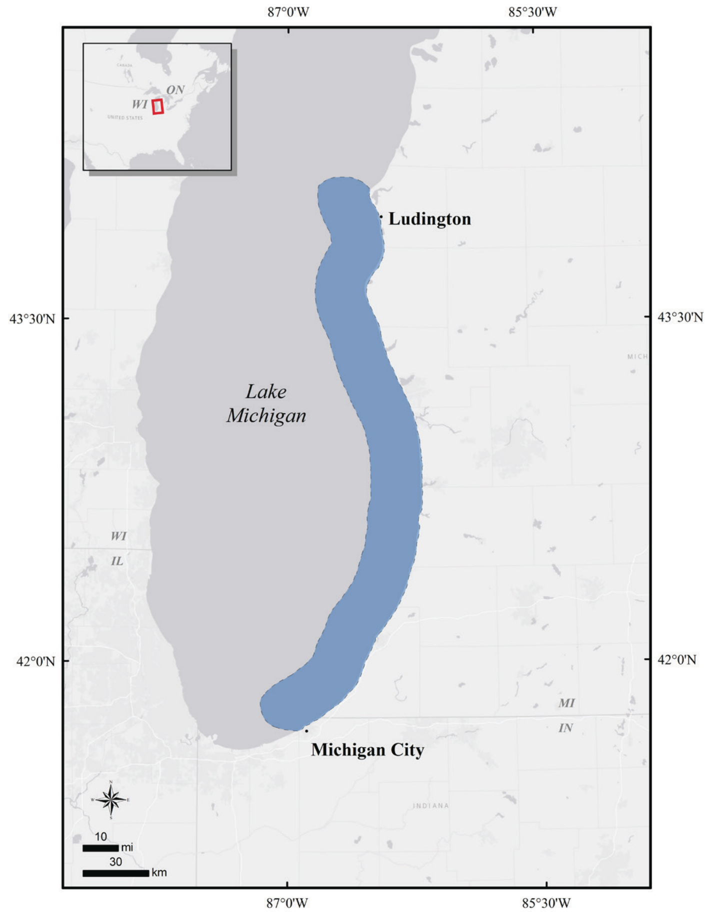
Key Site 71: Southeast Lake Michigan, Michigan and Indiana

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 near-shore 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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