U.S. Atlantic Coast Key Sites

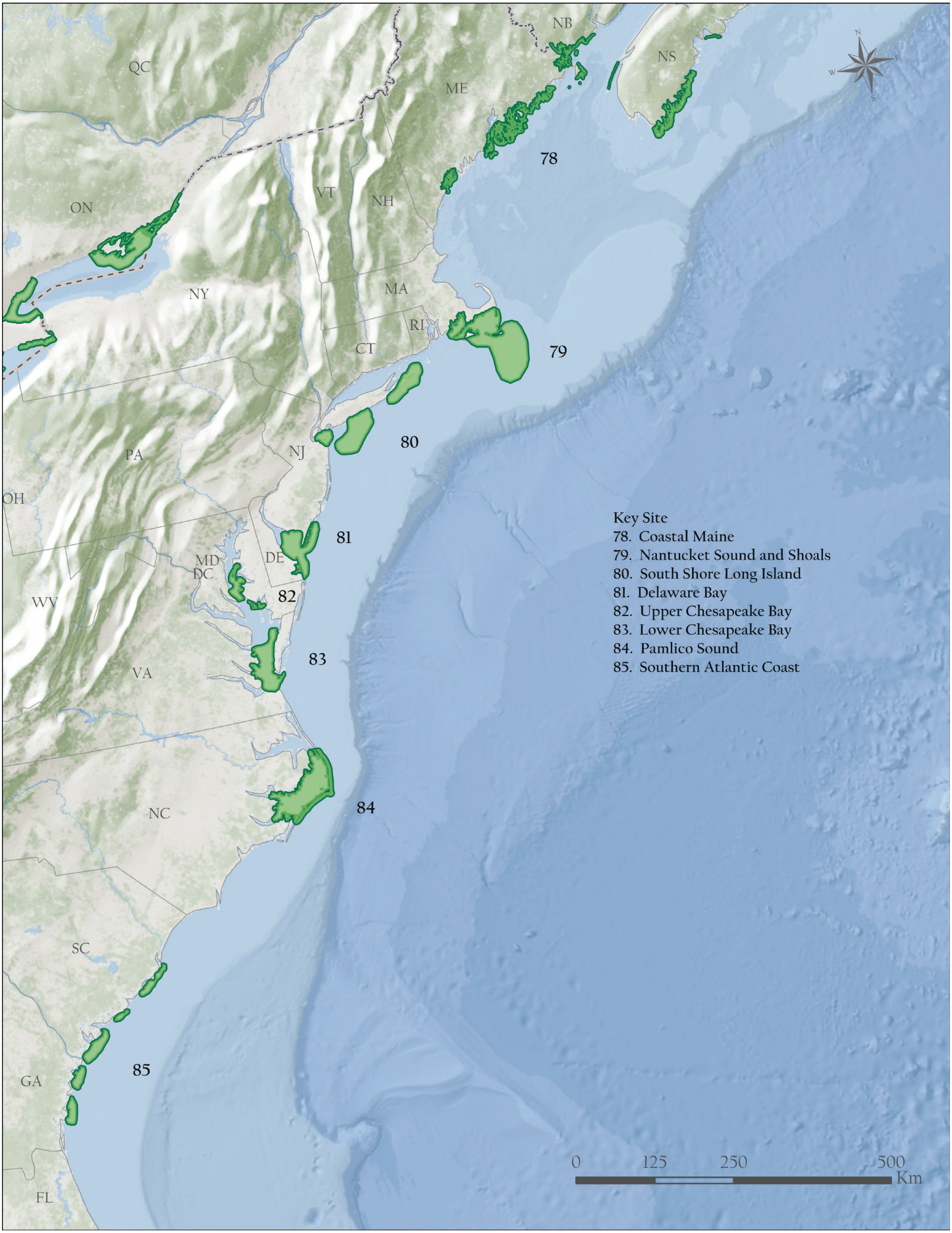


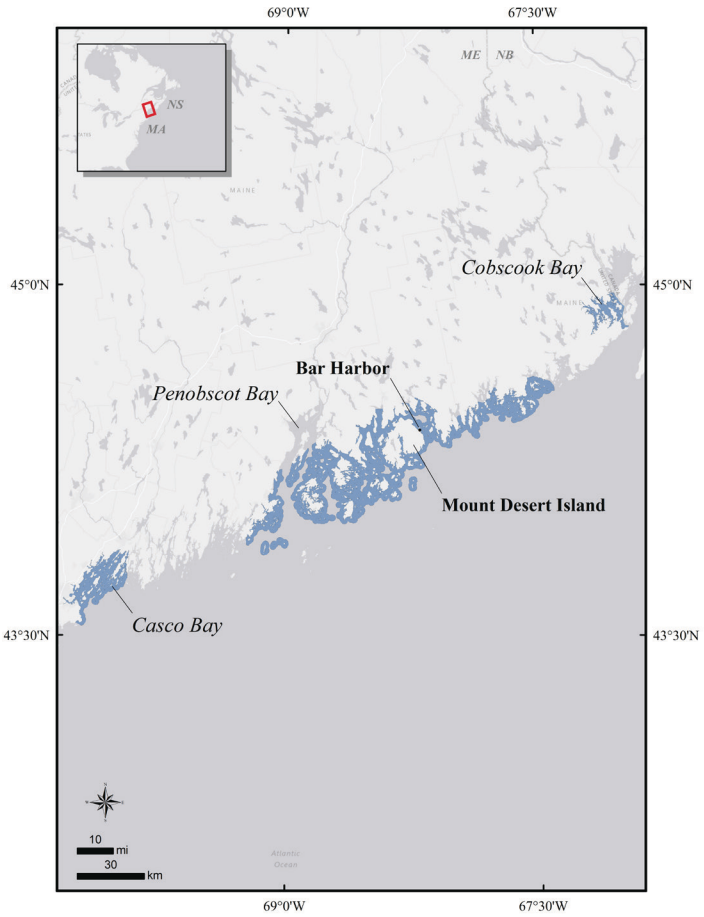
Figure 9. Key habitat sites for sea ducks along the U.S. Atlantic coast.

Key Site 78: Coastal Maine

Location: 44°12'59"N, 68°19'39"W

Size: 1974 km^2

Description: The Coastal Maine key site stretches as a contiguous area from the communities of Jonesport to St. George, and also includes sections of Cobscook Bay to the east and Casco Bay to the west. This area encompasses several bays such as Western Bay, Wohoa Bay, Narraguagus Bay, Dyer Bay, Gouldsboro Bay, Mount Desert Narrows, Frenchman Bay, Blue Hill Bay, Jericho Bay, Isle Au Haut Bay, and east and west Penobscot Bay. Mount Desert Island is the largest island off the coast of Maine. Other islands such as Isle Au Haut, North Haven, Deer Isle, Swan's Island, Sheep Porcupine Island, Ironbound Island, and dozens of smaller islands dot the waters of the coast. Vegetation on the islands is variable, with some islands sparsely vegetated, many treeless, and some grazed by sheep; most of the small islands have no permanent human presence. There are abundant cobble beaches, few sandy beaches, and most of the coast is rugged with small bays, fjords, and inlets. The inlets and narrows that separate the mainland and the coastal islands vary in depth. For example, Frenchman Bay, which separates Bar Harbor and mainland, is approximately 16 km long and 6.4 km wide with depths of 1.8 to 24 m. It includes a deep channel that allows passage for large cruise ships and commercial vessels.



Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on data from the Atlantic Coast Wintering Sea Duck Survey (see Silverman et al. 2012 for methods; also see Methods section in this atlas) and related surveys (Mid-Winter Survey [MWS; Eggeman and Johnson 1989] or Atlantic Marine Assessment Program for Protected Species [AMAPPS 2015]). Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detecting or other biases. Further, abundance estimates do not include the Cobscook Bay section of the key site; therefore, abundance estimates should be considered minimum estimates.

Biological Value: Coastal Maine is an important wintering area for several species of waterfowl. The geography of the coastline includes large intertidal areas that support bivalves, such as blue mussels and crustaceans (Department of Marine Resources: https://www.maine.gov/dmr/science-research/species/bluemussel.html). Mollusks and crustaceans are the most common food item of Common Eider (*Somateria mollissima*), Long-tailed Duck (*Clangula hyemalis*), and scoters (*Melanitta* spp.) (Cantin et al. 1974, Cottam 1939, Krasnov et al. 2009), and blue mussels make up most of their diet in this area, although mussels are becoming less abundant in recent years. Eelgrass beds have expanded greatly since 2007 due to comprehensive restoration projects north of Bar Harbor (Kidder et al. 2015). Eelgrass beds provide excellent habitat for aquatic insects, crustaceans, and mollusks. The varying depths of the bays and inlets accommodate benthic feeders such as White-winged Scoters (*Melanitta deglandi*), which can dive up to 20 m (Brown and Fredrickson 1997) and Long-tailed Ducks (Schorger 1947). The intertidal areas attract shallow divers such as scaup (Kessel et al. 2002) and Surf Scoters (*Melanitta perspicillata*) (Cottam 1939). Silverman et al. (2012; see Methods section in this atlas) estimated a

minimum of 3800 scoters, 33,000 Common Eiders, and 10,000 Long-tailed Ducks in the key site.

Sensitivities: The coast of Maine is vulnerable to the same host of threats as other coastal habitat along the Atlantic coast. Shipbuilding, commercial fishing, and tourism are important economic activities on the coast. Commercial shipping creates opportunities for oil spills, pollution, and introduction of invasive species. During the summer, intense tourist and recreational activity may disturb eelgrass beds and wildlife. Commercial fishing for blue mussels via dragging destroys eelgrass beds and can overharvest local stocks (Neckles et al. 2015). Aquatic invasive species are another common threat in this area because of boating and commercial activities, which carry unwanted species on their hulls. The coastal waters of Maine are warming because of climate change; the increase in water temperature allows invasive species such as the green crab to flourish and has negative impacts on eelgrass beds and invertebrate communities important to sea ducks and other waterbirds (Neckles 2005). The apparent decline of blue mussel beds in Maine is likely a major factor in the declines in wintering eiders and scoters. Climate change also increases the acidification of the coastal oceans, reducing the abundance and densities of soft-shell clams, a valuable local resource.

Potential Conflicts: Conflicts with commercial shipping, commercial fishing, and tourism may become more common as population increases, and tourism accounts for a large part of the local economy. One of the most common conflicts in this area is between the mussel fishing industry and eelgrass restoration projects. Several boat launches around the area can serve as introduction points of invasive species. More recently, a wind energy initiative in the Gulf of Maine may create conflicts with sea duck use of this key site.

Status: Coastal Maine is a mosaic of lands under various land ownership, including private, commercial, and residential developments. Land managers include the Maine Department of Inland Fisheries and Wildlife, Maine Bureau of Parks and Lands, National Park Service, Nature Conservancy, U.S. Fish and Wildlife Service, and other nongovernment organizations and municipalities. The previously small fishing communities on the mainland and on the islands are growing into large towns and increasing pressure on the local resources. No designated Marine Protected Areas currently exist within the key site. Commercial fisheries are regulated and monitored by the State of Maine Department of Marine Resources (https://www.maine.gov/dmr/laws-regulations/index.html). This area is open to commercial shipping and to recreational boating.

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American Common Eiders roosting. Photo: Christine Lepage.

Key Site 79: Nantucket Sound and Shoals, Massachusetts

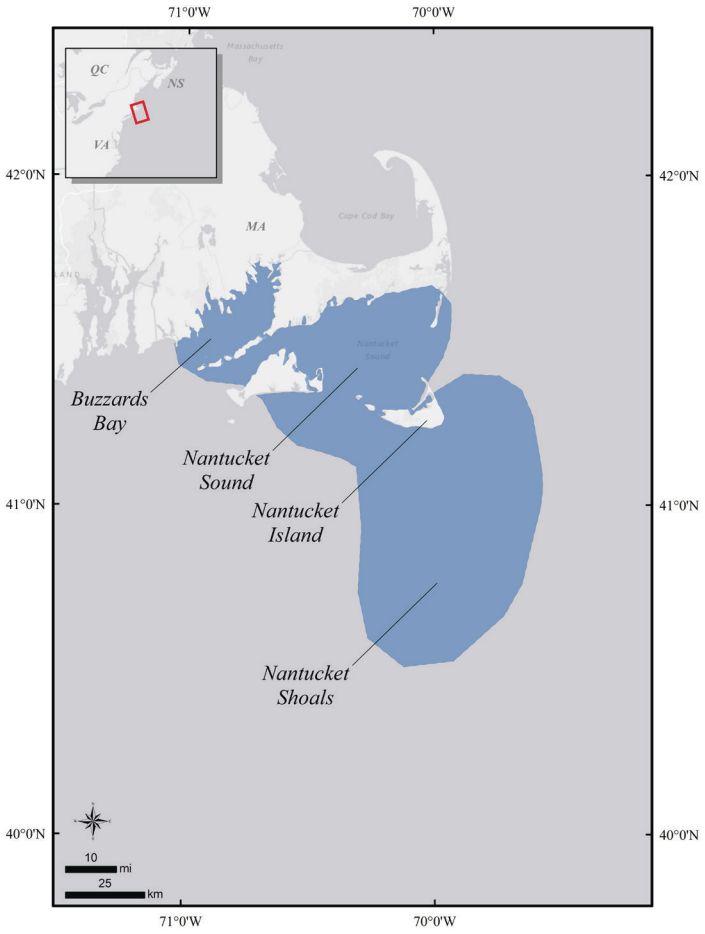
Location: 41°9'35"N, 70°19'57"W

Size: 7855 km^2

Description: Nantucket Sound is located between Cape Cod, Martha's Vineyard, and Nantucket Island. It is approximately 48 km long and 40 km wide. The sound is located at the confluence of the cold Labrador currents and the warm Gulf Stream, which creates a coastal habitat broadly representing the southern extent of northern Atlantic marine species and the northern extent of Mid-Atlantic marine species. This area also includes the Nantucket Shoals, a 2000 km^2 expanse of shallow (4 to 35 m deep), sandy-bottom habitat extending from Nantucket Island eastward for 37 km and southwestward for 64 km. In some places water depth can be as shallow as 1 m, though depth is unpredictable due to shifting bottom sediments caused by strong currents. Air temperatures range from a mean high of 3°C to a mean low of –5°C in winter and a mean high of 26°C to a mean low of 17°C in summer.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on data from the Atlantic Coast Wintering Sea Duck Survey, January to March 2009–2014 (see Silverman et al. 2012 for methods; also see Methods section in this atlas) and related surveys (Mid-Winter Survey [MWS; Eggeman and Johnson 1989] or Atlantic Marine Assessment Program for Protected Species [AMAPPS 2015]). Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detection or other biases. Abundance estimates should, therefore, be treated as minimum estimates.

Biological Value: Expansive seagrass beds in Buzzards Bay and Nantucket Sound provide critical nursery habitats for fish, shellfish, and crustaceans (Costello and Kenworthy 2011). The shallow waters of Nantucket Shoals create perfect conditions for seasonal phytoplankton blooms, which serve as the base of the marine food web (Saba et al. 2015). The shoals support high concentrations of benthic amphipods and mollusks (Avery et al. 1996), which are important seasonal prey items for several sea duck species (Brown and Fredrickson 1986, Benoit et al. 1996, Haszard and Clark 2007, White et al. 2009).



Nantucket Shoals have been identified through extensive aerial surveys as having a high density of wintering sea ducks and other sea birds (Veit et al. 2016). Silverman et al. (2012; see Methods section in this atlas) estimated a minimum of 73,000 scoters (*Melanitta* spp.), 117,000 Common Eiders (*Somateria mollissima dresseri*), and 159,000 Long-tailed Ducks (*Clangula hyemalis*) in the key site.

Winter distributions of Long-tailed Duck and White-winged Scoter (*Melanitta deglandi*) have been found to closely associate with prey aggregations at Nantucket Shoals (White and Veit 2020). The highest densities of White-winged Scoter along the Atlantic coast occur between Cape Cod and Long Island Sound (Silverman et al. 2013), accounting for approximately 94% of the entire U.S. Atlantic coast wintering population (Silverman et al. 2012). Similarly, a high proportion of scoters radio-tagged during both the wintering and molting periods in southern New England and the St. Lawrence estuary (Quebec) have spent roughly half of the annual cycle in the vicinity of Nantucket Sound and the shoals

(Meattey et al. 2018, Lepage et al. 2020). Aerial surveys from 2011 to 2015 documented high densities of White-winged Scoter along the western edge of the Nantucket Shoals during the spring period (Veit et al. 2016). Several White-winged Scoters tagged with satellite transmitters during the winter period staged at Nantucket Shoals for one to two weeks before spring departure (Meattey et al. 2019). This suggests that the shoals are a seasonally important area for sea ducks, likely due to high densities of high-quality prey (e.g., the pelagic amphipod *Gammarus annulatus*) that sea ducks may rely on for reserve-building before long-distance migration (White et al. 2009). Annual Christmas Bird Counts from Nantucket Island commonly estimate hundreds of thousands of Long-tailed Duck commuting between nighttime roosts on Nantucket Sound and foraging areas on Nantucket Shoals (White et al. 2009). Sea ducks commonly form extensive foraging rafts around Nantucket, numbering in the thousands to tens of thousands of birds. A recent study also suggests that Long-tailed Duck and White-winged Scoter distributions on Nantucket Shoals may be associated in such a way that each species may benefit from noting the foraging locations or aggregations of the other, even though there is little overlap in preferred prey species (White and Veit 2020).

Sensitivities: Nantucket Sound, Nantucket Shoals, and Buzzards Bay are vulnerable to the same host of threats as other Atlantic coastal habitats. Human population growth in Massachusetts has caused an increase in nutrient runoff and subsequent eutrophication events in the bays. These events result in massive fish die-offs and large-scale declines in seagrass meadows (Short and Burdick 1996), which can be important habitats for sea ducks. Commercial shipping also increases the chances of introduction of non-native species and accidental pollution events. For example, first introduced in New Jersey in 1988 through the release of ballast water from a commercial vessel, the invasive Japanese Shore Crab is now common in Buzzards Bay and Nantucket Sound (Ledesma and O'Connor 2001). Climate change also has multiple effects on this region. Sea-level rise is a concern in areas of low elevation near the coast, while changes in water circulation patterns due to slowing of the Gulf Stream may significantly affect nutrient turnover and the overall productivity of the region (Bryden et al. 2005).

The fragile benthic community of Nantucket Shoals and the shallow water make this region particularly sensitive to ecologically destructive fishing methods and climate change. Coastal tourism is a vital part of the year-round economy, and boating is an important recreational activity. Recreational boating can cause resuspension of bottom sediments (Hansen et al. 2019), which can decrease water clarity and negatively impact seagrass productivity (Short and Wyllie-Echeverria 1996, Koch 2002). Coastal development and population growth has significant impacts on water quality, increasing incidences of coastal nutrient loading and nonpoint source pollution (Center for Coastal Studies 2005).

Potential Conflicts: Buzzards Bay and Nantucket Sound fall within a region of heavy commercial activities, recreational beaches and fishing spots, residential development, and state and federal land. Such diverse land ownership creates potential conflicts in resource use and conservation. The largest port in Buzzards Bay is home to a fishing fleet with approximately 270 vessels. Extensive sandy beaches in Cape Cod and Buzzards Bay, as well as the islands of Martha's Vineyard and Nantucket, attract thousands of tourists annually. There are currently several state forests, national wildlife refuges, and other protected lands, but rapid human population growth and expanding development is encroaching on these areas and limiting wildlife habitat.

Nantucket Shoals is rich with natural resources, and potential conflicts arise among competing interests. Oil and gas exploration has historically occurred in this region and the growing demand for energy will likely increase pressure on state and federal agencies to sign new leases for these activities in the shoals, although drilling for oil and gas in federal waters off the Atlantic coast is currently banned until 2022. There are currently approximately 4000 km^2 of commercial offshore wind energy leases and planning areas off the coasts of Massachusetts, Rhode Island, and New York (BOEM 2022). Several of these lease areas have been designated in the waters south of Nantucket Sound and adjacent to Nantucket Shoals. Recent tagging studies suggest that current offshore wind energy lease areas in southern New England do not overlap significantly with White-winged Scoter high-use wintering areas (Meattey et al. 2019). However, White-Winged Scovers often traversed proposed wind energy areas, thus the potential

for displacement and obstruction could have compounding effects on the ability of sea ducks to use their entire wintering area (Meattey et al. 2019).

Status: There are several currently protected areas in and around Buzzards Bay and Nantucket Sound. Buzzards Bay is a designated estuary of significance under the National Estuary Program (Center for Coastal Studies 2005). The bay has a comprehensive conservation and management plan that is carried out by several state agencies, federal agencies, and two nonprofit organizations. The Buzzards Bay Coalition is a nongovernment organization that works to protect the area from pollution and degradation and restore ecosystem function and wildlife habitat. Regulations on fishing and trawling are strict, and boating can be limited in certain times of the year to protect marine mammals. Commercial fishing regulations and trawling regulations vary annually, and periodic closures of certain areas is becoming more common as incidences of algal blooms increases in Cape Cod Bay, Buzzards Bay and Nantucket Sound.

Existing ocean protection measures around Nantucket Shoals include the Great South Channel Critical Habitat Area and the Fishery Closure Area to the northwest of the shoals. However, nearshore areas and the shallow waters of Nantucket Shoals are not protected from development. At the federal level, there are several existing management and/or protection options for coastal and marine areas in the Nantucket Shelf region (Recchia et al. 2001), but none of these directly encompass Nantucket Shoals. The critical habitat areas are managed by the federal government and do not necessarily restrict development, but rather focus on habitat critical to the endangered right whale. Regulated or limited activities include marine discharge or dumping, nonrenewable resource extraction, dredging, and cable-laying (Recchia et al. 2001). The Fishery Closure Area east of Nantucket Shoals was established to rebuild the overfished stocks of cod, haddock, and flounder. Other seasonal closures, gear restrictions, and habitat protections are described in Center for Coastal Studies (2005).

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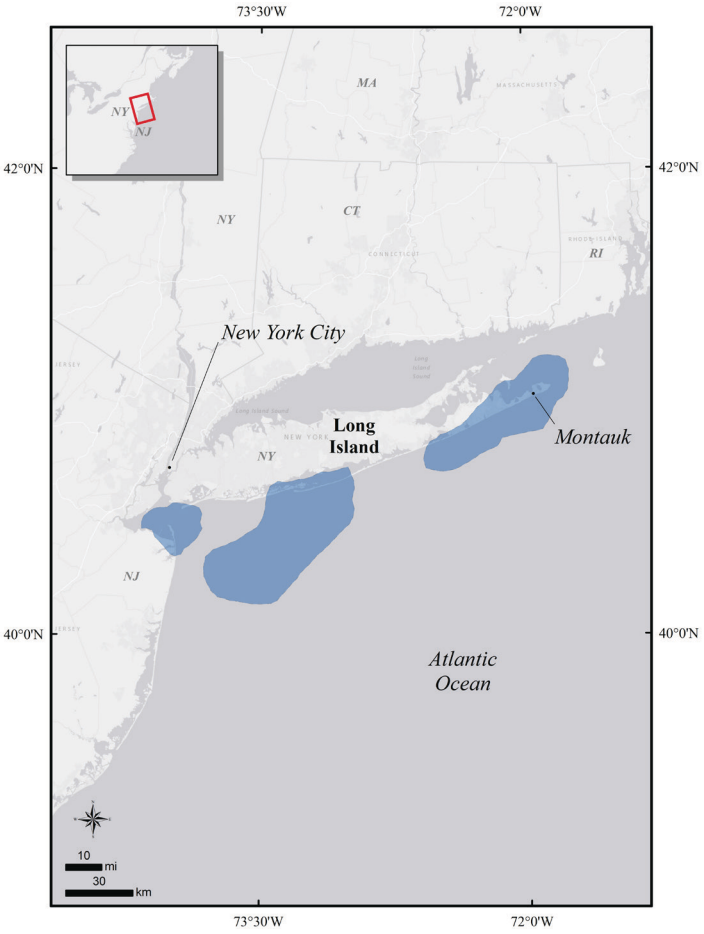
Key Site 80: South Shore Long Island, New York

Location: 40°42'50"N, 73°0'32"W

Size: 4723 km^2

Description: This key site includes the waters south of Long Island that include Lower New York Bay, Sandy Hook Bay, the deep waters of the New York/New Jersey Bight just south of Long Island, the Great South Bay and the area south, Shinnecock Bay and Napeague Bay, and the area surrounding Montauk. The barrier islands along the Atlantic Ocean and the estuary's shallow interconnected bays and tidal tributaries provide highly productive habitat. Water quality in the estuary is crucial to the health of the commercial and recreational fishing and shellfish industries. This region is highly populated with several large urban centers, including Staten Island, Brooklyn, Queens, Hempstead, and many other towns along the Long Island southern coast. Water depths range between <1 m to 30 m, but depth increases rapidly near the New York/New Jersey Bight. Air temperatures in winter range from a mean high of 3°C to a mean low of –4°C and a mean high of 28°C to a mean low of 21°C in the summer.



Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on data from the Atlantic Coast Wintering Sea Duck Survey (see Silverman et al. 2012 for methods; also see Methods section in this atlas) and related surveys (Mid-Winter Survey [MWS; Eggeman and Johnson 1989] or Atlantic Marine Assessment Program for Protected Species [AMAPPS 2015]). Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detection or other biases. Abundance estimates should, therefore, be treated as minimum estimates.

Biological Value: The cool waters south of Long Island are open to the Atlantic Ocean and are highly saline. Several large stretches of seagrass beds can be found in the Great South Bay, Moriches Bay, and Shinnecock Bay. However, where there used to be more than 200,000 acres of underwater meadows, there now remains approximately 1% of this productive habitat. These remaining beds serve as critical habitats for fish, shellfish, and crustaceans. Blue mussel, Atlantic surf clam, bay scallop, and eastern oyster are among the most studied and surveyed, but ribbed mussel, hard clam, black sandshell, and eastern pearlshell are also important bivalve species (New York Department of Environmental Conservation 2005). Wintering waterfowl congregate in large concentrations in the bays and in open water south of Long Island barrier islands. Silverman et al. (2012; see Methods section in this atlas) estimated more than 56,000 sea ducks use this area, primarily scoters (*Melanitta* spp.; minimum 16,700) and Long-tailed Duck (*Clangula hyemalis*; minimum 15,200). Areas of particular importance for wintering sea ducks include the New York/New Jersey Bight, the Great South Bay, and around Montauk on the east end of Long Island.

Sensitivities: Tidal marshes and other coastal habitats of Long Island are threatened by rising seas and warming sea surface temperatures resulting from climate change (Tiner et al. 2006, Anisfeld and Hill 2011). Changes in the salinity and temperature of water will have dramatic effects on the already stressed sea grass habitat (Short and Neckles 1999). Development and continued population growth on

the coast also threaten water quality. Nitrogen input from runoff causes hypoxic events, killing aquatic vegetation, fish, and other macroinvertebrates. Due to the large number of industrial facilities and power plants, there is also risk of increasing water temperatures from heated effluents discharge, causing die-offs of sea grasses (Thayer et al. 1984). Shellfish harvest in the nineteenth century coupled with disease and changing hydrologic patterns caused a significant decline in oysters (New York Department of Environmental Conservation 2005). Commercial and recreational boating in the bays on the southern coast creates opportunities for introduction of invasive species. Invasive species such as the Asian shore crab, Japanese shore crab, and colonial ascidians have already invaded the marine habitats of Long Island and are negatively affecting the sea floor habitat and coastal habitats and displacing native species (Lohrer and Whitlatch 1997, Kraemer et al. 2007, Mercer et al. 2009).

Potential Conflicts: Development pressure and high recreational and commercial use of the coastal zone may displace sea ducks or impact benthic resources important to sea ducks. Industrial activities on the coast contribute to marine pollution and hypoxic events, which result in large die-offs of seagrass, fish, and other species. Recreational boating traffic is common along the southern coast of Long Island, especially in areas like the Great South Bay, Moriches Bay, and Shinnecock Bay, as these are popular tourist destinations. Potential conflicts exist between the shellfish industry and bivalve recovery efforts. The Long Island Shellfish Recovery Project aims to restore degraded and destroyed clam and oyster beds throughout the waters of Long Island. However, demand for shellfish products continues to increase as populations in nearby urban areas grow. Industrial activities on the coast contribute to marine pollution and hypoxic events, which result in large die-offs of seagrass, fish, and other species. One offshore wind developer is proposing a wind farm that, if approved, would span 80,000 acres in the Atlantic Ocean off Long Island's South Shore, with its closest point to land being 22.5 km south of Long Beach and Jones Beach (NROC 2022). Additional wind planning areas are under consideration in the NY Bight area (BOEM 2022). These proposed developments threaten migratory birds and marine mammals, including an area with high numbers of wintering sea ducks. There are currently no marine protected areas or fishing exclusion zones in this region and as human populations on the coast continue to grow, so does the pressure on the natural resources.

Status: There are few state or federally protected areas in this key site. Among the exceptions are Fire Island National Seashore, Jones Beach Park, Heckscher State Park, and Hither Hills Woods Preserve and State Park. In 1993, the Long Island South Shore Estuary Reserve Act was enacted to establish the Long Island South Shore Estuary Reserve that focuses on the preservation, protection, and enhancement of the natural, recreational, economic, and educational resources of the reserve. However, the reserve does not include areas of the Lower New York Bay, Sandy Hook Bay, and the waters around Montauk. There are local restrictions to fishing, shellfishing, or commercial and recreational boating traffic throughout the area.

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Key Site 81: Delaware Bay, Delaware and New Jersey

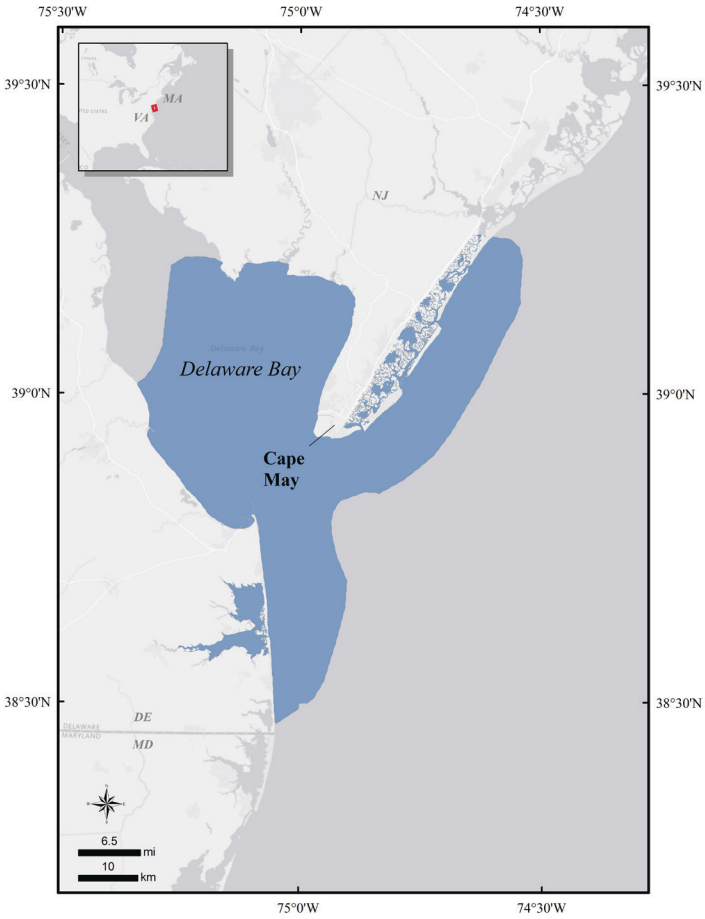
Location: 38°53'23"N, 75°0'21"W

Size: 2550 km^2

Description: Delaware Bay is the estuary outlet of the Delaware River. It lies between the states of New Jersey and Delaware. The coastal marshes and shoreline provide diverse habitats for migratory birds. The benthic habitats are also highly diverse in their physical characteristics. Shallow submerged mudflats, rippled sand flats, rocky hard-bottom habitats, silty and sandy shoals, shellfish beds, and tubeworm reefs are all present in Delaware Bay (Kreeger et al. 2010). Much of the coastline is undeveloped, with only a few small towns along the coast. Depths range from as shallow as 0.6 m near the shore to over 30 m near the mouth of the bay where it spills into the Atlantic Ocean.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on data from the Atlantic Coast Wintering Sea Duck Survey (see Silverman et al. 2012 for methods; also see Methods section in this atlas) and related surveys (Mid-Winter Survey [MWS; Eggeman and Johnson 1989] or Atlantic Marine Assessment Program for Protected Species [AMAPPS 2015]). Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detecting or other biases. Abundance estimates should, therefore, be treated as minimum estimates.

Biological Value: Delaware Bay has a rich benthic community. There are over 75 species of mollusks (e.g., clams, scallops, snails, etc.) and more than106 species of arthropods (e.g., crabs, shrimp, etc.) and many other annelids and echinoderms (Delaware Department of Natural Resources and Environmental Control 2015) that constitute important foods for sea ducks. Blue mussel beds provide valuable nearshore habitat, attracting thousands of Greater and Lesser Scaup, Surf Scoter (*Melanitta perspicillata*), Black Scoter (*M. americana*), and Long-tailed Duck (*Clangula hyemalis*). During some years in February, large concentrations of dwarf surf clams near the mouth of the Delaware Bay attract thousands of scoters. Silverman et al. (2012; see Methods section in this atlas) found Black Scoter and Surf Scoter present in high densities with an



estimated minimum of 28,000 scoters (*Melanitta* spp.). Significant numbers of scoters are present off Cape May during migration. The lagoon areas of the Atlantic Coast of New Jersey and Delaware (i.e., the small, shallow bays landward of the barrier islands) harbor tens of thousands of Bufflehead (*Bucephala albeola*) and Red-breasted Merganser (*Mergus serrator*) but very few scoters and Long-tailed Ducks (T. Nichols, New Jersey Department of Environmental Protection, pers. comm.). Scoters and Long-tailed Ducks only occur in significant numbers east, or seaward, of the barrier islands.

Sensitivities: Delaware Bay is a major shipping channel in the eastern United States. Therefore, heavy commercial traffic can disturb wildlife habitat and increase the chance of oil spills (NOAA 2021). Bivalve species in the Delaware Bay are particularly sensitive to climate change. Warming sea-surface temperatures are causing outbreaks of epizootics in oysters and can decimate entire reefs (Cook et al. 1998). Overharvest of oysters and other mussels has also occurred in the past and can cause collapses of

the bivalve communities on which sea ducks rely. Shipping also poses a high risk of invasive species. The spread of the Asian shore crab has already been documented (Epifanio et al. 2013). These non-natives can drastically change the benthic community and outcompete other native species such as the fiddler crab.

Potential Conflicts: The Delaware estuary is one of the nation's largest petrochemical centers, and the potential for oil spills is an ever-present threat. Direct threats from the energy production industries are associated with cooling water intakes and discharges (Delaware Department of Natural Resources and Environmental Control 2015). There is an active lease area for offshore wind turbines located offshore of the mouth of Delaware Bay and this key site, with additional planning areas under consideration (BOEM 2021). Offshore sand mining occurs in the Delaware Bay and Atlantic Ocean and can have long-term effects on benthic habitats. An increase in the volume and relative size of ship traffic is expected in the Delaware Bay as navigation channels continue to be deepened.

Status: Several of the rivers and streams that flow into Delaware Bay have protected salt marsh bordering the bay. These marshes serve as breeding grounds for many aquatic species. Additionally, the Delaware Bay shore has been protected by the Delaware Coastal Zone Act for the past 40 years, and more than half of the bay-shore acreage remains undeveloped. At the mouth of Delaware Bay, the Carl N. Shuster, Jr. Horseshoe Crab sanctuary was established in 2001. The area is meant to protect the spawning population of horseshoe crab. Inland on the western shore of the bay are Bombay Hook and Prime Hook National Wildlife Refuges. On the eastern shore are Egg Island and Heislerville Wildlife Management areas. The Delaware Bay shore is also protected by numerous state wildlife areas, including, from north to south, Augustine Wildlife Area, Cedar Swamp Wildlife Area, Woodland Beach Wildlife Area, Little Creek Wildlife Area, Ted Harvey Conservation Area, Milford Neck Wildlife Area, Prime Hook Wildlife Area, and also Cape Henlopen State Park.

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Key Site 82: Upper Chesapeake Bay, Maryland

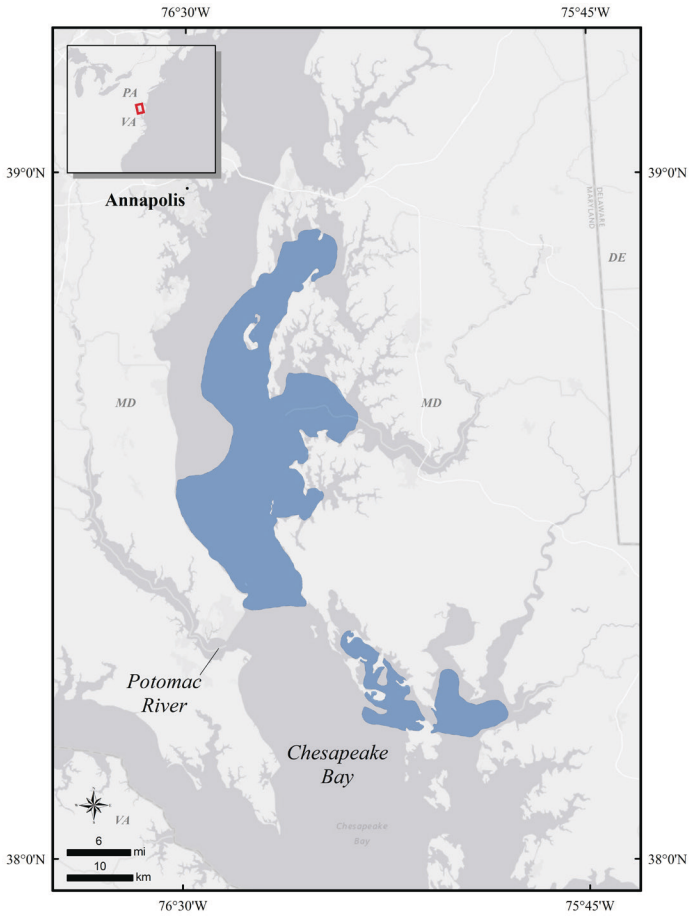
Location: 38°34'14"N, 76°21'29"W

Size: 963 km^2

Description: Chesapeake Bay is the largest estuary in the United States and the third largest in the world. It is more than 320 km long, stretching from Havre de Grace, Maryland, to Virginia Beach, Virginia (Schubel and Pritchard 1986). The bay can be subdivided into upper and lower Chesapeake Bay, because benthic communities and salinity regimes differ substantially. The upper portion of the Bay is located within Maryland and stretches to approximately the confluence of the Potomac River (Schubel and Pritchard 1986). Large islands such as Hart-Miller Island, Pooles Island, and Kent Island dot the upper reaches of the bay. The bay is relatively shallow with an average depth of 6.46 m. Annapolis, a major port city and a naval shipyard, is located on the western bank of the upper bay. The bay is fed by three large rivers: the Susquehanna, Potomac, and James, which provide more than 80% of the fresh water to the bay. This is a highly populated area, with major cities such as Washington, D.C., and Baltimore, Maryland, lying within the watershed. Salinities range from 0 to 15 ppt in the upper bay where many eelgrass beds are found. Average water temperatures in the bay range from a mean of 4°C in the winter to a mean of 24°C in the summer.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on data from the Atlantic Coast Wintering Sea Duck Survey (see Silverman et al. 2012 for methods; also see Methods section in this atlas) and related surveys (Mid-Winter Survey [MWS; Eggeman and Johnson 1989] or Atlantic Marine Assessment Program for Protected Species [AMAPPS 2015]). Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detection or other biases. Abundance estimates should, therefore, be treated as minimum estimates.

Biological Value: Extensive grass beds (e.g., eelgrass) support a huge diversity of bivalves and crustaceans (Seitz et al. 2006), which are an important food source for scoters (*Melanitta* spp.) and Long-tailed Ducks (*Clangula hyemalis*) (Cottam 1939). Millions of waterfowl use the Chesapeake Bay as



their migration stopover and wintering site; the most prominent sea duck species are scoters and Long-tailed Duck. Silverman et al. (2012; see Methods section in this atlas) estimated a minimum of 19,300 sea ducks, including 4400 wintering scoters and more than 5000 wintering Long-tailed Ducks in the upper reaches of the bay. Eastern Bay, the lower Choptank and Nanticoke Rivers, and Fishing Bay are especially important to sea ducks at this site.

Sensitivities: Chesapeake Bay is a major commercial shipping and naval cruiser waterway. Heavy commercial traffic can disturb local wildlife and their habitats. Areas around Chesapeake Bay are highly populated, and the expansion of urban landscapes increases incidents of pollution, nutrient runoff, and sedimentation in the bay. Eutrophication can be a serious problem with adverse effects on fisheries and oyster reefs (Kemp et al. 2005). Climate change may also have drastic impacts on the health of the bay. Extensive tidal marshes, which have served as effective nutrient buffers along the bay margins, are now being lost with rising sea level. In addition, in drier

years the decreased inflow of fresh water from rivers can drastically alter the salinity gradients, causing a decline in certain species of submerged aquatic vegetation (Kemp et al. 2004). Warming water temperatures can cause massive die-offs of eelgrass beds and oyster reefs (Cook et al. 1998). Introduction of invasive species such as zebra mussels is also more common as this is a high-traffic shipping channel and tourist location; their spread is exacerbated by increasing water temperatures (Setzler-Hamilton et al. 1995) as a result of climate change.

Potential Conflicts: There are many potential conflicts in the upper reaches of the Chesapeake Bay because this area is highly populated. There is an increasing demand for more boat ramps and waterway access areas, which can increase incidence of invasive species introductions that may alter the prey base for sea ducks. Commercial fishing, crabbing, and oyster economies have seen significant declines due to overharvest since the early nineteenth century (Rothschild et al. 1994, Sharov et al. 2003). Declining bivalve communities due to eutrophication, warming water temperatures, and competition with invasive species can decrease the quality of habitat for wintering sea ducks.

Status: There is a significant amount of protected land in the upper Chesapeake Bay. Most of the land is private and under conservation easement, but there are also federal and state lands such as the Chesapeake Marshlands National Wildlife Refuge Complex, Elk Neck State Park, and Susquehanna State Park, and numerous state wildlife areas (Chesapeake Bay Program 2019). Land and water below the mean high-tide mark is owned and managed by the State of Maryland, with a few exceptions. There are also significant efforts to identify and protect watersheds that are critical to the water quality of the bay. Among the most critical of these is the area surrounding Chesapeake Marshlands National Wildlife Refuge Complex (Chesapeake Bay Program 2019). The Southern Dorchester County Important Bird Area is within this key site. The protection and health of the Chesapeake Bay is closely monitored by the Chesapeake Bay Program (2019).

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Key Site 83: Lower Chesapeake Bay, Virginia

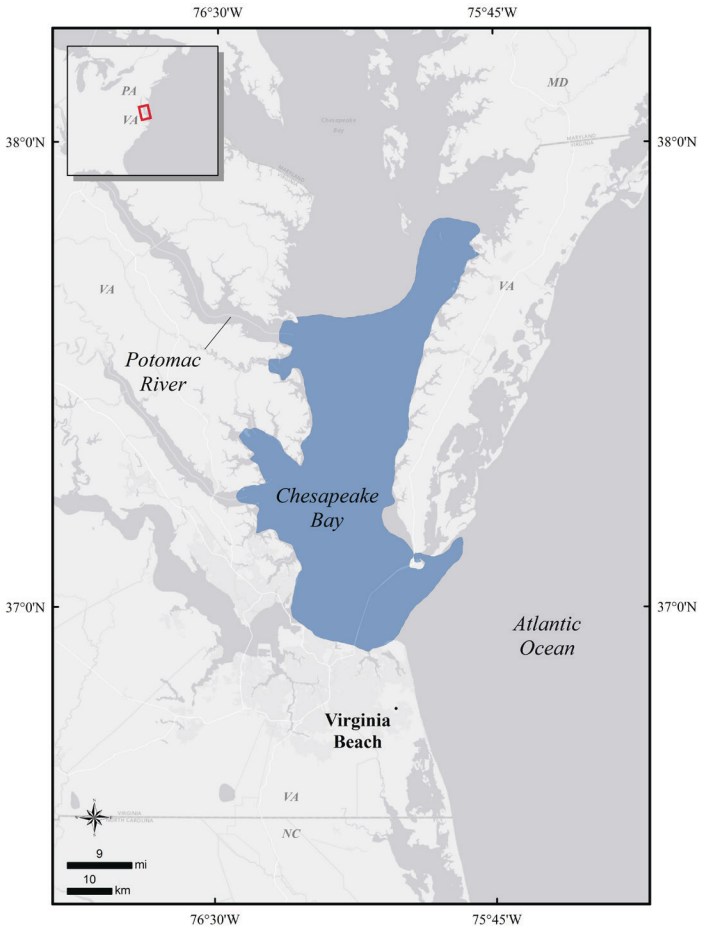
Location: 37°23'41"N, 76°5'51"W

Size: 2655 km^2

Description: Chesapeake Bay is the largest estuary in the United States and the third largest in the world. It is more than 320 km long, stretching from Havre de Grace, Maryland, to Virginia Beach, Virginia (Schubel and Pritchard 1986). The bay can be subdivided into upper and lower Chesapeake Bay because benthic communities and salinity regimes differ substantially. The lower portion of the bay stretches from Potomac River to Virginia Beach at the mouth of the bay in the Atlantic Ocean. The lower reach is dotted by several large islands such as Bloodsworth, Smith, and Tangier Islands. The bay is relatively shallow with an average depth of 6.46 m, and lower bay salinities range from 15 to 29 ppt. The bay receives about half of its water volume from the Atlantic Ocean in the form of saltwater. Large rivers such as the Potomac, Rappahannock, York, and James Rivers contribute millions of gallons of fresh water to the lower reaches of the bay (Chesapeake Bay Program 2019). This is a highly populated area with large cities such as Richmond on the James River and Norfolk at the mouth of the bay. Air temperatures range from a mean high of 6°C to a mean low of –2°C in the winter and a mean high of 30°C to a mean low of 22°C in the summer.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on data from the Atlantic Coast Wintering Sea Duck Survey (see Silverman et al. 2012 for methods; also see Methods section in this atlas) and related surveys (Mid-Winter Survey [MWS; Eggeman and Johnson 1989] or Atlantic Marine Assessment Program for Protected Species [AMAPPS 2015]). Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detection or other biases. Therefore, abundance estimates should be considered minimum estimates.

Biological Value: During winter, this area supports 87 different species of waterbirds and 29 species of waterfowl (Chesapeake Bay Program 2019). The seagrass beds (e.g., eelgrass and widgeon grass) support a huge diversity of bivalves and crustaceans (Seitz et al. 2006), which are an important food source for scoters (*Melanitta* spp.) and Long-tailed Duck (*Clangula hyemalis*) (Cottam 1939), which are the most common sea duck species wintering in the area. Silverman et al. (2012; see Methods section in this atlas) estimated a minimum of 40,000 sea ducks, including 31,000 wintering scoters and more than 4000 wintering Long-tailed Ducks in the lower reaches of the bay. Important features for sea ducks in this key site are relatively shallow areas in and around the mouths of rivers such as the Potomac, Rappahannock, York, and James Rivers.



Sensitivities: The lower Chesapeake Bay is a major commercial shipping and naval cruiser waterway. The mouth of the bay experiences high waterway traffic near Norfolk, primarily from a naval base, and civilian boating traffic near Virginia Beach and Hampton. This high commercial, military, and civilian waterway traffic has the potential for increasing pollution, habitat destruction, and introduction of invasive species. Eutrophication from runoff from residential areas and commercial sites, and warming water temperatures, can be a serious problem

with adverse effects on fisheries and oyster reefs (Cook et al. 1998, Kemp et al. 2005). Climate change may also have drastic impacts on the health of the bay. Extensive tidal marshes, which have served as effective nutrient buffers along the bay's margins, are now being lost with rising sea level. Also, in drier years the decreased inflow of fresh water from rivers can drastically alter the salinity gradients, causing a decline in certain species of submerged aquatic vegetation (Kemp et al. 2004). The spread of invasive species is exacerbated by increasing water temperatures (Setzler-Hamilton et al. 1995) as a result of climate change.

Potential Conflicts: There are many potential conflicts in the lower reaches of the Chesapeake Bay because of high human densities. Hard clam aquaculture is a growing industry in the lower Chesapeake Bay and often conflicts with restoration of submerged aquatic vegetation, which is important for fish and blue crab (Hershner and Woods 1999). Declining bivalve communities due to eutrophication, warming water temperatures, and competition with invasive species can decrease the quality of habitat for wintering sea ducks.

Status: Most of the land in the lower Chesapeake Bay is private and under conservation easement, but there are also protected federal and state lands such as Plum Tree Island National Wildlife Refuge, Savage Neck Dunes State Natural Area Reserve, and Saxis Wildlife Management Area (Chesapeake Bay Program 2019). On the eastern shores are Chesapeake Bay National Estuarine Research Reserve, Janes Island State Park, Saxis Wildlife Management Area, and Martin National Wildlife Refuge. There are also significant efforts to identify and protect watersheds that are critical to water quality in the bay. Nonetheless, there are far fewer protected areas in the lower reaches of the bay than in the upper Chesapeake Bay. Areas below mean high tide fall under the jurisdiction of the Commonwealth of Virginia, particularly the Virginia Marine Resources Commission. There are a number of Important Bird Areas (IBA) within the key site. Of particular importance to sea ducks are the Chesapeake Bay Islands and Western Marshes IBAs. The protection and health of the Chesapeake Bay is closely monitored by the Chesapeake Bay Program (2019).

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Key Site 84: Pamlico Sound, North Carolina

Location: 35°22'26"N, 75°51'20"W

Size: 5598 km^2

Description: Pamlico Sound in North Carolina is the largest lagoon on the East Coast of North America. It is part of a larger, interconnected network of lagoon estuaries, known as the Albemarle-Pamlico Sound, the second largest in the United States. Ten major rivers, and creeks too numerous to count, drain into Pamlico Sound. The sound is separated from the Atlantic Ocean by a series of sandy barrier islands known as the Outer Banks. The sound is known for its wide expanse of shallow water, generally ranging from 1.5 to 2 m, and for its susceptibility to wind-driven tidal fluctuations. The shallow, warm waters make this area an important recreational destination in the summer and a popular fishing location. There are hundreds of kilometers of sandy beaches where wave action from the Atlantic Ocean constantly redefines the coast. This area is often impacted by hurricane activity but tends to be resilient to major ecosystem changes. Temperatures range from a mean high of 53°F to a mean low of 38°F in the winter and a mean high of 86°F to a mean low of 74°F in the summer.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are from two sources: first, the Atlantic Coast Wintering Sea Duck Survey (ACWSDS), conducted between January 31 and February 13 in 2009 to 2011 (see Silverman et al. 2012 for methods; also see Methods in this atlas); second, abundance data from the Mid-Winter Waterfowl Survey (MWS), including shoreline areas outside the area covered by the ACWSDS were considered when estimating density of sea ducks. Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detection or other biases. Abundance estimates should, therefore, be treated as minimum estimates.

Biological Value: Pamlico Sound is a biodiversity hotspot for fish and marine invertebrates (Cooksey et al. 2010). Because the system is mostly enclosed by barrier islands, small amounts of saltwater push in through several inlets, resulting in relatively low salinity levels. The average freshwater residence time is approximately one year in the sound proper, and this promotes effective use and cycling of nutrients, allowing the system to support high rates of primary and secondary production and serve as a vitally important fisheries nursery. There are several diverse habitats such as areas of hard bottom and rocky outcrops as well as soft sand bottoms with submerged aquatic vegetation. The extensive eelgrass and shoal grass beds provide habitat for blue mussels, American oysters, blue crab, and many other bivalve and crustacean species (Taylor et al. 1996, Neves et al. 1997, Paerl et al. 2010). Mollusks and crustaceans make up the majority of the diet of scoters (*Melanitta* spp.) (Cottam 1939). On the Atlantic coast during winter, scoters tend to concentrate at the mouths of estuaries (Stott and Olson 1973), possibly because these places offer a greater diversity of food items. Pamlico Sound is a vital area for wintering Surf Scoter (*M. perspicillata*) and Black Scoter (*M. americana*); most winter at sea near estuaries, bays, and open coastline, all characterized by shallow water and a sandy or gravelly bottom with

accompanying shellfish beds (Stott and Olson 1973, Sanger and Jones 1984). Silverman et al. (2012; see Methods section in this atlas) reported a minimum of 59,000 sea ducks in the area of the sound covered by the ACWSDS, including more than 26,000 scoters. An additional 42,000 sea ducks, on average (mainly Bufflehead [*Bucephala albeola*], mergansers [*Mergus* spp.], and scoters) were counted during the MWS in areas outside the ACWSDS area from 2011 to 2015 (D. Howell, North Carolina Wildlife Resources Commission unpublished data).

Sensitivities: The hydrologic characteristics that make the sound such a biodiverse aquatic system also make it very sensitive to over-enrichment and eutrophication (Paerl et al. 2010). The large human population on the coast increases opportunities for pollution, disturbances from recreational activities (e.g., boating), and residential and commercial development. Most of Pamlico Sound is classified as Nutrient Sensitive Waters (North Carolina Department of Water Quality 2006). Agricultural activities inland contribute to nutrient inputs that reduce water quality, may cause algal blooms, and can kill off fish and bivalve communities in the sound (Summerson and Peterson 1990, Uhler et al. 1993, Paerl et al. 2010). The area is also susceptible to the destruction of hurricanes, which makes it very sensitive to the increasing occurrence of such events due to climate change (Paerl et al. 2010).

Potential Conflicts: The area surrounding Pamlico Sound is home to millions of residents and thousands more tourists during the summer months. Recreational activities such as boating cause disturbance to wildlife and habitat. Conflicts between local industry and the North Carolina Recreational Water Quality Program can arise when discharge rates are decreased due to decreasing water quality (North Carolina Department of Water Quality 2006).

Status: Pamlico Sound is an estuarine system, and therefore protections of the watershed inland may be most critical to the sustainability of the sound. Shoreline between the Pamlico and Neuse Rivers is a matrix of state game lands and private lands. There are several national wildlife refuges (e.g., Alligator River, Cedar Island, Swanquarter, and Mattamuskeet), national forests (e.g., Croatan), and national seashores (e.g., Cape Lookout and Cape Hatteras), which provide some protection to uplands impacting waters that eventually run into the sound. However, there are currently no designated marine protected areas in Pamlico Sound, and regulation only extends to fishing industries and restrictions in recreational activities during times of poor water quality. There are several American oyster restoration reefs and limitations on shellfish harvest in eelgrass beds.

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Key Site 85: Southern Atlantic Coast, South Carolina and Georgia

Location: 32°11'37"N, 80°33'37"W

Size: 2730 km^2

Description: The Southern Atlantic Coast key site extends from approximately Myrtle Beach, South Carolina, to Cumberland Island, Georgia. The coast is bisected by major river drainages such as the Santee, Edisto, Savannah, and Altamaha and is characterized by numerous barrier islands separated from the mainland by vast salt marshes (Kovacik and Winberry 1987).

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on data from the Atlantic Coast Wintering Sea Duck Survey (see Silverman et al. 2012 for methods; also see Methods section in this atlas) and related surveys (Mid-Winter Survey [MWS; Eggeman and Johnson 1989] or Atlantic Marine Assessment Program for Protected Species [AMAPPS 2015]). Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detection or other biases. Abundance estimates should, therefore, be treated as minimum estimates.

Biological Value: The Southern Coast is an extremely biodiverse region, and the rich waters are critical sites for wintering sea ducks. Estuarine and coastal benthic species richness, abundance, and density are among the highest on the entire Atlantic Coast (Wenner et al. 1983, Cooksey et al. 2010). Benthic bivalve species are key foods for thousands of wintering waterfowl that congregate in this region.

The rich waters are critical sites for wintering sea ducks. Silverman et al. (2012; see Methods section in this atlas) estimated that a minimum of 22,000 scoters (*Melanitta* spp.) winter in this region. Black Scoter (*M. americana*) is by far the most abundant species. They arrive in early to mid-October and often congregate around the Cape Romain area in South Carolina. Some scoters remain in that area and others disperse southward along the coast into Florida; most occur within a mile of the coast.

Sensitivities: The South Carolina and Georgia coasts are relatively low in elevation and have flat

topography and large tidal influxes. Therefore, impacts from sea level rise are predicted to be significant (Epanchin-Niell et al. 2017). Potential oil and gas exploration and offshore drilling in this region may have detrimental effects on the benthic community. NOAA ranks the South Atlantic as having the highest relative environmental sensitivity to spilled oil (Coastal Conservation League 2017). Physical burial of surrounding benthic communities from oil platform construction and release of drilling muds is the most deleterious impact (Michel 2013). Two of the largest shipping ports in North America (Charleston and Savannah) are found in the key site. Invasive species introduction is common due to the two large shipping ports and rapidly growing boating and recreational activities. Green mussels, an introduced species, have been observed along coastal Georgia since 2003, which represents an expansion of their range into these southern waters (Power et al. 2004). Additionally, rapid population growth in coastal counties in South Carolina and Georgia (Bailey 1996) has increased human and

domestic animal waste input, which affects shellfish beds. This region's sandy beaches make it a popular tourist destination, and recreational activities such as boating and fishing are common. Residential land development, commercial landscaping, and golf courses are sources of fertilizers, pesticides, herbicides, sedimentation, and turbidity (Bailey 1996). Hurricanes can have large impacts on the regional coastline and on wildlife habitat on the Southern Coast (Scott et al. 2003).

Potential Conflicts: Potential conflicts exist between the fishing industry and benthic habitat conservation initiatives. Shrimping is an important commercial activity in the region that occurs in nearshore waters. There are initiatives in South Carolina and Georgia to develop offshore wind turbines (Michel 2013, BOEM 2021a). Development of offshore wind farms could impact migrating birds. Leases for oil and gas exploration and well drilling were issued in several areas in 1978, 1982, and 1983 (Michel 2013). There are no active leases in the area, but future oil and gas exploration can still be a potential conflict with conservation initiatives.

Status: Nearshore state waters are under the jurisdiction of the South Carolina Department of Natural Resources as well as the South Carolina Department of Health and Environmental Control. The coasts of South Carolina and Georgia are part of the South Atlantic Planning Area (BOEM 2021b). Several protected and limited use areas aim to protect this region's natural resources and the area has the highest proportion of protected coastline on the Atlantic seaboard (Epanchin-Niell et al. 2017). The Cumberland Island National Seashore is the only national park unit, which is located in Georgia. It is a barrier island with 6820 hectares of marsh, mudflats, and tidal creeks. Additionally, there are four coastal national wildlife refuges falling within sea duck habitat (Cape Romain, Wassaw, Blackbeard Island, and Wolf Island). Several state (Georgia and South Carolina) wildlife management areas abut the coast. Five marine protected areas have been established since 2009 (Michel 2013) to protect coral and benthic habitat from damage related to fishing activities. Although significant habitat protection measures are in place, energy development, commercial shipping, and human population development within the region pose serious threats to vital habitats.

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Black Scoters. Photo: Tim Bowman.