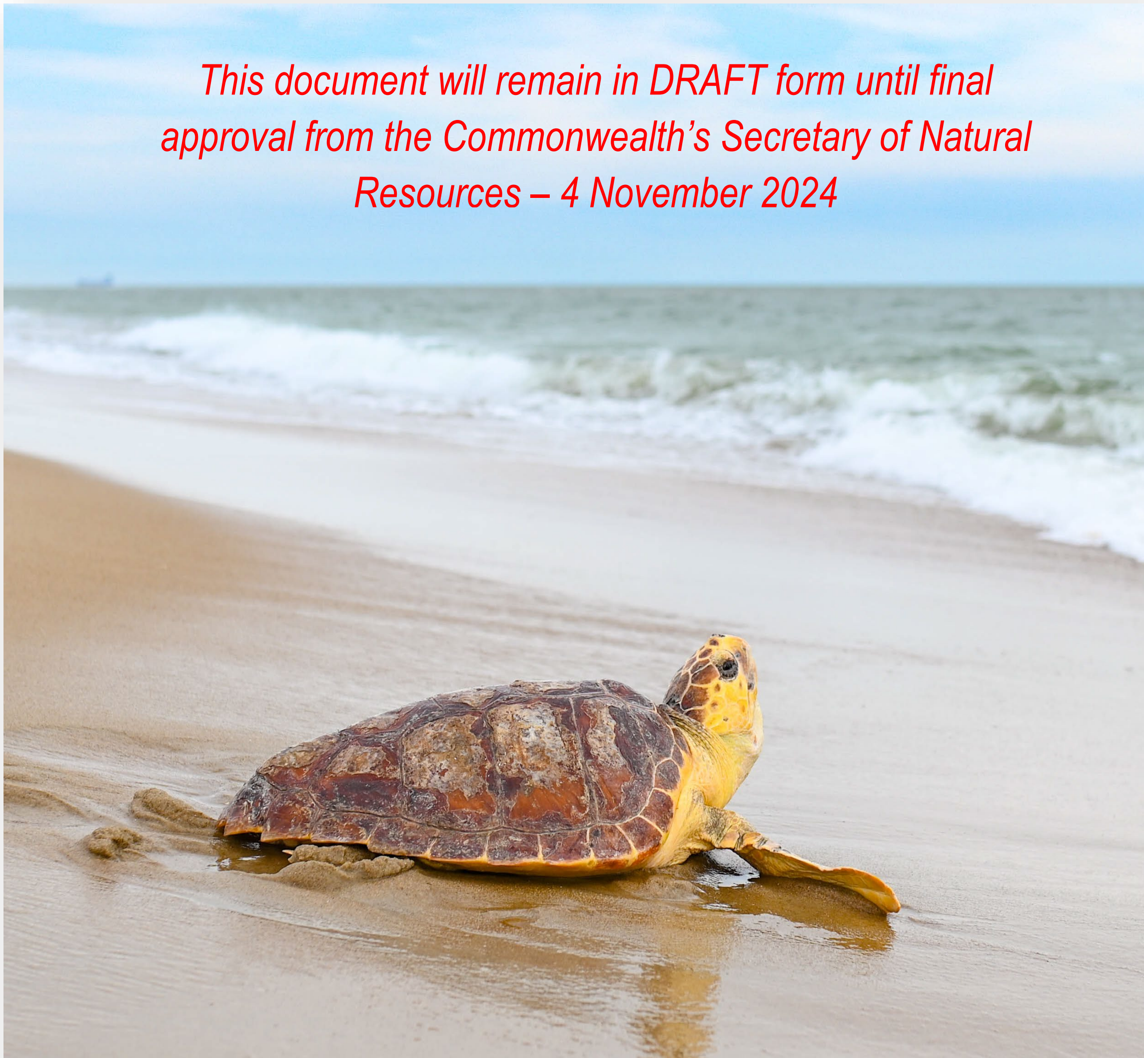
2024

Virginia Sea Turtle Conservation Plan



Prepared by

Virginia Department of Wildlife Resources

With

Virginia Coastal Zone Management Program

National Oceanic and Atmospheric Administration

2024

Virginia Sea Turtle Conservation Plan

Virginia Department of Wildlife Resources

Virginia Coastal Zone
MANAGEMENT PROGRAM

This document serves as a final report to the Virginia Coastal Zone Management Program of the Department of Environmental Quality in fulfillment of Award Number NA 21NOS4190152 FY21 Task # 92.03 from the National Ocean Service of the National Oceanic and Atmospheric Administration.

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Cover image: Loggerhead turtle that stranded and was rehabilitated by the Virginia Aquarium Stranding Response Program makes its way back into the ocean after release (credit: Virginia Aquarium & Marine Science Center).

2024
Virginia Sea Turtle
Conservation Plan

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Disclaimer

The 2024 Virginia Sea Turtle Conservation Plan has been approved by the Virginia Department of Wildlife Resources (DWR) but does not necessarily represent the official positions or approvals of cooperating agencies, or the views of all stakeholders who participated in the development of the plan. This plan will be updated every 10 years but is subject to more frequent modifications should new findings that redirect actions or changes in species status occur in the interim. Goals and strategies will be attained, and funds expended contingent upon appropriations, priorities, and other budgetary constraints.

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Disclaimer

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List of Acronyms and Abbreviations

AINS	Assateague Island National Seashore
ASMFC	Atlantic States Marine Fisheries Commission
Bay	Chesapeake Bay
BBNWR	Back Bay National Wildlife Refuge
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management (US)
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNWR	Chincoteague National Wildlife Refuge
CVOW	Coastal Virginia Offshore Wind, development off Virginia owned by Dominion Power
DCR	Department of Conservation and Recreation

List of Acronyms and Abbreviations (*cont.*)

DE Bay	Delaware Bay
DEQ	Department of Environmental Quality (VA)
DEQ-CZM	Department of Environmental Quality–Coastal Zone Management
DNNB	Dam Neck Naval Base
DOD	Department of Defense (US)
DPS	distinct population segment (of sea turtles)
DWH	Deep Water Horizon (oil spill)
DWR	Division of Wildlife Resources (VA)
EEZ	Unites States Exclusive Economic Zone which goes 200 NM from shore
EPA	US Environmental Protection Agency
ESA	Endangered Species Act (US)
FCSP	False Cape State Park
FINWR	Fisherman Island National Wildlife Refuge
GI	gastrointestinal (contents of digestive system)
HAB	harmful algal bloom
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JEBFS	Joint Expeditionary Base – Fort Story Navy
JEBLC	Joint Expeditionary Base – Little Creek Navy
Mid-Atlantic Bight	section of the U.S. Atlantic continental shelf that extends from Long Island, New York to Cape Hatteras, North Carolina. It is often used in fishery management actions.
MARCO	Mid-Atlantic Regional Council on the Ocean MOU – Memorandum of Understanding
MRC	Marine Resources Commission (VA)
NEPA	National Environmental Policy Act (US)
NGO	Non-governmental organization
NM	nautical miles
NMFS	National Marine Fisheries Service also known as NOAA Fisheries (US)
NOAA	National Oceanic and Atmospheric Association (US)
NPS	National Park Service (US)
ODESS	US Army Corps of Engineers' Operations and Dredging Endangered Species System
ODU	Old Dominion University
OLE	Office of Law Enforcement (NOAA OLE)
OSW	offshore wind
PBDE	polybrominated diphenyl ethers
PCB	polychlorinated biphenyls
PCH	polychlorinated hydrocarbons

<u>List of Acronyms and Abbreviations (*cont.*)</u>

PFA	per-and polyfluoroalkyls
PFO	Perfluorooctane sulfonate
PSO	Protected Species Observer
RWSC	Regional Wildlife Science Collaborative for Offshore Wind
SGCN	Species of Greatest Conservation Need
STDN	Sea Turtle Disentanglement Network (US)
STSSN	Sea Turtle Stranding and Salvage Network (US)
TNC	The Nature Conservancy (NGO)
US	United States
USACOE	US Army Corps of Engineers
USCG	US Coast Guard
USFWS	US Fish and Wildlife Service
USFWS-VFO	US Fish and Wildlife Service Virginia Field Office
USMC	US Marine Corps
USN	US Navy
UXO	unexploded ordinance
VAMSC	Virginia Aquarium & Marine Science Center (the Department within the City of Virginia Beach responsible for the municipal portion of the Aquarium facility)
VAQF	Virginia Aquarium & Marine Science Center Foundation (NGO)
VAQS	Virginia Aquarium Stranding Response Program (program under VAQF that manages STSSN in VA)
VIMS	Virginia Institute of Marine Science (VA)
VPA	Virginia Port Authority
VSTSSN	Virginia Sea Turtle Stranding and Salvage Network
WFF	Wallops Island Flight Facility

Executive Summary

Loggerhead, Kemp's ridley, green and leatherback sea turtles regularly occur in Virginia waters and all four species are protected under the Virginia and U.S. Endangered Species Acts. Loggerhead and green turtle populations that occur in Virginia are state and federally listed as threatened whereas leatherbacks and Kemp's ridleys are state and federally listed as endangered.

As highly mobile marine mega-vertebrates, none of these species spend their lives exclusively in Virginia. Juvenile loggerhead, Kemp's ridley and green sea turtles migrate seasonally to Virginia to forage during their development into adulthood. Adult male and female loggerhead turtles have been tracked to Virginia from nesting beaches south of Virginia, presumably to forage after breeding activities. All three species nest in Virginia, but only loggerheads nest regularly in the state. Leatherbacks occur in Virginia at any time of year but are most often present in the spring. To date, no leatherback nesting activity has been documented in Virginia despite the fact that nests have been reported in states to the north and south of the Commonwealth.

Because sea turtles that occur in temperate habitats are migratory animals with wide ranges, it is necessary to coordinate conservation efforts with those of other state, federal and international entities. Although threats to sea turtles in Virginia are consistent with those reported throughout the mid-Atlantic region, the density of turtles compared to areas north of Virginia appears to be relatively high in Virginia; thus, making the conservation and management of sea turtles and their habitats especially important in the Commonwealth. Sea turtle injuries and mortality are primarily attributed to anthropogenic activities including commercial and recreational fishing gear, hopper dredges, and vessel strikes. Although cold-stunning is a natural phenomenon, global climate change has contributed to an increase in the variability of fall and early winter coastal water temperatures, which has led to a rise in the numbers of turtles affected. Non-lethal, compounding stressors may also be compromising animals, making them more susceptible to disease, parasites, and cold stunning. These stressors include low levels of contaminants and poor prey and water quality (resulting from various types of pollution), shifting prey bases, invasive species, harmful algal blooms, marine construction, and military activities.

The overarching goal of this Plan is to enhance the survival and conserve the habitats of sea turtles in Virginia in a manner that is consistent with regional and federal research, management, and conservation efforts. There are three conservation goals under which strategies and actions with lead agencies and timelines are described. The three goals discussed below are:

Conservation Goal 1: Maintain a permanent and effective Sea Turtle Stranding and Salvage Network in Virginia

Conservation Goal 2: Identify and mitigate risks to sea turtle populations and habitats in Virginia through cost-effective monitoring, research, and best practices.

Conservation Goal 3. Promote sea turtle conservation in Virginia through social marketing and information dissemination.

As the agency responsible for conservation and management of protected species, the Virginia Department of Wildlife Resources (DWR) is responsible for developing state conservation plans. Coordination and communication between the DWR and the Virginia Marine Resources Commission, the two state agencies responsible for managing protected marine species in the Commonwealth along with NOAA Fisheries and the U.S. Fish and Wildlife Service, which provide national oversight, is a key aspect of sea turtle conservation in Virginia. This plan aligns with and builds on federal recovery efforts described in species recovery plans and status reviews. Moreover, the successful implementation of most of the conservation strategies and actions identified in this Plan rely heavily on the cooperation of many other collaborating agencies, organizations, and partners who will also be key to communicating with the general public. Since sea turtle conservation fundamentally includes human beings, the most successful conservation actions will be those aligned with the values, wellbeing, and perspectives of people who are expected to support lasting change. Finally, this Plan was developed in concert with the 2024 Marine Mammal Conservation Plan (MMCP) and many of its strategies and actions are similar to those identified for sea turtles. The coordination and implementation of related efforts outlined in both plans should be executed in a way that maximizes limited state resources and provides the greatest conservation benefits for both species groups.

Introduction

Five species of sea turtles occur in the Chesapeake Bay and the coastal waters of Virginia with varying regularity. They include, in order of occurrence from stranding and survey data, the loggerhead sea turtle (*Caretta caretta*); the Kemp's ridley sea turtle (*Lepidochelys kempii*); the green sea turtle (*Chelonia mydas*); the leatherback sea turtle (*Dermochelys coriacea*); and the hawksbill sea turtle (*Eretmochelys imbricata*). There have also been suspected and confirmed hybrids in the stranding record (Virginia Aquarium Stranding Response Program (VAQS) *unpublished data,* May 2023). Loggerhead, Kemp's ridley, and green turtles occur annually in Virginia (Lutcavage and Musick 1985; Keinath *et al.* 1987; Byles 1988; Mansfield 2006; Costidis *et al.* 2021; Costidis *et al*. 2022; Epple *et al.* 2023). Leatherback turtles appear in the stranding record less frequently but are likely present in Virginia annually (DiMatteo *et al.* 2024). Loggerhead and Kemp's ridley turtles appear annually in the stranding record from April/May through December/January, and green turtles occur June/July through October/November (Costidis *et al.* 2021; Costidis *et al*. 2022; Epple *et al.* 2023). Occurrence of leatherback turtles is less predictable but strandings and/or entanglements are reported in most years with most strandings occurring in spring. The Hawksbill turtle, a tropical species, is the rarest of all species in waters north of Florida and has only been recorded twice in Virginia. Therefore, this species will not be directly addressed in this Plan.

The species summaries presented below represent what is currently known about the four regularly occurring species and focuses primarily on information that is pertinent to sea turtle populations in Virginia. Additional species information for the United States (US) can be found on the NOAA Fisheries Sea Turtle website (https://www.fisheries.noaa.gov/sea-turtles). Global information on sea turtles can be found on the State of the World's Sea Turtles (SWOT) website (https://www.seaturtlestatus.org/). Loggerhead sea turtles are the most abundant and widely distributed species in Virginia waters, and it is the only species that nests regularly in the state. Therefore, it is the most comprehensive of all the summaries and much of it is specific to Virginia and the mid-Atlantic region. As such, a great deal of the information presented in the loggerhead summary informed the development of the Plan's conservation strategies. Lastly, efforts were made to ensure that the strategies align with recovery actions outlined in federal recovery plans.

Species Descriptions

Loggerhead Turtle (*Caretta caretta*)

Status

In 1978, the loggerhead turtle was listed as threatened by the USFWS and NOAA Fisheries (also known as NMFS-National Marine Fisheries Service) under the ESA of 1973 (43 FR 32800). The Federal status was adopted by the DWR in 1987, and the loggerhead is currently designated as a Species of Greatest Conservation Need (SGCN) in the Virginia Wildlife Action Plan (VDGIF 2015). In 2011, the Northwest (NW) Atlantic Ocean loggerhead turtle distinct population segment (DPS) which encompasses all nesting assemblages within the NW Atlantic region (*i.e.,* US east coast; entire Gulf of Mexico; greater Caribbean region; and Dry Tortugas regions), was listed as threatened (76 FR 58868). The IUCN Red List lists the loggerhead turtle as vulnerable globally, with the Northwest Atlantic subpopulation listed as being of *Least Concern* for all criteria that were assessed (Casale and Tucker 2017). In August of 2014, NOAA Fisheries and USFWS designated critical in-water and nesting (79 FR 39755) habitats for the NW Atlantic Ocean loggerhead turtle DPS. No beaches or state waters in Virginia were designated as critical habitat; however, federal waters south of Cape Hatteras, North Carolina were designated as critical winter migratory habitat. The outer continental shelf and Sargasso Sea east of Virginia were designated as critical foraging habitat for hatchlings. After the most recent loggerhead critical habitat designation, a paper was published which identified important foraging habitat in

Chesapeake Bay for both loggerhead and Kemp's ridley turtles using boosted regression tree models with tag and environmental data (DiMatteo *et al.* 2022).

Distribution and abundance in Virginia and the Region

Along the US Atlantic coast, loggerhead turtles are distributed seasonally from southern Florida to Atlantic Canada, with the majority of the population occurring south of Cape Hatteras in cooler months (January-March). Models developed by the US Navy (USN) suggest highest abundance in the lower Mid-Atlantic, an area defined as Delaware Bay to Cape Hatteras, occurs in August (Figure 1) and lowest abundance occurs in February (Figure 2; DiMatteo *et al.* 2024). The USN models were presented as long-term monthly average estimates of density, expressed as the number of individuals per square kilometer.

Loggerhead turtles are found seasonally in the Chesapeake Bay (Bay) from Baltimore south to the Bay mouth, in the estuarine portions of all the major rivers in the Bay watershed, along Virginia's entire Atlantic Coast, and into the channels and lagoons between and landward of the Commonwealth's barrier islands (Brady 1925; Lutcavage 1981; Lutcavage and Musick 1985; Keinath *et al*. 1987; Byles 1988; Musick and Limpus 1997; Mansfield 2006; VAQS *unpublished data,* May 2023). Habitat modeling suggests that preferred habitat in the Bay includes the deeper main stem waters (DiMatteo *et al.* 2022). The majority of loggerhead turtles observed in mid-Atlantic waters are juveniles and sub-adults (Musick and Limpus 1997) along with a number of adults, some of which were present in nesting areas during the breeding season (Ceriani *et al.* 2012; Pajuelo *et al*. 2012; Ceriani *et al.* 2014). Loggerhead turtles occur consistently in Virginia from May to October but may appear earlier and remain longer if water temperatures are above 20°C (Mansfield *et al*. 2009; DiMatteo *et al.* 2022), an important consideration for future climate change scenarios. When sea surface temperatures in Virginia drop below 20°C, sea turtles begin a southward migration to the waters south of Cape Hatteras, North Carolina, where a large portion of the turtles are likely to overwinter, while others travel to more southern wintering areas of the southeastern US (Conant *et al.* 2009; Mansfield *et al*. 2009; Barco *et al.* 2015; DiMatteo *et al.* 2024).

Aerial surveys in Chesapeake Bay and ocean waters from the shoreline to approximately 40 km from shore were conducted in Virginia and Maryland by the Virginia Aquarium Foundation (VAQF) and other partners in the spring, summer and fall of 2011, spring and summer of 2012 and summer of 2013 and represent the most recent survey data available for sea turtles in Chesapeake Bay. Abundance was corrected for subsurface turtles unable to be detected from the aircraft using a moderately deep availability correction factor of 0-1m from the surface in ocean waters, and only time directly on the surface was used to correct abundance in the more turbid waters of Chesapeake Bay. Sea turtle density and abundance in the ocean within 40 miles of the coastline decreased seasonally from a high of 2.514 turtles/km^2 and 60,993 turtles (CV = 0.30) in the spring, to 1.102 turtles/km^2 and 26,590 turtles (CV = 0.27) in the summer and down to 1.289

turtles/km^2 and15,562 turtles (CV = 0.54) in the fall. The density of all sea turtle species combined was estimated for Bay waters in spring and summer and was corrected for availability using a shallow correction of <0.5m depth. Chesapeake Bay spring and summer density and abundance estimates were 1.276 turtles/km^2 and13,006 turtles (CV = 0.68) and 1.184 turtles/km^2 and 12,293 (CV = 1.01) turtles, respectively (Barco *et al.* 2018). There were too few sightings to estimate fall abundance in Bay waters. More than 85% of the turtles identified to species in both Bay and ocean waters were loggerhead turtles. The density models generated by DiMatteo *et al*. (2024) predicted higher abundance in the mid-Atlantic in summer (August) than spring, and the observed higher ocean abundance compared to Barco *et al.* (2018) where higher abundance was calculated in spring. This differences between the two estimates can be explained by; 1) different analyses used (*i.e.,* density surface model vs calculated abundance), 2) use of different data sets (fine scale spring, summer and fall surveys 2011-13 in Barco *et al.* 2018 versus multiple year round surveys but not including those used in Barco *et al.* 2018 in DiMatteo *et al.* 2024), 3) scale of the study areas (Atlantic coast to outer continental shelf in DiMatteo *et al.* 2024 versus inshore to mid-continental shelf of Virginia and Maryland Barco *et al.* 2018) and 4) differences in correction factors used in the studies. It is likely that a significant portion of the loggerhead turtle population that migrates north of Virginia is present offshore of Virginia in spring, and the Barco *et al.* (2018) surveys captured some of that population.

Values generated from the 2011-2013 surveys in the Bay were significantly higher than those obtained from 2001-2004 surveys conducted by the Virginia Institute of Marine Science (VIMS) (Mansfield 2006; Barco *et al.* 2018) but were similar to estimates reported in the 1980s (Byles 1988 reviewed in Mansfield 2006). While the surveys used different aircraft, speed and altitudes which could account for the differing abundance estimates, if there was a true increase in abundance it could indicate population recovery or recruitment from other areas since the early 2000s (Barco *et al*. 2018).

Relationship of Virginia populations to rookery sources

There is still uncertainty surrounding the genetic origins of juvenile loggerhead turtle populations inhabiting the Mid-Atlantic Bight (ocean waters from Long Island, NY to Cape Hatteras, North Carolina), but recent research indicates mixed origins from more than one Recovery Unit of the NW Atlantic DPS. Several studies suggested that the Northern Recovery Unit of the NW loggerhead turtle DPS (NRU) contributes disproportionately to juvenile foraging stocks occurring in nearshore waters north of the Florida/Georgia border and that genetic relatedness, measured using haplotype frequency, were significantly correlated between coastal feeding

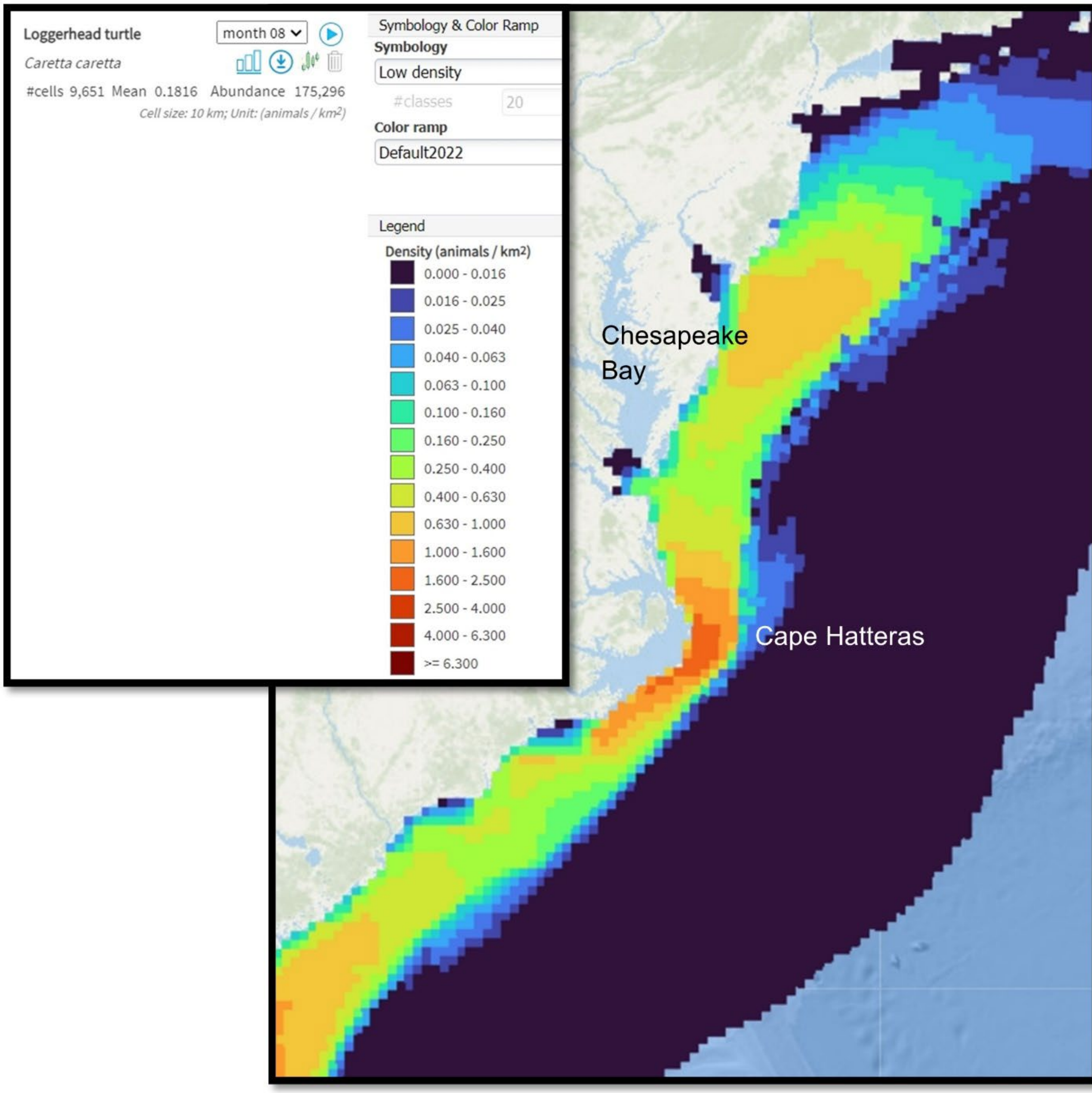


Figure 1. Modeled loggerhead density map for August, the month when density is predicted to be highest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

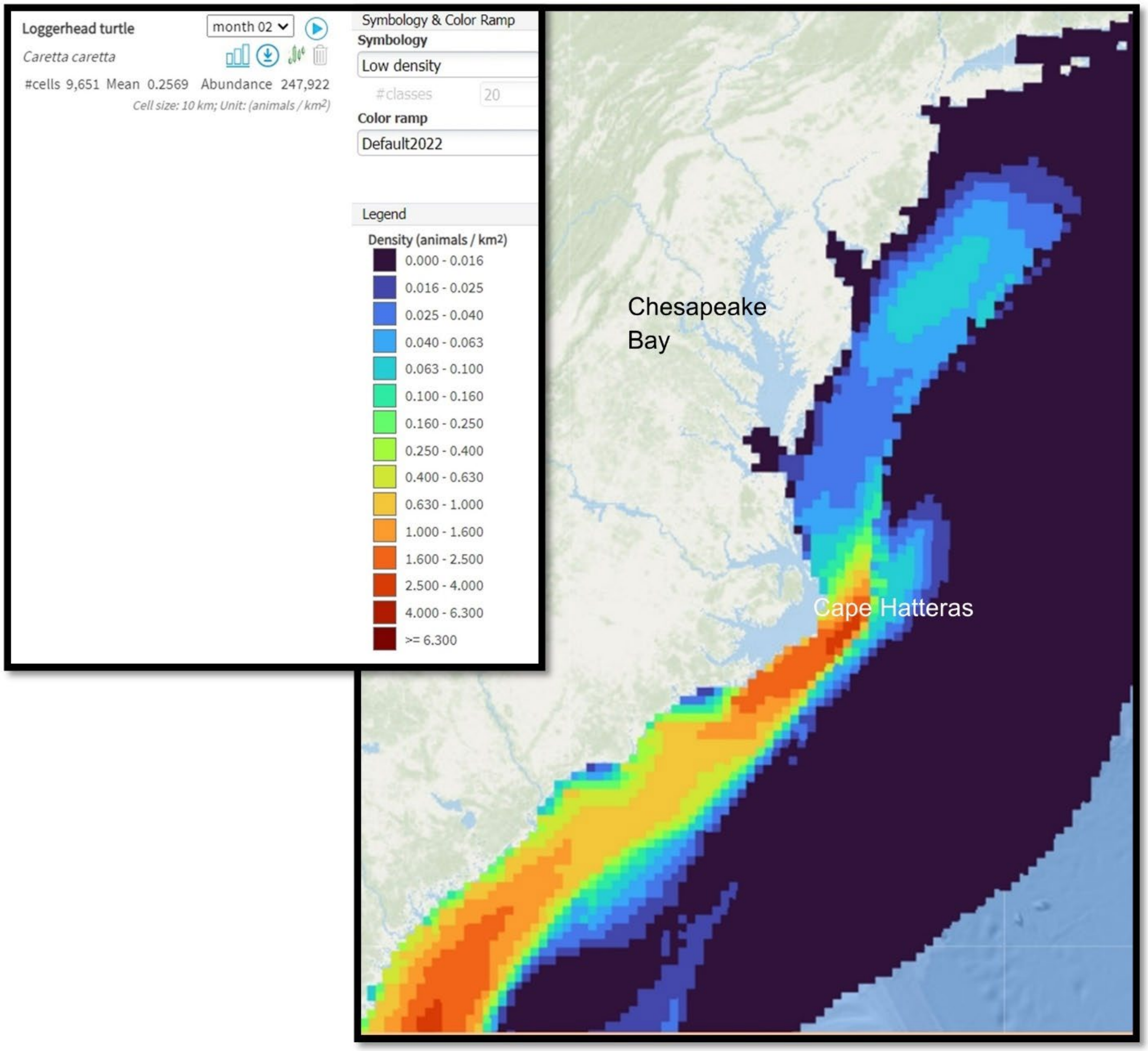


Figure 2. Modeled loggerhead density map for February, the month when density is predicted to be lowest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

populations and adjacent nesting populations (Bowen *et al.* 2004; Roberts *et al.* 2005; Mazzarella 2007; Conant *et al.* 2009). Stable isotope studies of nesting females in the NRU, which includes all females nesting north of Florida-Georgia border, suggest that these turtles forage predominantly in the Mid-Atlantic Bight, and females nesting in Florida forage in the subtropical NW Atlantic and Gulf of Mexico (Pfaller *et al.* 2020). Genetic samples collected from immature loggerhead turtles incidentally captured in sea scallop and offshore longline fisheries operating in the central North Atlantic are almost exclusively of NW DPS origin with the majority coming from the central eastern and south Atlantic Florida rookeries (Haas *et al.* 2008; LaCasella *et al.* 2013). In the NW Atlantic, juvenile loggerhead turtles incidentally captured a variety of ways such as research trawl and research dip netting, hopper dredge, and bycaught in a variety of fisheries including recreational hook and line, bottom trawl targeting fish, scallop, and shrimp, dredge targeting scallop, and sink gillnet in the neritic region and both neritic and pelagic longline were nearly all from the NW Atlantic DPS. Nesting origin, however, varied by turtle size and location (Stewart *et al.* 2019). Large juveniles caught north of Cape Hatteras, North Carolina were more likely to be from the NRU while smaller juveniles captured north of Cape Hatteras, North Carolina were generally caught farther offshore, and were more likely to have hatched in Florida. South of Cape Hatteras the nesting origin of large and small juveniles were split between central and southern Florida nesting units (Stewart *et al.* 2019). Many turtles incidentally captured in the Mid-Atlantic Bight statistical fishing area (Cape Hatteras to CT coast to mid-continental shelf) were from central eastern and south Atlantic Florida nesting beaches. Heavy representation of the Florida population may be due to the size of the eastern Florida rookeries, which are orders of magnitude greater than most other rookeries. Collectively, these studies suggest that loggerhead turtles that forage in the Mid-Atlantic Bight originate from more than one nesting unit, and though there may be some size and spatial structure to their distribution.

Diet and Foraging in Virginia

Mollusks, true benthic crabs (decapod crustaceans of the infraorder Brachyura) and horseshoe crabs (*Limulus polyphemus*) make up the primary diet of the NW Atlantic loggerhead turtle population (Seney and Musick 2007; Barco *et al.* 2015; NMFS and USFWS 2023). Gastrointestinal (GI) tract content analyses conducted on sea turtles that stranded in Virginia from 1980 to 2002 revealed shifts in the diet of loggerhead turtles. In the early to mid-1980s, horseshoe crabs were the predominant prey item followed by a shift to blue crabs in the late 1980s and early 1990s. A second shift to mostly finfish of a variety of species but predominantly Menhaden (*Brevoorita tyrannus*) occurred in the late 1990s and early 2000s (Seney and Musick 2007). The latter data suggested that turtles were foraging in greater numbers in or around fishing gear and/or on discarded bycatch in response to local declines in horseshoe crab and blue crab populations (Seney and Musick 2007). Analyses of GI contents collected from stranded loggerheads in Virginia from 2008 to 2012 suggested a return to a more traditional diet of mollusks, decapod crustaceans, and horseshoe crabs, although there were differences in turtle size, geographic distribution of stranded turtles between the two studies (*e.g.,* earlier samples were primarily collected from turtles stranded in the lower and mid-Chesapeake Bay, later samples were collected from turtles stranded closer the Bay mouth and ocean coasts; Barco *et al.* 2015). Large whelks constituted the highest percent number of prey items (39%), followed by decapod crustaceans (27%), horseshoe crab (13%), moon snail (*Neverita duplicata*; 7%) and bony fishes (4%). Prey numbers in these categories were significantly affected by turtle size class (MANCOVA: p=0.001) and proximity to the ocean (p<0.001) but not by season (p=0.088). Decapod crustaceans and horseshoe crabs comprised the highest percent dry weight values (Barco *et al.* 2015). These data suggest that blue crab and horseshoe crab populations may have increased since the early 2000s.

Loggerhead turtles migrate to Virginia presumably because of increased foraging potential. Switching state-space modeling, a methodology used to identify different types of behavior, can be applied to satellite telemetry data and has been used to identify foraging behavior in sea turtles based on an animal's movement patterns (Jonsen *et al.* 2006; Jonsen *et al.* 2007; Eckert *et al.* 2008; Maxwell *et al.* 2011; Hart *et al.* 2012; Shaver *et al.* 2013). Switching state-space modeling using data obtained from satellite tagged loggerhead turtles in the Chesapeake Bay showed that they spent most of their time foraging (Barco *et al.* 2015; DiMatteo *et al.* 2022). A habitat model, using suitable "habitat days" based on environmental parameters for each species as its unit of measure, identified loggerhead turtle foraging habitat in the Bay and its major tributaries from May through November. The greatest number of suitable habitat days for loggerheads was in the mainstem of the lower Bay and tidal waters of the major tributaries (Figure 3).

Reproductive activity in Virginia

Loggerhead turtles are the only sea turtle species to nest consistently nearly every year in Virginia, and, thus, the only species with a section on reproductive activity in this Conservation Plan. Virginia is considered the northernmost extent of the NW Atlantic loggerhead turtle's regular nesting range (Conant *et al.* 2009; NMFS and USFWS 2023); however, records exist of nesting occurring as far north as New Jersey (Pritchard 1979; Brandner 1983). Up to 15 nests per year have been reported on the ocean-facing beaches of Virginia with an increasing decadal mean from 1.0/yr. in the 1970s to 8.3/yr. from 2011-2020 (Figure 4). Nest monitoring efforts on most of the Virginia barrier islands has not been nearly as frequent or consistent as those on the more populated southeastern Virginia coast (hereafter referred to as the southern mainland beaches that extend from the North Carolina/Virginia border north to the Joint Expeditionary Base-Fort Story in Virginia Beach) and northernmost parts of the coast. Daily monitoring for nests occurs from late May to early September annually on southern mainland beaches and on the Virginian section of Assateague Island and Wallops Island which is included in Chincoteague National Wildlife Refuge and Assateague Island National Seashore.

From 1970 to 2005, 94 loggerhead turtle nests were documented in Virginia, of which 80% (n = 75) were deposited on the southern mainland beaches (Boettcher *et al.* 2008). The remaining nests (N = 19) were documented on Virginia's barrier islands located on the seaward fringe of the lower Delmarva Peninsula with the majority occurring on Assateague and Wallops islands, which are consistently monitored as opposed to barrier islands with no vehicular access to the south. Although the majority of the state's nesting activity continues to occur on southern mainland beaches, decadal loggerhead turtle nesting activity on Assateague and Wallops islands combined, which, like the southern mainland beaches are monitored daily, more than doubled over the 50-year time span from the early 1970s to 2020 (DWR *unpublished data,* May 2023). Most of the barrier islands south of Wallops Island are monitored every 3 - 7 days primarily for

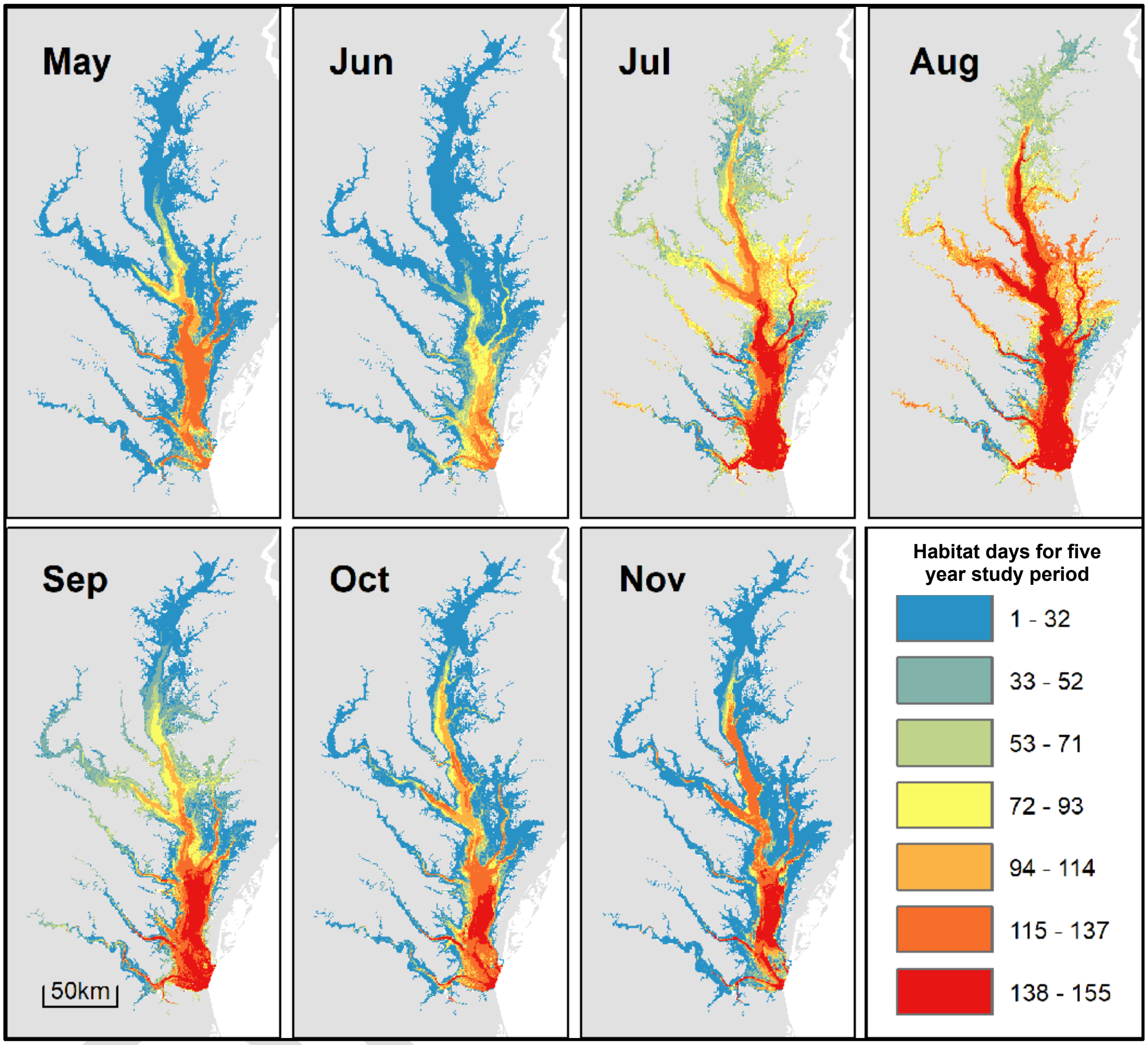


Figure 3. Monthly location of suitable habitat from models (in habitat days during the 5-year study period) for loggerhead turtles in Chesapeake Bay and its tributaries (Figure 4 in DiMatteo et al. 2022).

breeding shorebirds. Four loggerhead nests, eight false crawls (non-nesting emergences), and three undetermined crawls (crawls obscured by wind, rain and/or overwash which made it impossible to determine whether they were nesting or non-nesting emergences) have been detected since intensive shorebird studies began on most of these islands in 2004. For now, this level of coverage seems sufficient given these islands are remote, accessible only by boat (except for Fisherman Island which can be accessed by vehicle but is closed to the public year-round), under conservation ownership, and receive little to no human disturbance. Moreover, a coordinated mammalian predator management program has been in place on seven of the 14

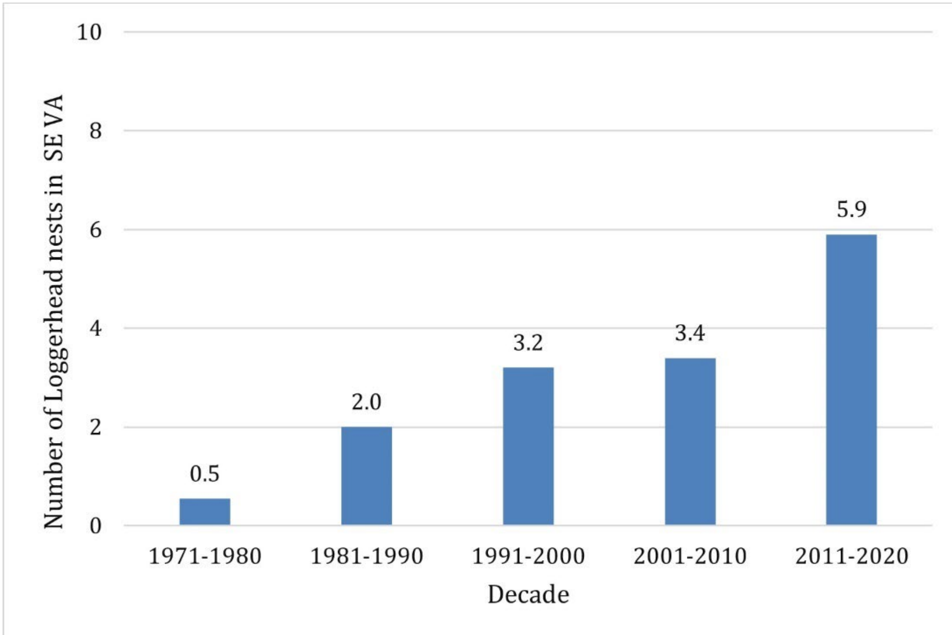


Figure 4. Decadal mean number of loggerhead turtle nests on the southern mainland beaches from the North Carolina/Virginia border to the Joint Expeditionary Base-Fort Story, Virginia. Number of nests per year ranged from 0 to 15 with a 50 year mean of 3 nests per year on the southern mainland beaches and 4.1 nests per year for the entire state (DWR unpublished data, April 2024).

islands since 2005, and most barrier island public use policies, such as the collaboratively funded and developed Explore our Seaside program, are designed to benefit wildlife. While it is likely that a few nests and false crawls were missed over the years, daily coverage is not warranted at this time due to the low level of nesting activity, logistical constraints, limited staff, and the fact that the all the islands except for NASA-owned Wallops Island, are under conservation ownership.

In late July 2015, the first reported loggerhead turtle nest was confirmed on Gwynn's Island, Virginia, along the western shore of the Chesapeake Bay. None of the eggs hatched because they were washed out in a fall hurricane. In 2021, three crawls were documented near Gwynn's Island in Matthews County, Virginia, but no eggs were found. Collectively, these records represent the first confirmed nesting emergences on estuarine beaches located more than 60km from the Atlantic Ocean (mouth of Chesapeake Bay) in Virginia (DWR *unpublished data,* May 2023).

Based on long-term tagging studies conducted on nesting beaches, breeding female loggerhead turtles were historically thought to exhibit a high degree of natal site fidelity returning to nest on or near their natal beach (Miller *et al.* 2003). Virginia has been participating in an on-going genetic mark-recapture study of the NRU nesting subpopulation within the NW loggerhead turtle Distinct Population Segment that is attempting to identify individual females and examine relatedness among nesting females (mother/daughter pairs or sister pairs), characterize genetic structure of the subpopulation, and determine clutch frequency, nesting site fidelity, inter-annual nesting intervals, and female reproductive life span. Since 2010, 23 unique females have nested in Virginia, of which only eight have confined their nesting solely to Virginia beaches (B. Shamblin, *personal communication*, Aug 2015). Results of genetic testing on eggs recovered from Virginia have revealed that the nine loggerhead turtle nests documented in 2010 were laid by four different individuals. One of the females also laid two nests in North Carolina before arriving to lay a final nest in Virginia. Another female deposited one clutch in South Carolina, a second clutch in North Carolina and a third clutch in Virginia within a four-week period. A female that nested in Maryland the same year was an unidentified individual for which no match could be found among the sampled nesting population. The nine Virginia loggerhead turtle nests sampled in 2011 were laid by six different individuals, four of which nested in North Carolina before arriving in Virginia (B. Shamblin, *personal communication*, Aug 2015). In 2012, 15 loggerhead turtle nests laid by eight different individuals were deposited on Virginia beaches. Of these, only three nested in another state during the 2012 season; two laid clutches in North Carolina, and one deposited eggs on Assateague Island in Maryland. Five individuals laid six nests on Virginia beaches in 2013, of which two laid a subsequent nest on North Carolina's Outer Banks. These results indicate that nest site fidelity among nesting females may not be as strong as once believed, especially towards the northern extent of the nesting range (Shamblin *et al.* 2017).

Habitat requirements

Loggerhead turtles nest primarily on ocean-facing beaches and rarely on estuarine shorelines with suitable sand (NMFS and USFWS 2023). Nests are typically laid at night between the high tide line and the seaward base of the primary dune (Witherington 1986; Hailman and Elowson 1992). Wood and Bjorndal (2000) found that slope had the greatest influence on loggerhead nest site selection; however, a review of related studies found no consistency among factors analyzed or preferences for particular nest locations (Miller *et al*. 2003). Over 85% of the nests on the southern mainland beaches have been documented on state and federal lands (False Cape State Park [FCSP], Back Bay National Wildlife Refuge [BBNWR] and Dam Neck Naval Base [DNNB]), while the rest were deposited on municipal beaches adjacent to significant development. Nesting habitat on Virginia's transgressive barrier islands is mostly free from development and is largely under the protective ownership of federal, state and private conservation agencies. NASA-owned Wallops Island is the only barrier island that is partially developed. Because it supports assets worth billions of dollars, it continues to be subjected to a variety of shoreline stabilization activities that can affect the quality of sea turtle nesting habitat including, but not limited to, periodic beach renourishment and the installation of sea walls, rock revetments, geotubes, and more recently nearshore breakwaters.

Sea turtle eggs require a high-humidity substrate that provides sufficient gas exchange for embryonic development (Miller *et al*. 2003). Moisture conditions in the nest influence incubation period, hatching success, hatchling size and sex ratios (McGehee 1990, Carthy *et al*. 2003, Lolavar and Wyneken 2020). Mean clutch sizes range roughly between 100 and 126 eggs, and the length of the incubation period is inversely related to nest temperature; the warmer the sand surrounding the egg chamber, the faster the embryos develop (Mrosovsky and Yntema 1980). Prevailing sand temperatures during the middle third of the incubation period determine the sex of hatchling sea turtles (Mrosovsky and Yntema 1980). Incubation temperatures near the upper end of the tolerable range produce only female hatchlings while incubation temperatures near the lower end of the tolerable range produce only male hatchlings. The pivotal temperature (*i.e.*, the incubation temperature that produces equal numbers of males and females) in loggerheads is approximately 29°C (Limpus *et al*. 1983, Mrosovsky 1988, Marcovaldi *et al*. 1997).

Immediately after loggerhead turtle hatchlings emerge from the nest, they find their way to the surf by orienting toward the bright oceanic horizon. Once they enter the water, they are swept through the surf zone and continue swimming away from land (Carr and Ogren 1960; Carr 1962; Carr 1982; Wyneken and Salmon 1992; Witherington 1995), relying on a store of energy and nutrients within their retained yolk sac (Kraemer and Bennett 1981). When neonate loggerhead turtles reach the shallow neritic waters along the continental shelf, they begin to feed on their own and no longer rely on their retained yolk (Witherington 2002). The post-hatchling swim frenzy may last for weeks (Witherington 2002; Mansfield and Putman 2013) until turtles move into the North Atlantic gyre or the Sargasso Sea (Bolten 2003; Mansfield and Putman 2013; Mansfield *et al.* 2014; Putman and Mansfield 2015, Putman *et al.* 2020; Phillips 2022). The life stage following the post-hatchling swim frenzy is currently being referred to as the juvenile dispersal stage (Phillips 2022) as opposed to the juvenile neritic stage when larger juveniles move shoreward and feed on primarily benthic prey. During the juvenile dispersal stage, young turtles inhabit areas where surface waters converge to form local downwelling that are characterized by floating material, especially *Sargassum,* and where primary productivity and chlorophyll are elevated. Juvenile dispersal stage turtles are not considered to be passive drifters. Comparison of tracks between tagged juvenile dispersal stage turtles and tags allowed to drift passively suggests active swimming behavior and orientation by these small turtles, and they appear to be influenced by the Earth's magnetic field, ocean circulation, and currents and other environmental cues (Mansfield and Putman 2013; Mansfield *et al.* 2014; Putman *et al.* 2020; Philips 2022). Juvenile dispersal stage turtles spend most of their time near the surface and likely feed on a wide variety of floating organisms commonly associated with the *Sargassum* community (Mansfield *et al.* 2014; Witherington 2002; Putman *et al.* 2020) and shelter under mats of *Sargassum* and other flotsam. North Atlantic loggerhead turtles inhabit the pelagic waters of the north Atlantic and western Mediterranean Sea for between six and twenty-five years whereupon they move back into the neritic zone off the US Atlantic coast and settle into the neritic environment at 42-50 cm straight carapace length (Bjorndal *et al*. 2000; Snover 2002; Avens and Snover 2013).

Juvenile neritic stage loggerhead turtles in the NW Atlantic commonly inhabit continental shelf waters from Atlantic Canada, south through Florida (Engstrom *et al*. 2002; Hall and James 2021). Temperate estuarine waters, including the Chesapeake Bay, comprise important inshore habitat, and turtles migrate into the area when waters warm to approximately 20°C (Musick and Limpus 1997; Mansfield *et al.* 2009; DiMatteo *et al.* 2024). Long-term in-water studies indicate that juvenile loggerhead turtles reside in specific developmental foraging areas for many years, while others move back and forth between neritic and oceanic waters (Mansfield 2006; McClellan and Read 2007; Mansfield *et al*. 2009). In Virginia's Chesapeake Bay waters, loggerhead turtles appear to prefer the deeper central mainstem of the Bay as opposed to Kemp's ridley turtles which appear to prefer shallower nearshore habitat (DiMatteo *et al.* 2022). Little is known about any sea turtle species presence in Virginia's seaside coastal bays and few strandings are reported in that area. It is unclear whether low stranding numbers are the result of low turtle density, low human density resulting in poor coverage and reporting, low turtle mortality or a combination of factors.

Adult female loggerhead turtles from the northern recovery unit typically inhabit warm waters (between 18.2 and 29.2 °C) in depths of 3.0–89.0 m and exhibit repeated movement patterns and home range behavior within these waters (Keinath *et al*. 1987; Mansfield 2006; Hawkes *et al.* 2011). Additionally, studies have tracked post-nesting females from northern recovery unit beaches and Florida nesting sites to Mid-Atlantic Bight waters, where they presumably come to forage (Arendt *et al.* 2012a; Arendt *et al*. 2012b; Ceriani *et al.* 2012; Griffin *et al*. 2013).

Kemp's ridley Turtle (*Lepidochelys kempii*)

Status

The Kemp's ridley turtle was listed as endangered throughout its range on December 2,1970 under the Endangered Species Conservation Act of 1970 (35 FR 8491) and has received Federal protection under the ESA since 1973 (NMFS and USFWS 2010). The Kemp's ridley turtle was listed in Appendix I by the Convention on International Trade in Endangered Species (CITES) on July 1, 1975, which prohibited all commercial international trade. The International Union for the Conservation of Nature (IUCN) Red List categorizes the Kemp's ridley turtle as Critically Endangered (NMFS and USFWS 2015, Wibbels and Bevan 2019). In Virginia, the Kemp's ridley sea turtle is listed as state endangered (Virginia Threatened and Endangered Faunal Species) and is a Tier I SGCN in the Virginia Wildlife Action Plan (VDGIF 2015).

Distribution, abundance, and habitat use

The Kemp's ridley turtle nesting population has a restricted distribution and is largely limited to the beaches of the western Gulf of Mexico, primarily in Tamaulipas, Mexico (NMFS *et al.* 2010, Wibbels and Bevan 2019). Nesting also occurs regularly in Texas but infrequently in other US states. Adult female Kemp's ridleys nest during the day and exhibit synchronized nesting behavior, called arribadas, which means "arrival" in Spanish. They gather off nesting beaches in northeastern Mexico and come ashore in large groups to nest simultaneously. Kemp's ridley arribadas have not been observed outside of the primary Gulf of Mexico nesting area. Kemp's ridley nesting in the Gulf occurs from April to July. Females lay two to three clutches per season, and return to the beach to nest in one to three year intervals. After emerging from the nest, hatchlings orient seaward by moving away from the darkest silhouette of the landward dune or vegetation to crawl towards the brightest horizon.

Nesting in the US and Mexico beaches in the Gulf of Mexico increased steadily from the mid-1990s to 2010. Immediately after the 2010 Deep Water Horizon (DWH) oil spill, however, annual nest numbers declined (Bevan *et al*. 2016; Wibbels and Bevan 2019). From 2011-2022 nesting has been annually variable, but has not returned to a steady increasing trend similar to the early 1990s to 2009 (Gladys Porter Zoo and Bi-National Mexico/USA Kemp's ridley Recovery Program *unpublished data,* May 2024). Though not showing an increasing trend, current nesting numbers are higher than those reported in the 1990s and 2000s (NMFS and USFWS 2015). In addition, late-stage embryo deformities have been observed more frequently on two nesting beaches in Texas, although there has been no change in clutch size or hatching success (Shaver *et al.* 2021).

Unlike adult Kemp's ridley turtles, which occur primarily in the Gulf of Mexico, juveniles have a broader distribution. In the NW Atlantic, foraging areas for a substantial population of coastal juvenile Kemp's ridley turtles are in shallow coastal waters, mainly in the large estuarine systems along the eastern US, extending from Florida to New England (NMFS *et al.* 2010; Wibbels and Bevan 2019). Modeling approaches to studying dispersal of oceanic stage hatchlings suggest that some proportion of oceanic Kemp's ridley turtles disperse into the NW Atlantic from the Gulf of Mexico nesting areas (Putman *et al.* 2013; Putman *et al.* 2020; Phillips 2022). Key juvenile developmental habitats include Chesapeake Bay where occurrences in foraging habitats are seasonal, spanning the warmer months (Lutcavage and Musick 1985; Keinath *et al.* 1987; Mansfield and Musick 2005; DiMatteo *et al.* 2022).

Using size structure of Kemp's ridley turtles captured in systematic trawl surveys off the southeastern US to model survival, Arendt *et al.* (2022) predicted high annual survival rates of juvenile Kemp's ridley turtles in the NW Atlantic from 1990 through 2019. Along the Atlantic coast of the US, Kemp's ridley turtles are distributed seasonally from southern Florida to Massachusetts, with most of the population occurring south of Cape Hatteras in cooler months

(December-March). Models developed by the US Navy (USN) suggest highest abundance in the lower Mid-Atlantic (Delaware Bay to Cape Hatteras) occurs in August (Figure 5) and lowest abundance occurs in February (Figure 6; DiMatteo *et al.* 2024). In these models, surface time for Kemp's ridley turtles was estimated using data collected in the Gulf of Mexico which may skew the density estimates, most likely resulting in overestimates of density compared with, for example loggerhead turtles. Because many of the Kemp's ridley turtles distributed in the Mid-Atlantic and Northeast US are small juveniles unable to be detected from aerial and shipboard platforms, these estimates may underrepresent the true abundance of this species.

Kemp's ridley turtles that migrate to Virginia presumably do so because of increased foraging potential compared to overwintering areas. Switching state-space modeling, an approach used to identify different types of behavior, can be applied to satellite telemetry data and has been used to identify foraging behavior in sea turtles based on an animal's movement patterns (Jonsen *et al.* 2006; Jonsen *et al.* 2007; Eckert *et al.* 2008; Maxwell *et al.* 2011; Hart *et al.* 2012; Shaver *et al.* 2013). Switching state-space modeling derived from satellite tagged Kemp's ridley turtles in the Chesapeake Bay showed almost all their time was spent foraging (Barco *et al.* 2015; DiMatteo *et al.* 2022). A habitat suitability model identified suitable Kemp's ridley turtle habitat in the mainstem of the Bay and river mouths from May through November with Kemp's ridley habitat identified as being close to shore in the mainstem Bay and throughout the tidal waters of major Bay tributaries (Figure 7). The model did not identify much suitable habitat for Kemp's ridley turtles in August, but the model was likely affected by sparse telemetry data acquired that month (DiMatteo et al 2022).

Thus far, no turtles tagged on the Atlantic coast as juveniles have been recorded nesting in Texas (NMFS *et al.* 2010), but at least two tagged juvenile rehabilitated and released turtles from Virginia were found stranded dead on barrier island beaches in Louisiana (VAQS *unpublished data,* May 2023).Tagging studies in the northern Gulf of Mexico show some neonate and juvenile dispersal to the Atlantic coast but the overall dispersal from that area is thought to be low (Gredzens and Shaver 2020; Phillips 2022).

Diet

Juvenile and adult Kemp's ridley turtles are considered to be carnivorous, feeding primarily on portunid, also called swimming crabs (*e.g.,* blue crabs) (Shaver 1991; Burke *et al*. 1993a, b; Marquez 1994; Seney and Musick 2005; Barco *et al.* 2015). Shaver (1991) suggested that the distribution of foraging Kemp's ridley turtles is related to the distribution and availability of all the major crab species that are consumed. Decapod crustaceans, predominantly blue crabs and spider crabs were the majority of prey for Kemp's ridley turtles in Virginia (Seney and Musick 2005; Seney *et al.* 2014). In a study examining the GI tract contents of 81 Kemp's ridley turtles that stranded in Virginia from 2010 to 2013, 85% of the samples contained decapod crustaceans and 28%, 25%, 23%, 7%, and 1% of samples contained mud snail shells, horseshoe crabs, bony fishes (primarily Menhaden), insects, and cartilaginous fish, respectively (Seney *et al*. 2014; Barco *et al.* 2015). Eight samples (~10%) contained anthropogenic items, including plastic, glass, and fishing twine.

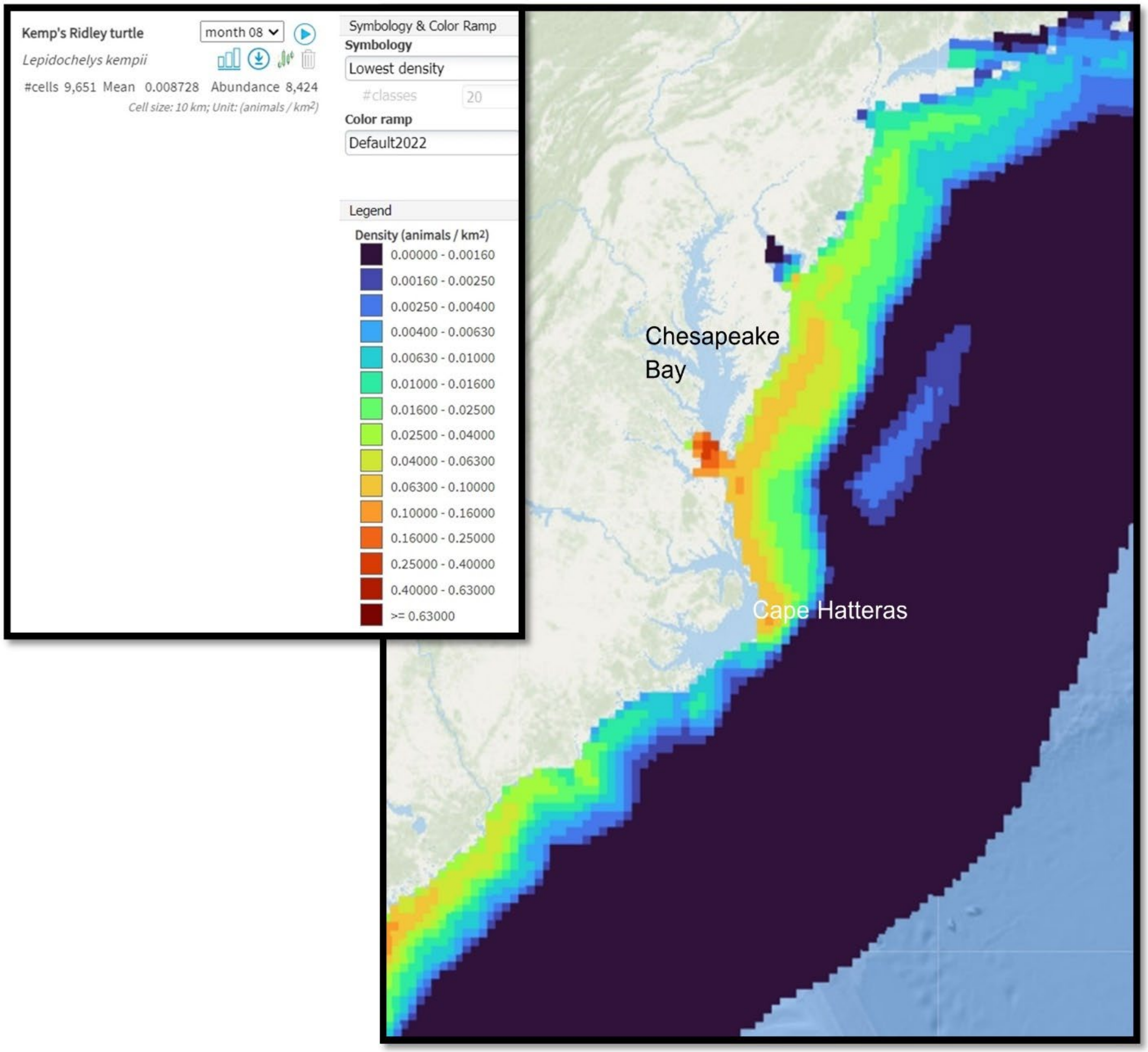


Figure 5. Modeled Kemp's ridley density map for August, the month when density is predicted to be highest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

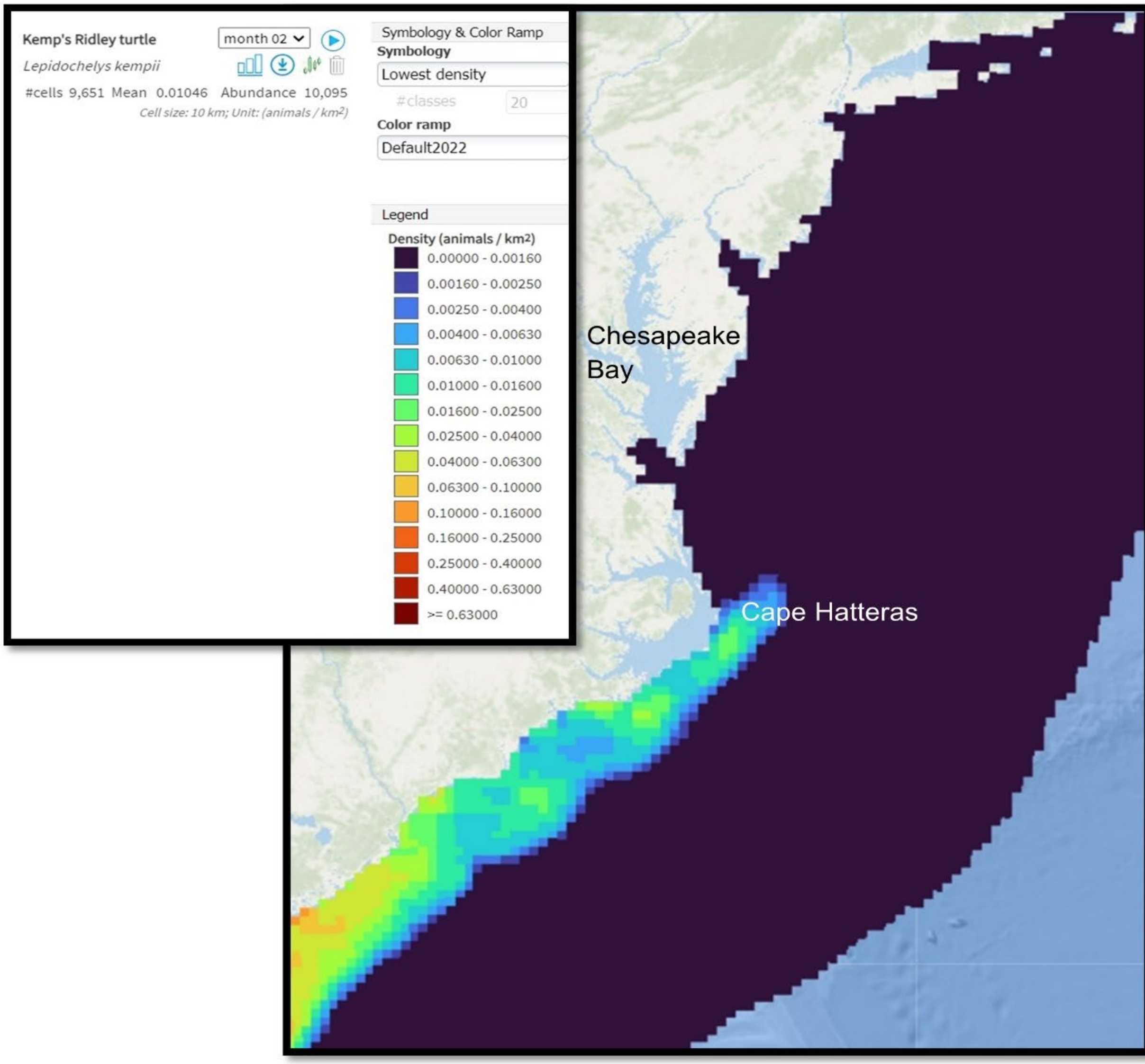


Figure 6. Modeled Kemp's ridley density map for February, the month when density is predicted to be lowest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

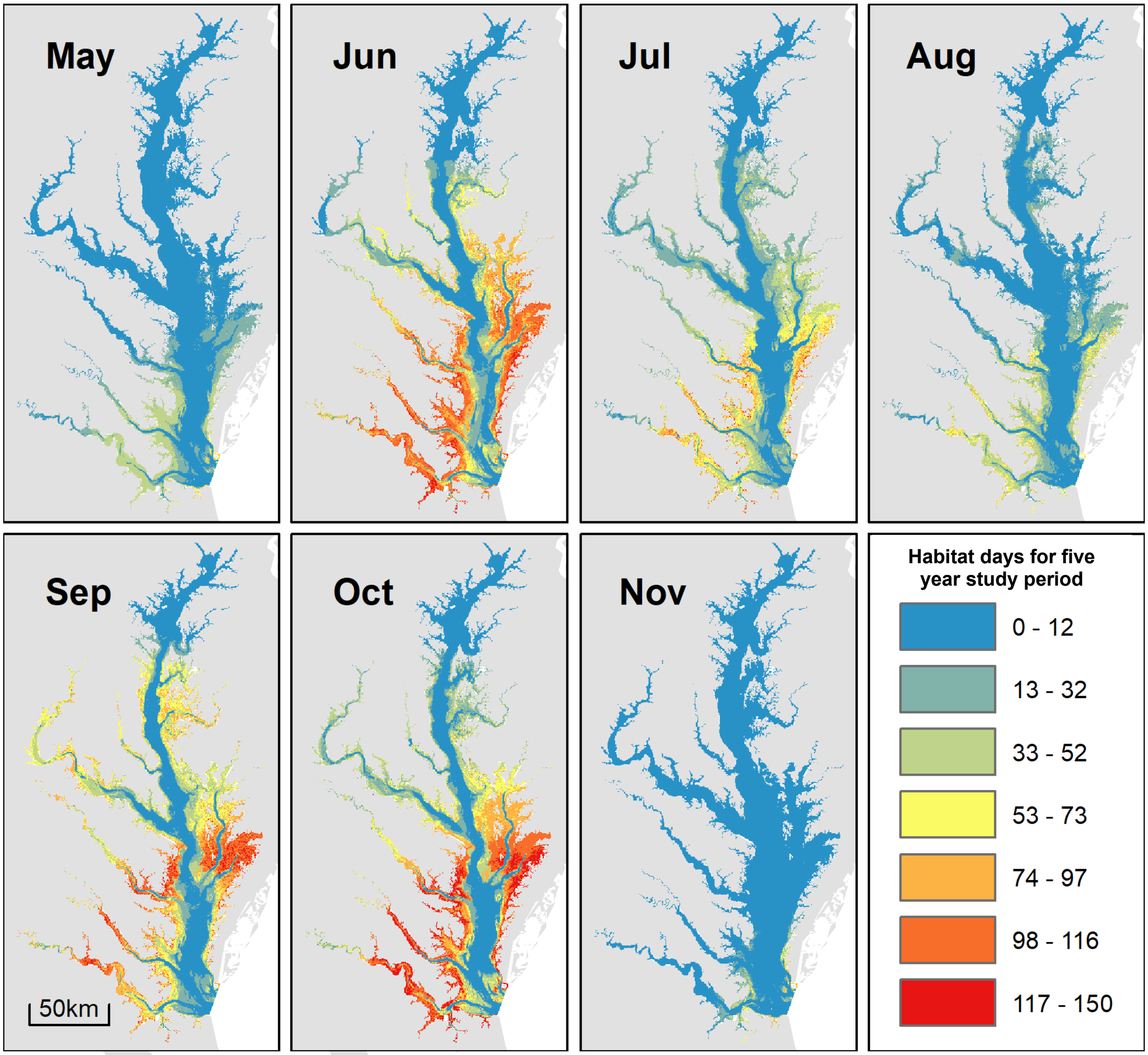


Figure 7. Monthly location of suitable habitat (in days) for Kemp's ridley turtles in Chesapeake Bay and its tributaries (Figure 3 in DiMatteo et al. 2022).

Habitat Requirements and Reproductive Activity in Virginia

Kemp's ridleys share a life history pattern generally similar to loggerhead turtles (Bolten 2003). Females lay their eggs on coastal beaches where the eggs incubate in sand. After 45-58 days of embryonic development, hatchlings emerge, *en masse*, and swim offshore into deeper, ocean water where they feed and grow until returning at a larger size to nearshore coastal habitats.

Kemp's ridley turtles occasionally nest along the Atlantic coast of the US including in Virginia where three nests have been documented in state records dating to the 1970s. The three documented nests were all within the city limits of Virginia Beach. The first was reported at Dam Neck Naval Base (DNNB) in 2012, the second at False Cape State Park in 2014, and third at Sandbridge Beach in 2021. The 2014 nest failed but the 2012 and 2021 nests had hatching success of 82% and 84% and emergence success of 97% and 99% respectively.

Juvenile neritic stage Kemp's ridley turtles in the NW Atlantic commonly inhabit continental shelf waters from Cape Cod Bay in Massachusetts, south through Florida (NMFS *et al.* 2011). Temperate estuarine waters, including the Chesapeake Bay, comprise important inshore habitat, and turtles migrate into the area when waters warm in spring. In Virginia's Chesapeake Bay waters, Kemp's ridley turtles appear to prefer shallow, near shore waters of the Bay including river mouths as opposed to loggerhead turtles which appear to prefer deeper mainstem bay habitat (see Figure 7; DiMatteo *et al.* 2022). Little is known about any sea turtle species presence in Virginia's seaside coastal bays and few strandings are reported in that area. It is unclear whether low stranding numbers are the result of low turtle density, low human density resulting in poor coverage and reporting, low turtle mortality or a combination of factors.
Kemp's ridley turtles along the eastern seaboard migrate out of coastal foraging areas, such as the Chesapeake Bay, to more favorable southern overwintering sites in response to abrupt temperature declines each year in late fall (Lutcavage and Musick 1985; Byles 1988; Morreale and Standora 2005; Barco and Rose 2019). Kemp's ridley turtles leave the Chesapeake Bay in mid-October through early November (Barco and Rose 2019). An important area for seasonal migrants may be off central North Carolina (Morreale and Standora 1998, DiMatteo *et al.* 2024) where the water is warmer because of the nearby Gulf Stream. In May, as water temperatures rise, Kemp's ridley turtles begin to reappear in Virginia (Costidis *et al.* 2022; Epple *et al.* 2023; DiMatteo *et al.* 2024).

Neritic Kemp's ridley turtle juveniles tagged along the US Atlantic coast have been observed nesting at Rancho Nuevo, Tamaulipas, Mexico (Schmid 1995; Chaloupka and Zug 1997; Schmid and Witzell 1997; Schmid and Woodhead 2000), providing evidence of their recruitment to the adult stage in the Gulf of Mexico. A juvenile turtle originally tagged in the Maryland waters of the Chesapeake Bay, was observed nesting in Tamaulipas, Mexico, in two different nesting seasons, which were three years apart (NMFS *et al.* 2010).

Green Turtle (*Chelonia mydas*)

Status

In 1978, the green turtle was listed as threatened except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered (43 FR 32800). Eleven distinct population segments (DPS) of green turtles were listed in 2016 as either endangered or threatened (81 FR20057). The North Atlantic green turtle DPS is currently listed as threatened, and thus, posed no change in Virginia's 1987 state threatened designation. Updated in-water critical habitat for green turtles in the US was proposed in summer 2023 (88 FR 46572) and should be finalized in summer or fall 2024 (J. Shultz, NOAA Fisheries *pers. comm*., April, 20 2024). For the North Atlantic DPS, proposed Atlantic coast critical habitat includes the east coasts of Florida and North Carolina (from the South Carolina border to Currituck Sound, North Carolina) from mean high water to 20m depth and offshore Sargassum habitat, as well as portions of Puerto Rico. The green turtle is globally listed as Endangered by the IUCN Red List (Seminoff 2004) and is listed on Appendix I of the CITES (NMFS and USFWS 1991b). Lastly, the green sea turtle is a Tier I SGCN in the Virginia Wildlife Action Plan (VDGIF 2015).

Distribution, abundance, and habitat use

Green turtles range throughout tropical oceans and estuaries. In the western Atlantic, they occur from Argentina north to New England (Carr 1952; NMFS and USFWS 1991b). Along the US Atlantic coast green turtles are distributed seasonally from southern Florida to Massachusetts, with the majority of the population occurring south of Cape Fear, North Carolina during the cooler months (December-February). Models developed by the USN suggest highest abundance in the lower Mid-Atlantic (Delaware Bay to Cape Hatteras) occurs in August (Figure 8) and lowest abundance occurs in December-February (Figure 9; DiMatteo *et al*. 2024). In these models, surface time for green turtles was estimated using data collected in the Gulf of Mexico which may skew the density estimates, most likely resulting in overestimates of density compared with, for example loggerhead turtles. Because many of the green turtles distributed in the Mid-Atlantic and Northeast US are small juveniles unable to be detected from aerial and shipboard platforms, these estimates may underrepresent the true abundance of green turtles. Interestingly, the models suggest that there are large juvenile and, possibly, adult sized green turtles offshore of the Mid-Atlantic although few records of animals larger than small juveniles exist in the stranding records for that area (VAQS *unpublished data*, May 2024; Barco *et al.* 2018; DiMatteo *et al.* 2024).

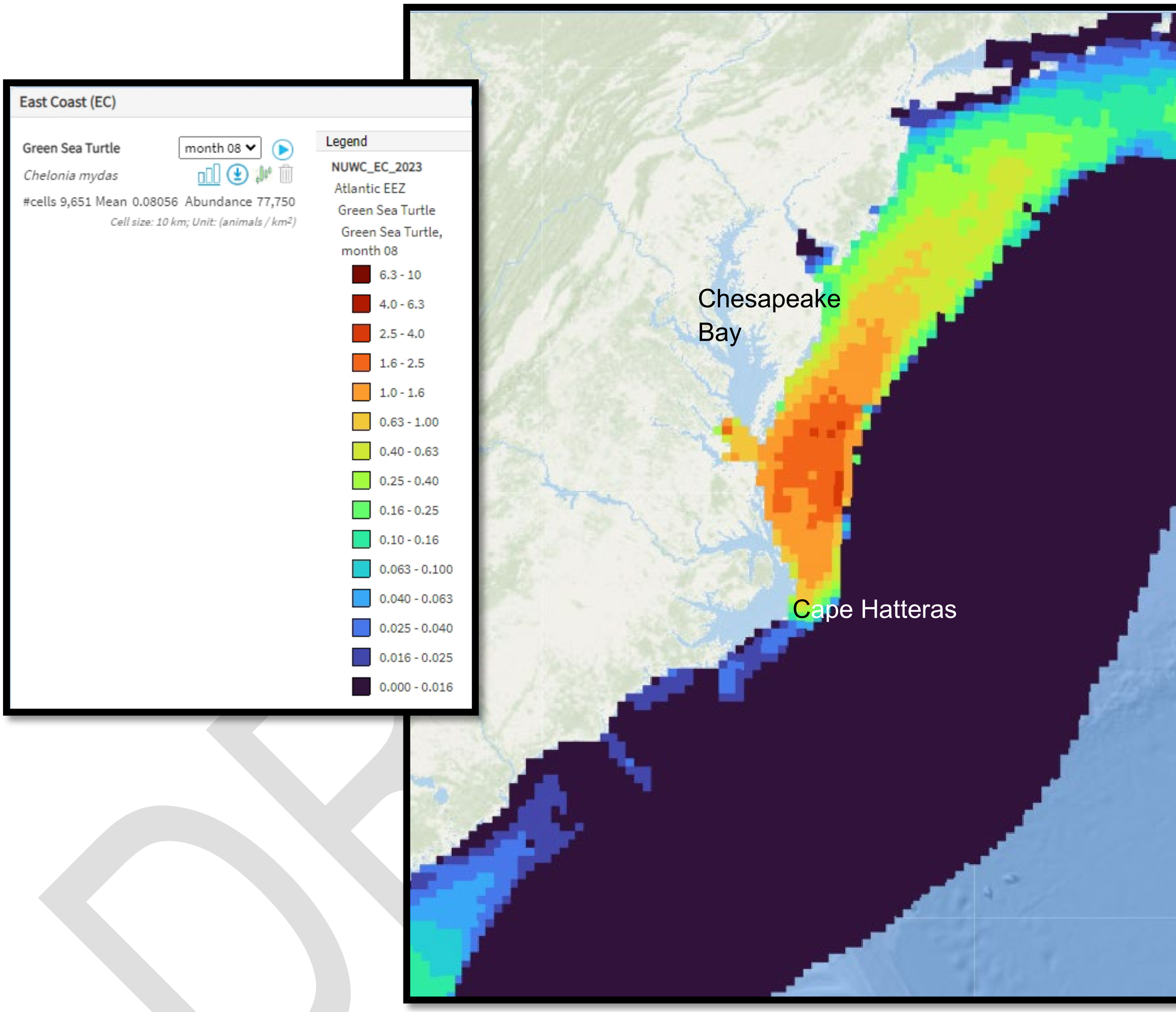


Figure 8. Modeled green turtle density map for August, the month when density is predicted to be highest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

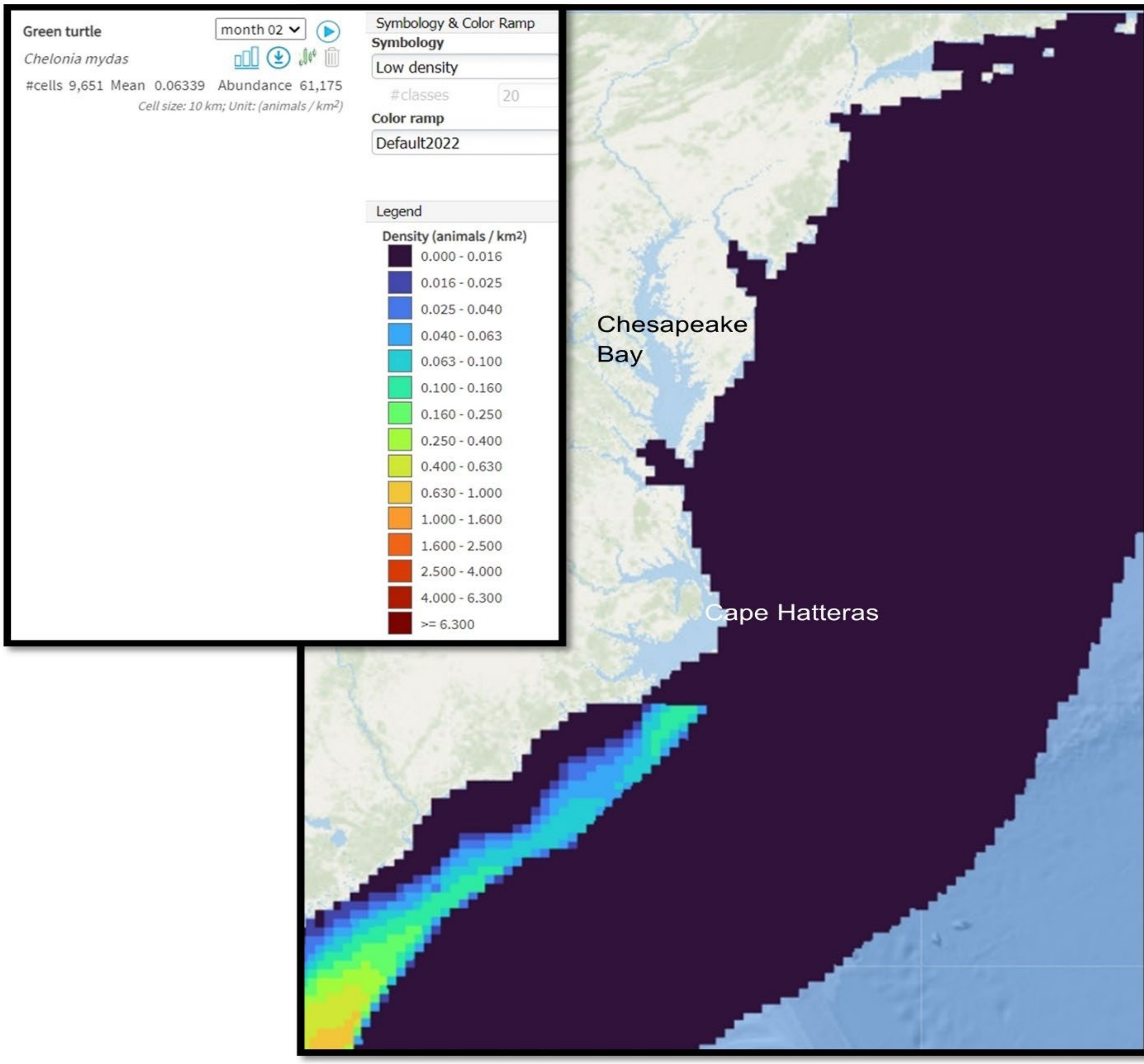


Figure 9. Modeled green turtle density map for February, the month when density is predicted to be lowest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

Diet

Unlike other sea turtle species, green turtles become primarily herbivorous once they shift to benthic habitats as young juveniles (Howell 2012) and remain so for the remainder of their lives (NMFS and USFWS 1991b). Stranding data indicate the majority of green turtles that occur in Virginia and Maryland waters appear to be small post-pelagic juveniles with straight carapace lengths < 40 cm (Costidis *et al.* 2021; Costidis *et al.* 2022; Epple *et al.* 2023). Past examinations of stomach contents of individuals stranded in Virginia included both eelgrass and macroalgae, especially sea lettuce of the genera *Ulva* (Bellmund *et al.* 1987; VAQS *unpublished data,* May 2023). More recently, preliminary examinations of GI tract contents collected from 27 green turtles between 2005 and 2011 revealed that all contained sea grasses. Eight (30%) of the sampled GI tracts had both sea grass and small pieces (<5 cm^2) of plastic debris in them (VAQS *unpublished data,* May 2023) suggesting the presence of plastic debris in grass beds.

Habitat requirements

Although historically reported as abundant in Virginia's waters (Brady 1925), today green turtles occur in relatively low numbers compared to loggerhead and Kemp's ridley turtles and since 1994 comprised less than 10% of the state's annual sea turtle stranding totals (0 – 20 strandings per year) (Swingle *et al.* 2013; Swingle *et al.* 2014). Green turtle strandings in Virginia, however, have increased in recent years with 41 reported in 2022, suggesting that there may be a greater number of green turtles occupying Virginia's waters than previous years (Costidis *et al.* 2021; Costidis *et al.* 2022; Epple *et al*. 2023).

Green turtle nesting has been increasing annually on Florida Atlantic beaches and the region now hosts the largest green turtle nesting assemblage in the western North Atlantic (Seminoff *et al.* 2015). The number of green turtle nests on index beaches in Florida broke previous record highs in 2011, 2013, 2015, 2017, 2019, and 2023 reflecting both a well-documented two year reproductive cycle and steadily increasing nesting population in the state (Florida Fish and Wildlife Conservation Commission accessed May 2024). Recruitment of juvenile green turtles to neritic habitats in the Mid-Atlantic and Northeast US will likely result from increased nesting in the past decade. The relatively low abundance of green turtles in Virginia compared to green turtles in North Carolina may be correlated with significant losses of eelgrass (*Zostera marina*) in the lower Chesapeake Bay and seaside coastal bays since the 1930s (Orth & Moore 1983; Muehlstein 1989; Lefcheck *et al.* 2017). Efforts currently underway to restore eelgrass in Virginia have been met with considerable success, especially in the state's coastal bays (Orth & McGlathery 2012; Oreska *et al.* 2021). This may result in an increase in Virginia's Green Turtle population as more eelgrass beds become established in state waters. To date, there have been no systematic sea turtle surveys in Virginia's coastal bays and knowledge of sea turtle distribution and abundance in that part of the state is lacking.

In the past, green turtle nesting along the US Atlantic coast was thought to be largely confined to Florida (NMFS and USFWS 1991b). However, in more recent years, reports of green turtle nesting activity from Georgia through North Carolina have become more frequent (http://www.seaturtle.org/nestdb// accessed May 2023; Shamblin *et al.* 2018). Six green turtle nests have been documented in Virginia since 2005 (DWR *unpublished data,* September 2024), all within the southern half of Virginia Beach's city limits. These nests may have been laid by females also nesting in northern North Carolina (NCWRC *unpublished data,* May 2023). From 2018-2022, 206 green turtle nests (annual average = 41 nests; range 20-62 nests) were reported in North Carolina, nearly half of which nested on the state's northern shorelines (seaturtle.org accessed May 2023). Thus, it is possible that more individuals may move north across the state line and nest on Virginia's beaches in the future.

Leatherback Turtle (*Dermochelys coriacea*)

Status

In 1970, the leatherback turtle was listed as endangered throughout its global range under the Endangered Species Conservation Act of 1970 (35 FR 8491) and has received Federal protection under the ESA since 1973. This status was adopted by the DWR in 1987 and is a Tier I SGCN in the Virginia Wildlife Action Plan (VDGIF 2015). In 2020, all leatherback turtle Distinct Population Segments (DPS) were designated as endangered under the ESA (85 FR 48332) including the NW Atlantic DPS. In 2013, the species was globally listed as *Vulnerable* on the IUCN Red List, and the NW Atlantic subpopulation was designated as being *Endangered* in 2019 (NW Atlantic leatherback Working Group 2019). According to the most recent US ESA status review, the NW Atlantic DPS appears to be exhibiting a decreasing nest trend at most index beaches and the primary in-water threat to this subpopulation is the incidental capture of nesting females, foraging adults and juveniles by coastal and pelagic commercial fisheries including longline, gillnet and pot/trap fisheries (NMFS and USFWS 2020). This persistent in-water threat combined with the declining trend in nesting activity have led the NMFS and USFWS to consider the NW Atlantic DPS to be at a high risk of extinction (2020). Leatherback turtles are also listed in Appendix I of the CITES.

Distribution, abundance, and habitat use

Leatherback turtles range throughout tropical and temperate oceans of the world and are the most widely distributed of all reptiles (Pritchard 1980). Along the Atlantic coast of the US, leatherback turtles are distributed throughout the outer continental shelf waters year-round but appear to occur in coastal waters south of Cape Hatteras during cooler months (January-March; Dodge *et al.* 2014). Models developed by the US Navy suggest highest abundance in the lower Mid-Atlantic (Delaware Bay to Cape Hatteras) occurs in August (Figure 10) and lowest abundance occurs in February (Figure 11; DiMatteo *et al.* 2024).

Despite being highly migratory and known to spend a significant amount of time in pelagic waters (NMFS and USFWS 2020), they also occasionally wander into nearshore and inshore waters of the mid-Atlantic (Keinath 1986; Rider *et al.* 2024). Leatherbacks have been observed regularly in the lower Chesapeake Bay and nearshore ocean waters during aerial surveys and by commercial and recreational fishermen and boaters (Terwilliger & Musick 1995; Dodge *et al.* 2014; Barco *et al.* 2016). In the decade from 2013-2022, a mean of four (±3 SD; range 0-11) leatherback strandings, including live animals entangled in crab and whelk pot buoy lines and in pound net leaders were reported annually on Virginia shorelines and waters (VAQS *unpublished data,* May 2023). Leatherbacks occur in Mid-Atlantic waters primarily during warmer months (May to November).

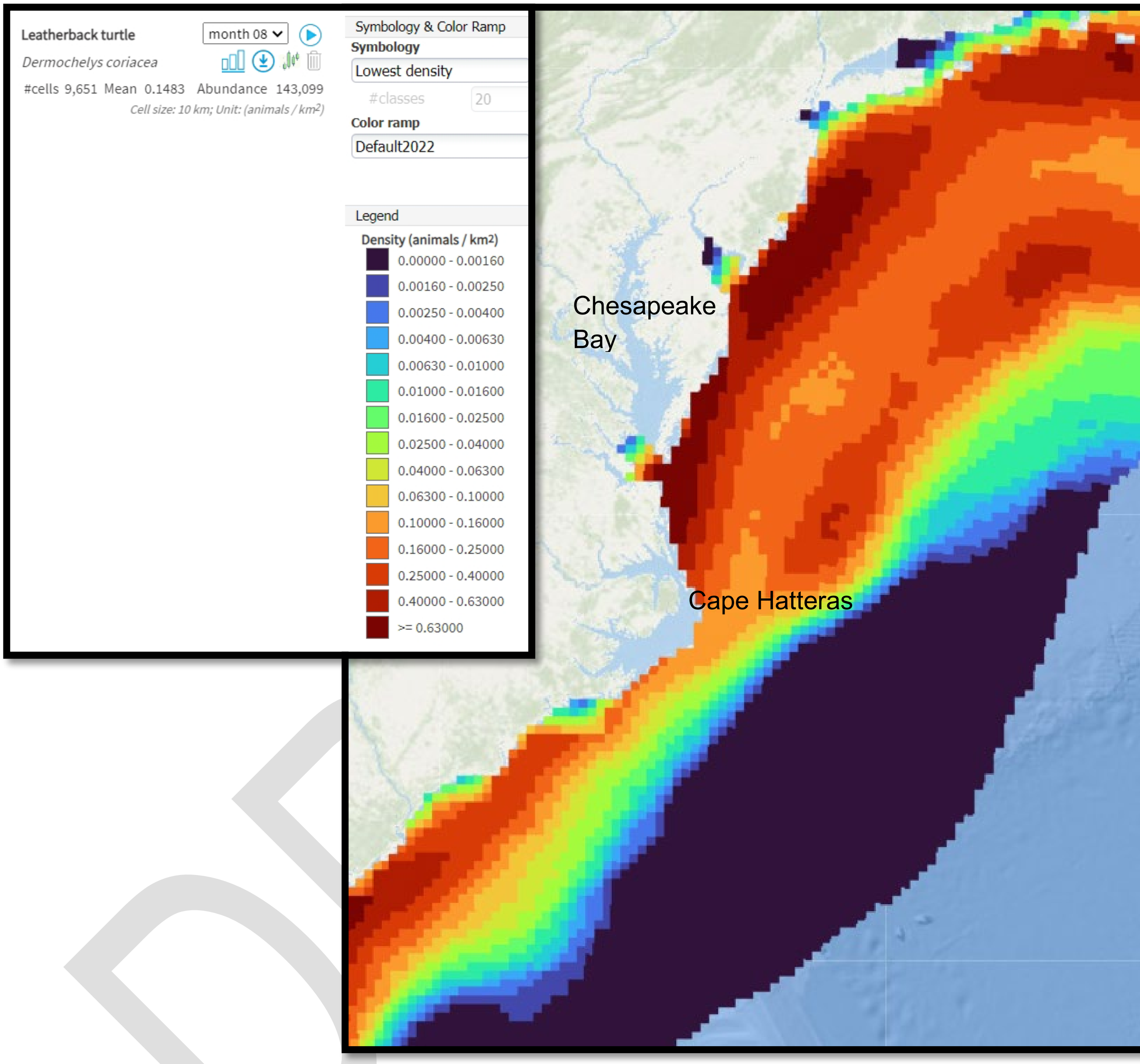


Figure 10. Modeled leatherback turtle density map for August, the month when density is predicted to be highest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

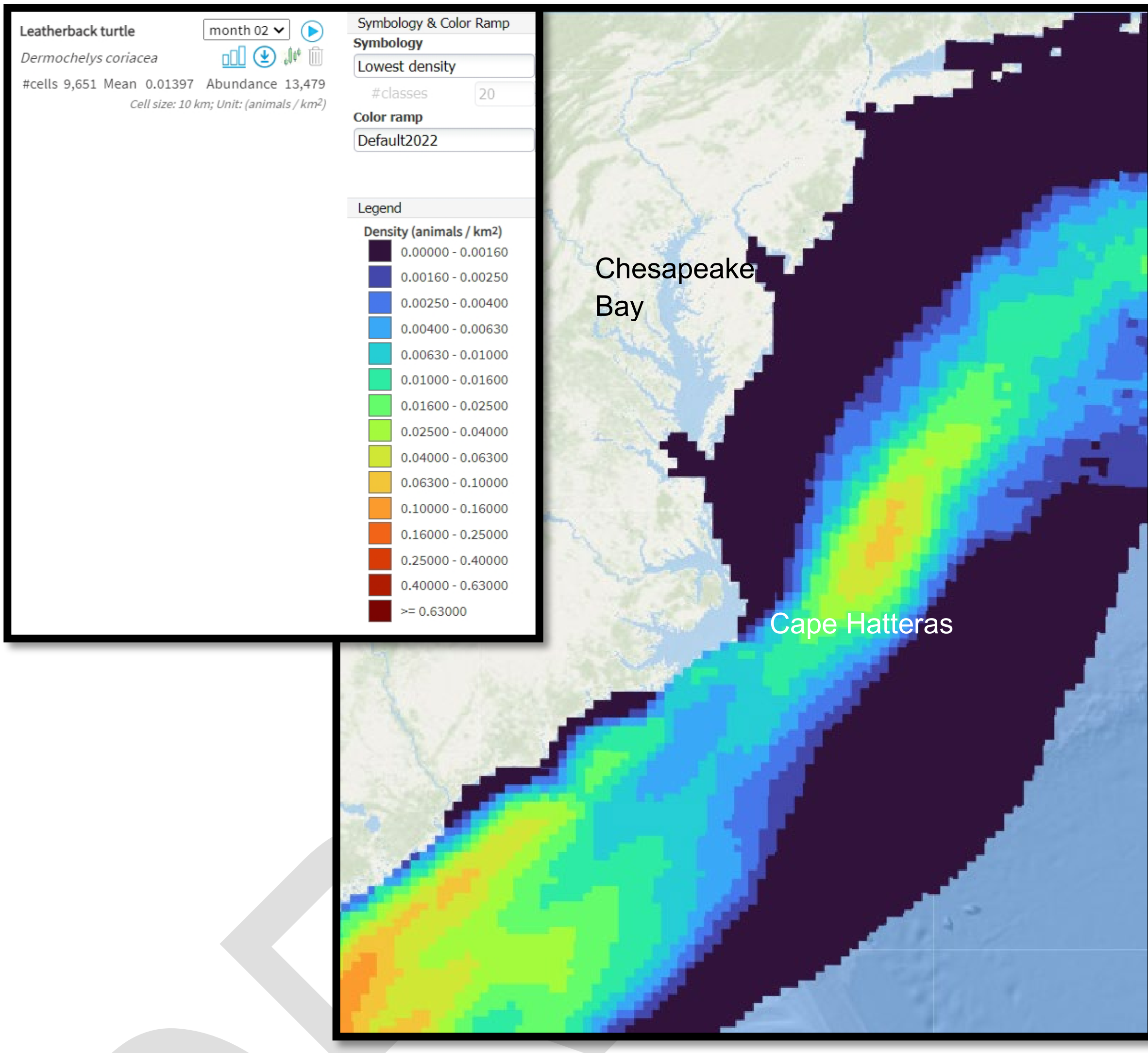


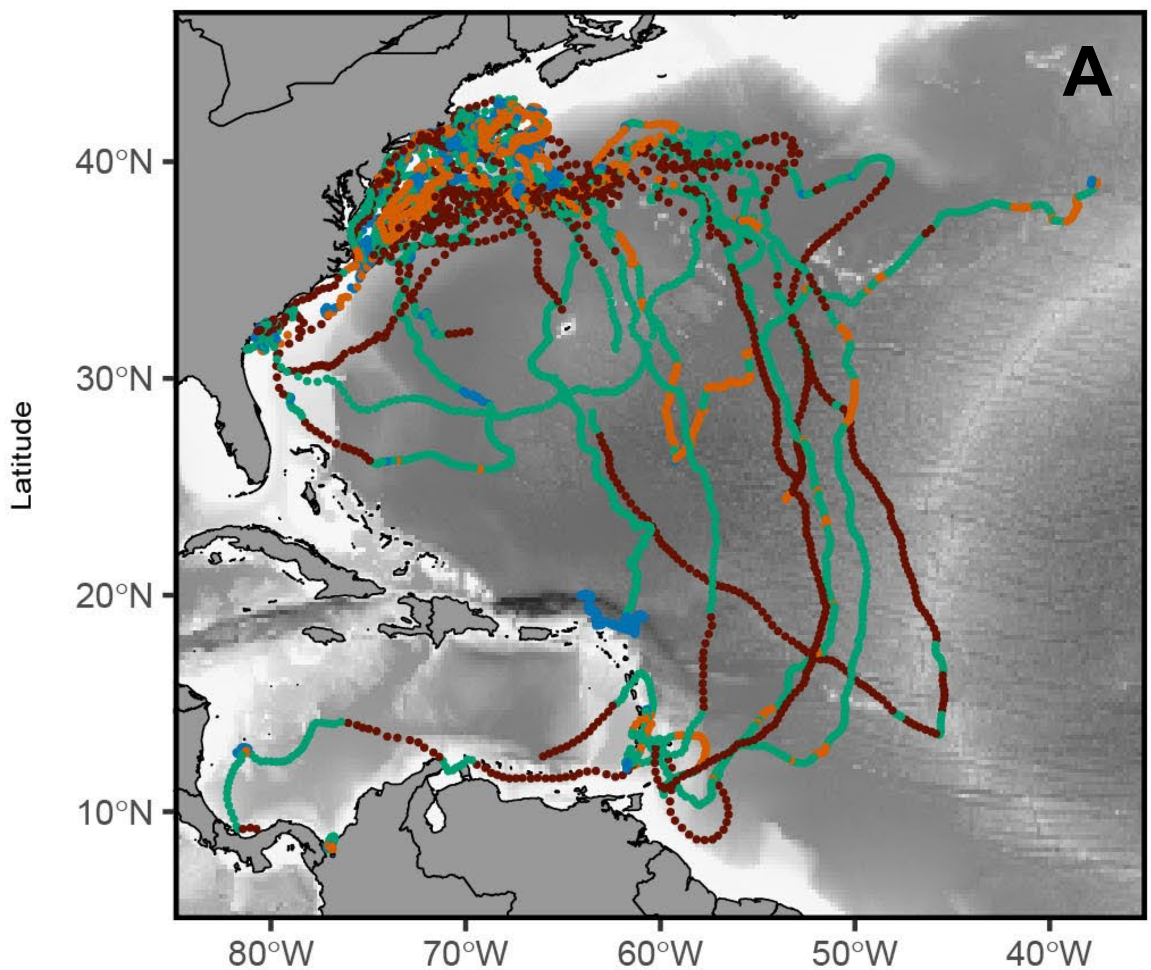
Figure 11. Modeled leatherback turtle density map for February, the month when density is predicted to be lowest in the Mid-Atlantic region (DiMatteo et al. 2024) [downloaded July 27, 2023: https://seamap.env.duke.edu/models/NUWC/EC/]

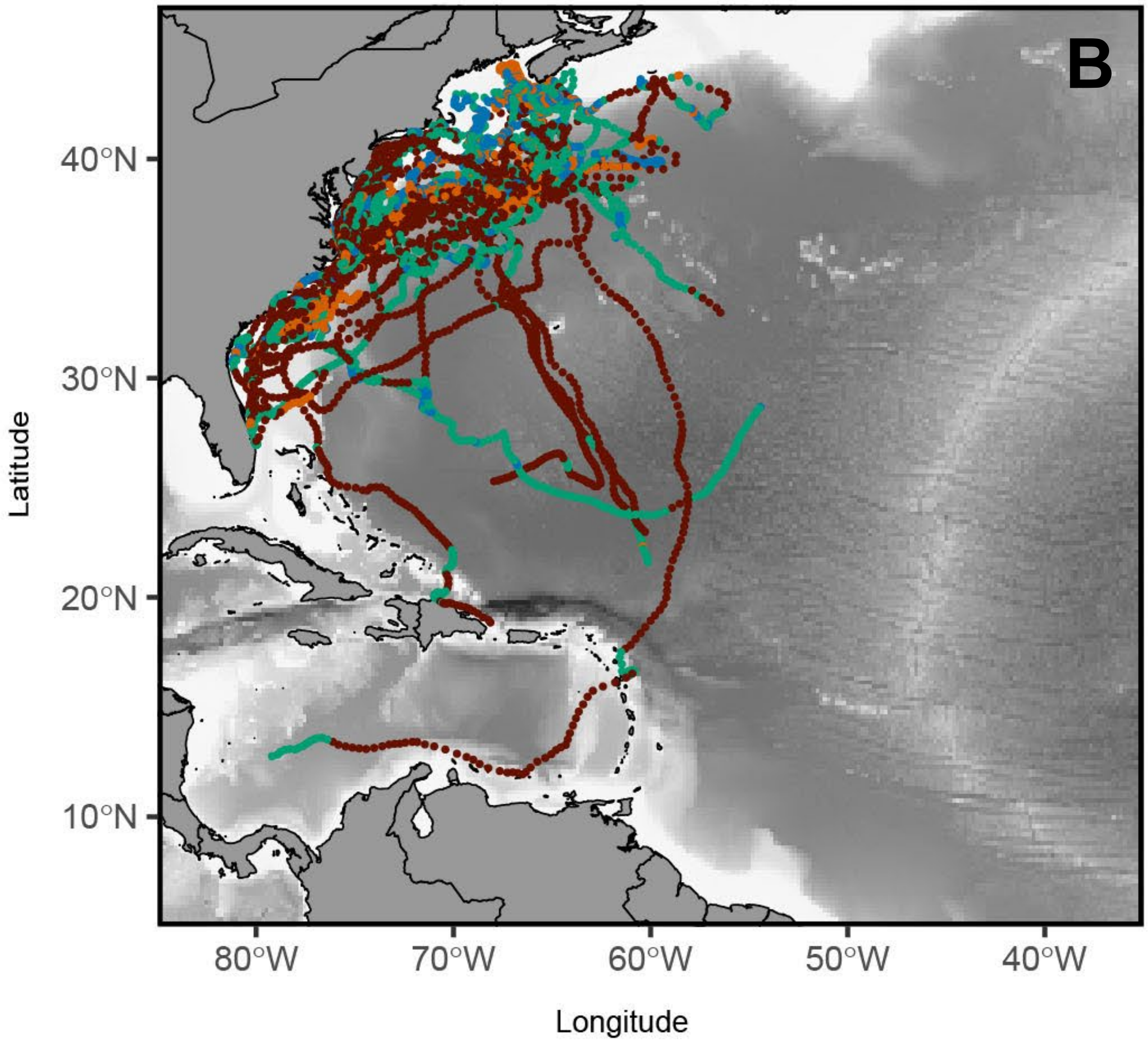
but have been observed in state waters in late fall and early spring when water temperatures are below the tolerance threshold of other sea turtle species (Barnard *et al*. 1989; DiMatteo *et al.* 2024). This may be because leatherback turtles have endothermic capacity (Standora *et al.* 1984), a heat-generating trait which permits their survival in cool waters.

Diet

In Virginia waters, leatherback turtles feed on soft-bodied invertebrates (Brongersma 1961, Pritchard 1971; Brongersma 1972; Pritchard 1980), primarily the sea nettle (*Chrysaora quinquecirrha*) and moon jellyfish (*Aurelia aurita;* Keinath *et al*. 1987; Musick 1988; Keinath & Musick 1990). Nordstrom *et al.* (2019) found that gelatinous prey distribution predicted leatherback turtle occurrence in Atlantic Canada and the same may be true for the Mid-Atlantic

Bight, including Chesapeake Bay. Recent analyses of satellite tagged leatherbacks from North Carolina and southern New England captures suggests that movement consistent with foraging (Area Restricted Surfacing or ARS) was prevalent in the Mid-Atlantic Bight, including Virginia Ocean waters (Figure 12; Rider *et al.* 2024). Leatherbacks in the Mid-Atlantic Bight tended to prefer water temperatures that hovered around 20°C associated with thermoclines between 10 and 20m deep in June and July and 30m deep in August and September (Rider *et al.* 2024). Jellyfish tend to concentrate near the thermocline and the Mid-Atlantic Bight has a high biomass of gelatinous zooplankton (Wallace *et al.* 2015).

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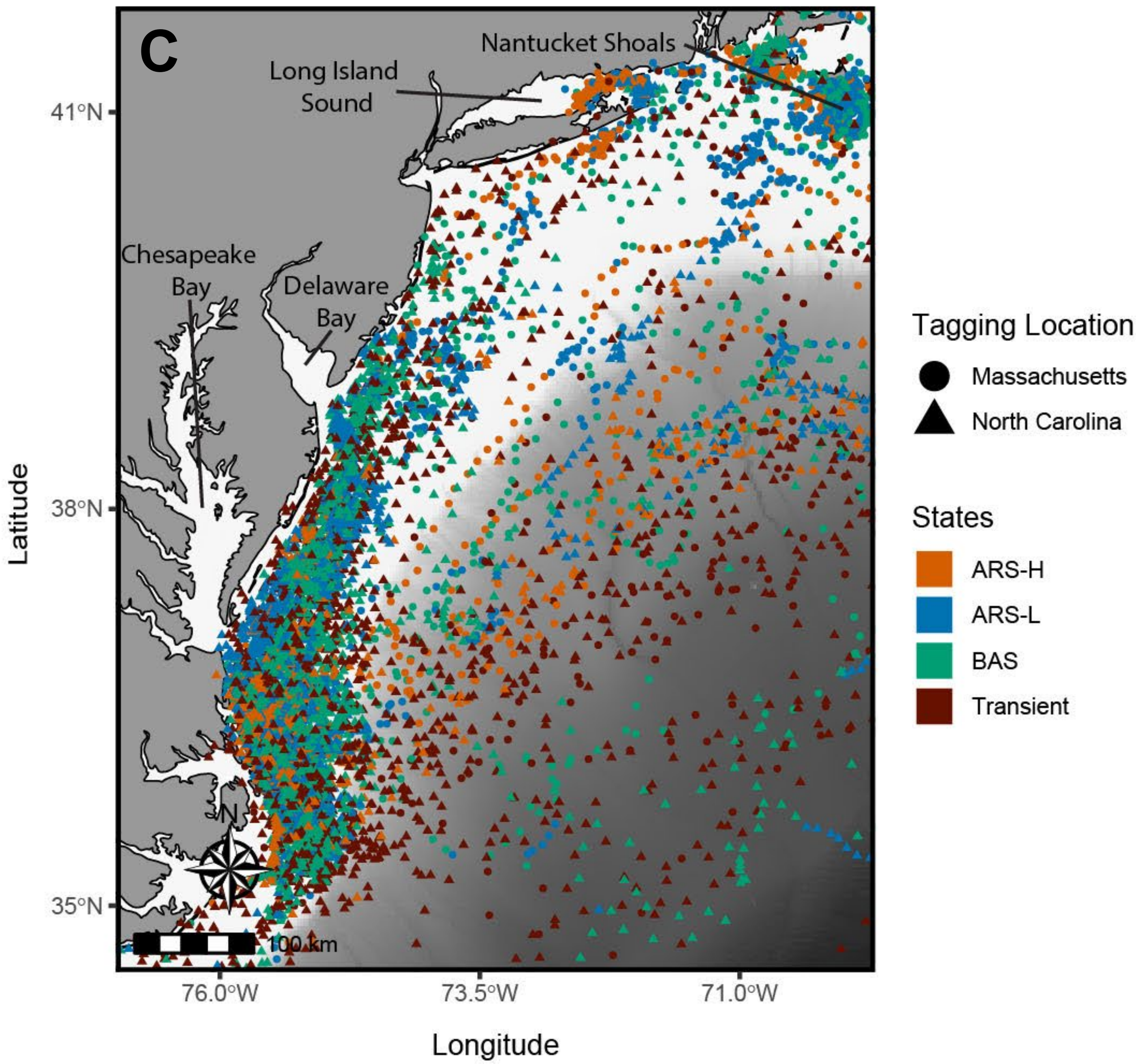

Figure 12. Reconstructed satellite tracks of leatherbacks tagged off Massachusetts in the summer (A) and North Carolina in the spring (B) between 2017 and 2022. Both turtles tagged in North Carolina (triangle) and Southern New England (circle) appeared in waters off Virginia. Colors correspond to the latent states predicted by the hidden Markov model: Area restricted search with high dive intensity (ARS-H), area restricted search with low dive intensity (ARS-L), broad area search (BAS), and transient [Figure 1 in Rider et al., 2024].

Leatherback turtle nesting along the US Atlantic coast is largely limited to Florida. However, occasional nesting has been documented as far north as North Carolina, where six nests were been documented from 2019-2023 (http://www.seaturtle.org/nestdb/index.shtml?view=1). To date, there are no records of leatherback turtles nesting in Virginia, however, a daytime nesting emergence was documented on Assateague Island National Seashore, Maryland, in 1996. A potential egg chamber was found at the site; however, no eggs were found despite a thorough search of this area (Rabon *et al.* 2003).

Management of Sea Turtles in Virginia

Virginia Regulatory Agencies

Two state natural resource agencies in Virginia have authority to manage federally listed sea turtles, marine mammals, and marine fishes (hereafter collectively referred to as protected marine species). They are the Virginia Department of Wildlife Resources (DWR) and the Virginia Marine Resources Commission (MRC). The DWR is charged with the management of all wildlife and inland fish in the Commonwealth (*Code of Virginia* §§ 29.1-103 and 29.1-109). The Board of Wildlife Resources (DWR Board) is a gubernatorially appointed supervisory board of the DWR. Pursuant to the Virginia Endangered Species Act (Virginia ESA; *Code of Virginia* §§ 29.1-563–570), the DWR Board has authority to adopt the federal list of endangered and threatened species (§ 29.1-566); to list additional species as endangered or threatened in the Commonwealth, *id*. and the Department manages and protects those species throughout the Commonwealth (§§ 29.1-564, -567, and -570). Together DWR and the DWR Board develop, adopt, and enforce state regulations pertaining to all state and federally threatened and endangered wildlife species, excluding listed species of the Class Insecta (§ 29.1-566). Via the Cooperative Agreement entered into with the NOAA Fisheries Service (also known as the National Marine Fisheries Service or NMFS) as provided for under Section 6 of the Endangered Species Act of 1973, as amended, the DWR also is responsible for protection and management of species listed under the federal Endangered Species Act of 1973 (federal ESA), as amended, 16 U.S.C.S. §§ 1531 to 1544. The DWR has broad wildlife management responsibilities, which are addressed by three discrete units: Wildlife Division, Aquatics Division, and Nongame & Endangered Species Program in the Executive Office. Regarding protection and management of the Commonwealth's endangered or threatened wildlife and fish species, the DWR's Nongame and Endangered Species Program and Law Enforcement Divisions are primarily responsible for program development and implementation regarding protection and management of endangered or threatened species that occur throughout the Commonwealth's lands and jurisdictional waters.

The MRC has the authority to develop and enforce fishery regulations pertaining to the protection and conservation of state and federally protected marine species. However, it is not responsible for developing or enacting state threatened and endangered species laws or regulations and draws no authority from the Virginia or federal ESA. The MRC is charged with the conservation of marine life and has comprehensive management authority for all marine organisms and associated habitats within its jurisdiction that extends from the fall lines of all tidal rivers to the 3-Mile Limit Line of the Territorial Sea (*Code of Virginia* § 28.2-101). This includes sea turtles and marine mammals as well as their prey bases *Code of Virginia* §§ 28.2-201 and -1204). The MRC has regulatory jurisdiction over activities affecting state-owned bottomlands in tidal waters only (*Code of Virginia* §§ 28.2-1200-1209). The MRC has authority over all commercial fishing activities within its jurisdiction, regulates the take of marine finfish and shellfish in Virginia's tidal waters, and has the ability to administer a protected species observer program for state fisheries with appropriate federal authorization and permits (*Code of Virginia* § 28.2-200-244). It is also responsible for establishing finfish and shellfish seasons, size and possession limits, species-specific landings, harvest quotas, and harvest size restrictions (*Code of Virginia* § 28.2-101). The Code of Virginia authorizes the MRC to promulgate regulations that conserve and promote the seafood and marine resources of the Commonwealth (*Virginia Code* § 28.2-201), establish and limit licenses, *id*., collect fisheries statistics (*Code of Virginia* § 28.2-204) and prepare fishery management plans (*Code of Virginia* §§ 28.2-201, -203 and -203.1). The MRC's Fisheries and Habitat divisions are responsible for development and implementation of programs that carry out these mandates.

The DWR conservation police officers and MRC marine police officers share some of the same powers; each is vested with the authority to enforce the criminal laws of the Commonwealth; see *Code of Virginia* §§ 28.2-106 (B) (providing that "Officers of the Virginia Marine Police shall have the same powers as (i) sheriffs and other law-enforcement officers to enforce all of the criminal laws of the Commonwealth, and (ii) regular conservation police officers appointed pursuant to Chapter 2 (§29.1-200 et seq.) of Title 29.1.") and 29.1-205 (providing that "Regular conservation police officers are vested with the same authority as sheriffs and other law-enforcement officers to enforce all of the criminal laws of the Commonwealth."). As it is a criminal violation to violate the provisions of the Virginia ESA, Virginia Code § 29.1-567(1), the Conservation Police and the Marine Police have equal authority to enforce the Commonwealth's endangered species laws. Moreover, the MRC has standing law enforcement agreements with National Oceanic and Atmospheric Administration (NOAA) Fisheries and the US Fish and Wildlife Service (USFWS), enabling marine patrol officers to collaborate with their federal counterparts on protected species investigations, patrols, inspections, warrants, and arrests. The DWR has a standing law enforcement agreement with the USFWS that allows conservation police officers to serve as Deputy US Fish and Wildlife Special Agents and conduct investigations both in-state and across state lines when violations of federal wildlife laws have been committed. Finally, the MRC Marine Police receives annual funding from NOAA Fisheries to assist with sea turtle and marine mammal stranding response and fishery management in the Commonwealth through a Joint Enforcement Agreement with NOAA Fisheries.

A third state entity, the Virginia Institute of Marine Science (VIMS), has conservation responsibilities as well, but has no authority to enact or enforce state regulations; s*ee Code of Virginia* §§ 28.2-1100 -1104 (establishing VIMS and setting forth its authority, duties, and responsibilities). VIMS is a part of both the College of William and Mary and Richard Bland College (§23.1-2807). VIMS is specifically mandated to serve the state in matters of marine research and has marine conservation duties (*Code of Virginia* §28.2-1100). VIMS has a three-part mission to conduct interdisciplinary research in coastal and estuarine science; to educate students and citizens; and to provide advisory service to policy makers, industry, and the public (https://www.vims.edu/about/). VIMS' duties include advising, training, providing technical and scientific assistance, and conducting research for the MRC, federal agencies, and other public and private groups on the conservation and management of marine, coastal, and estuarine resources (*Code of Virginia* § 28.2-1100). Research at VIMS extends from inland watersheds to the open ocean and is conducted by teams of scientists with diverse expertise in areas such as plankton and nutrient dynamics; shoreline and wetlands processes; fisheries ecology and stock assessment; fisheries gear engineering and bycatch; aquaculture; genetics; immunology; toxicology; biological, chemical, and physical oceanography; aquatic diseases; computational modeling; and marine geological processes.

Federal Endangered Species Act (ESA)

In 1973, Congress passed the federal ESA (16 U.S.C. 1531 *et. seq*.), which enhanced federal abilities to protect endangered species and develop measures for their recovery. During each reauthorization of the Endangered Species Act, amendments have been added which reflect the experience and knowledge gained in administering its provisions. The 1978 amendments required the USFWS and NMFS to develop and implement recovery plans for species under their jurisdiction. Between 1991 and 1993 recovery plans were completed for all four species of sea turtles covered in this plan (NMFS 1991a, 1991b, 1992, USFWS and NMFS 1992). A second revision of the loggerhead turtle recovery plan for the NW Atlantic population was completed in 2008 (NMFS and USFWS 2008) and the second revision of the Kemp's ridley recovery plan was published in 2011 (NMFS *et al.* 2011). Five-year status reviews have been completed for the Kemp's ridley turtle (NMFS and USFWS 2015), the leatherback turtle (NMFS and USFWS 2020), North Atlantic green turtle (Seminoff *et al.* 2015) and the NW Atlantic loggerhead DPS (NMFS and USFWS 2023).

The federal ESA offers endangered and threatened species comprehensive protection and is administered jointly by the USFWS and NOAA Fisheries. The USFWS has authority over terrestrial and freshwater fish, wildlife, plants and insects while NOAA Fisheries has authority over marine and anadromous fish and wildlife. The two agencies share jurisdiction over sea turtles with responsibilities elucidated in the 2015 Memorandum of Understanding; NOAA Fisheries is responsible for the conservation and recovery of sea turtles in the marine environment, and the USFWS is responsible for the conservation and recovery of sea turtles on nesting beaches and in captivity/rehabilitation. Section 4 of the federal ESA contains provisions for the listing and recovery planning process, including the determination of critical habitat and the issuance of regulations deemed necessary and advisable to further the conservation and recovery of listed species. Section 6 allows for the establishment of cooperative agreements with states that give state fish and wildlife agencies shared authority over the recovery and conservation of federally listed species within state boundaries. Federally -permitted, -funded, or -conducted actions known to impact sea turtles, such as dredging and in-water military training activities, are addressed under Section 7 through incidental take statements for intergovernmental consultation. Section 10 provides for the development of habitat conservation plans and incidental take permits for non-federal actions that threaten listed species, such as state commercial fishery operations.

USFWS and NOAA Fisheries Section 6 Cooperative Agreements

Section 6 of the federal ESA provides a mechanism for cooperation between states and the two federal agencies responsible for overseeing the conservation and recovery of federally threatened, endangered, and candidate species. Under section 6, NOAA Fisheries and USFWS are authorized to enter into agreements with any State that establishes and maintains an “adequate and active” program for the conservation of endangered and threatened species. Once a State enters into such an agreement, NOAA Fisheries and USFWS are authorized to assist in, and provide Federal funding for, implementation of the State’s conservation program. The DWR entered into a cooperative agreement with the USFWS in 1976 and signed a cooperative agreement with NOAA Fisheries in 2009.

Virginia’s Wildlife Action Plan

On November 5, 2001, President Bush signed the Department of the Interior and Related Agencies Appropriations Act, 2002, which created the State Wildlife Grants (SWG) program. As indicated within this legislation, these grants were established to help fund the development and implementation of programs for the benefit of wildlife and associated habitats, including nongame species. The SWG program receives annual Congressional appropriations that are administered by USFWS. USFWS apportions these funds, using a legislated formula based on human population and geographic area, to fish and wildlife management agencies within the 50 states, the five U.S. territories, and the District of Columbia. To receive annual SWG appropriations, Congress stipulated that each wildlife agency must produce a Comprehensive Wildlife Action Plan (WAP), to be updated every 10 years. The 2015 WAP (http://bewildvirginia.org/wildlife-action-plan/), designates all four species of sea turtles covered by this plan as Species of Greatest Conservation Need. The 2025 iteration of the WAP is currently being updated and this plan will serve as an appendix to the upcoming version.

Virginia ESA

Virginia's ESA (*Code of Virginia* §§29.1-563-570), administered by the DWR, provides for adoption of the federal endangered and threatened list (*Code of Virginia* § 29.1-566), listing at the state level, *id*., and protection of those species in the state (*Code of Virginia* § 29.1-567). Further protective legislation for non-endangered species is found in *Code of Virginia* §29.1-521, which provides for the protection of wildlife in general. The DWR Executive Office units along with the following divisions are responsible for program development and implementation: Wildlife, Fisheries, Law Enforcement, Outreach, Planning and Finance.

Virginia Sea Turtle Nest Monitoring Program

Virginia is the nearly northern extent of the loggerhead nesting range along the US Atlantic coast and is part of the species' Northern Recovery Unit (NRU) within the NW Atlantic Ocean Distinct Population Segment (NMFS and USFWS 2008). Currently, an average of seven loggerhead nests are laid annually on Virginia's beaches. In addition, six green turtle and three Kemp's ridley nests have been documented in the Commonwealth since 2005 (DWR, *unpublished data*, September 2024). The monitoring of sea turtle nesting activity has been on-going since 1970. Over 77% (n = 192 nests) of all documented nests were laid on ocean-facing beaches between the North Carolina/Virginia border and the Joint Expeditionary Base - Ft. Story (hereafter referred to as the southern mainland beaches). All but one of the remaining nests (n = 65 nests) were deposited on the beaches of Virginia's barrier islands in Accomack and Northampton counties. The exception was a loggerhead nest found on Gwynn's Island in Matthew's County approximately 45 miles north of the mouth of the Chesapeake Bay.

Currently, daily nest patrols are conducted on the southern mainland beaches and on Assateague and Wallops islands, Virginia's northernmost barrier islands, which are owned and managed by Chincoteague National Wildlife Refuge and NASA, respectively. Of the 65 nests documented on the barrier islands since 1970, 46 were deposited on Assateague Island and 13 nests were laid on Wallops Island. Most other barrier islands are monitored every 3 – 7 days in conjunction with shorebird productivity studies. The level of coverage on islands south of Wallops has thus far proven to be adequate since they are remote and accessible only by boat (except for Fisherman Island which can be accessed by vehicle), undeveloped, under conservation ownership (*i.e.,* TNC, USFWS and DCR), and receive little to no human disturbance. Moreover, only four nests and 16 false crawls have been detected since shorebird studies began in 2004. While it is likely that some nests and non-nesting emergences were missed, daily coverage is not warranted at this time given the logistical constraints (*e.g.*, vehicles are not allowed and must be covered on foot) and overall lack of capacity. All sea turtle nest monitors are permitted by the USFWS or the

DWR and follow nest monitoring and management protocols outlined in the Virginia Sea Turtle Nesting Handbook (VDGIF 2017).

Virginia Sea Turtle Stranding and Salvage Network (VSTSSN)

Nationally, the Sea Turtle Stranding and Salvage Network (STSSN) is overseen by the NOAA Fisheries as stated by the 2015 MOU. Virginia is the southernmost state in NOAA Fisheries' Greater Atlantic Region (GAR) which extends from Virginia to Maine. Individual states and organizations in GAR are authorized by the USFWS to recover, examine, and rehabilitate stranded sea turtles either through Section 6 Cooperative Agreements or endangered species permits. On-water disentanglement activities are authorized by NOAA Fisheries. Research on in-water wild turtles requires a permit from the NOAA Fisheries Permit Division, and research on land based wild turtles, rehabilitated or captive turtles requires a permit from the USFWS. In Virginia, DWR's Section 6 Cooperative Agreement with USFWS includes authority to manage the VSTSSN, and DWR has designated staff and volunteers with the Virginia Aquarium & Marine Science Center's Stranding Response Program (VAQS) as agents of the state under DWR's authority (Appendix). VAQS recruits and trains staff and volunteers in sea turtle stranding response and rehabilitation and enters Virginia sea turtle stranding data into the NOAA Fisheries Sea Turtle Stranding and Salvage Database. VAQS also collects and manages additional necropsy and rehabilitation data and images. VAQS coordinates sea turtle response efforts with a variety of federal, state, NGO and municipal entities including the MRC Marine Police, US Coast Guard, NOAA Fisheries Office of Law Enforcement, DWR, state parks, federal wildlife refuges, The Nature Conservancy and military bases.

Limiting Factors, Causes of Mortality, and Other Threats to Sea Turtles in Virginia

A host of factors affect sea turtle populations and their habitats. The growth and subsequent expansion of human population has been well-documented and resulted in a decline in nesting, migration, and foraging habitat throughout these species' ranges. A five-factor analysis is used by NMFS and the USFWS when a species or population is considered for ESA listing, de-listing or undergoing a five-year status review. Here we use four similar factors that are most relevant to Virginia and the Mid-Atlantic region.

- Human caused destruction, modification or restriction of habitat or range
- Mortality or serious injury resulting from commercial, recreational, scientific, or educational activities
- Predation and disease
- Other natural or human created factors affecting each species' continued existence

Each of these factors is explained below in the context of those species that occur in Virginia state waters and adjacent federal waters. Under each factor are descriptions of risks and threats selected from recent sea turtle status reviews that are most relevant to Virginia and the mid-Atlantic region.

When a federal action is proposed that may affect protected marine species, the entity conducting the work must seek consultation with agencies overseeing federal protections. For protected marine species in the water, NOAA Fisheries is consulted through the Section 7 incidental take consultation process, and NOAA Fisheries scientists produce a Biological Opinion as to whether and how the action may harm the species involved which leads to required mitigation measures. Terrestrial actions that may affect sea turtles are reviewed through the USFWS Section 7 consultation process. In addition to actions that directly or indirectly affect federally listed or proposed species and their habitats, there is a federal action review process required for the National Environmental Policy Act (NEPA). The extent to which private entities must comply with these policies depends on the location, action, and funding source. For example, NOAA Fisheries reviews navigational channel dredging funded by the Army Corps of Engineers and any private dredge companies hired by the Corps must comply with terms and conditions detailed in the Reasonable and Prudent Measures and incidental take limits issued by NOAA through the Section 7 consultation. Commercial fishers using gear that is known to take sea turtles as bycatch must comply with any applicable federal regulations and allow onboard observers, observation from separate vessels, or gear inspections when requested while commercial fishers in state waters using gear not deemed to take sea turtles have no applicable federal regulation that they must adhere to. Thus, many actions undergo a federal review process that determines whether harm may come to sea turtles and how that potential harm should be mitigated and monitored. Additional state actions can be required for actions that are federally reviewed but, in many cases, federal mitigation may be sufficient.

1) Human caused destruction, modification or curtailment of habitat or range

This factor includes the effects of activities such as dredging, sand mining, marine construction, shoreline stabilization, and other actions on sea turtle habitat. The presence of fixed structures and gear may displace, destroy, degrade or modify habitat which can result in range curtailment of animals sensitive to such changes. In some cases, human presence alone can curtail habitat (*e.g.,* people moving around and using lights on nesting beaches at night).

In Virginia, coastal habitat loss and degradation have affected overall species diversity, abundance, and distribution in the ocean as well as in the Chesapeake Bay and its tributaries (Kemp *et al.* 1983; Kemp *et al.* 2005). Sea level rise and/or land subsidence is considerable in parts of Virginia (Ezer and Atkinson 2015; Zhang and Li 2019; Ezer 2023), and this phenomenon threatens sea turtle nesting habitat. Nesting habitat can also be degraded by the presence of humans, human activities (such as beach driving), and recreational equipment (*e.g.*, boats, cabanas, and furniture). All sea turtle species in Virginia are affected by the destruction, degradation or modification of in-water habitats. Ocean-facing beaches are the primary terrestrial habitat which sea turtles inhabit. In Virginia, the loggerhead turtle is the species most affected by perturbations to beach habitats since they are the most frequent nesting species in Virginia. NMFS and USFWS (2023) lists threats that interfere with successful nesting, egg incubation, hatchling emergence, and transit to the sea, such as: erosion and erosion control, coastal development, artificial lighting, beach use (including beach driving and cleaning), and beach debris. Nesting females, eggs and hatchlings are all affected by these types of habitat modification and destruction. Equipment left on beaches and other beach debris can also deter, impede, and/or entrap nesting females and hatchlings, discouraging nesting (*e.g.,* higher prevalence of false crawls), and interfering with hatchling emergence and transit to the sea (Fuentes *et al.* 2023). Microplastic beach debris alters the temperature and permeability of sand (Andrady 2011; Fuentes *et al.* 2023), disturbing the incubating environment for marine turtles (Beckwith and Fuentes 2018).

Erosion, erosion control & beach replenishment

Beach erosion is a consequence of many processes including sea level rise, land subsidence, and increased frequency and intensity of storms. Structures built on sea turtle nesting beaches are protected from erosion in a number of ways, including beach armoring structures such as rock revetments, bulkheads, and geo-textile tubes. These structures impede natural coastal processes by physically prohibiting dune formation from wave uprush and wind-blown sand. Beach armoring structures result in lower nest density and lower nesting success depending on the type of armoring, species and location (Rizkalla and Savage 2011; Hirsch *et al.* 2022). Similarly, groins and jetties prevent normal sand transport and cause accelerated beach erosion downdrift of the structures, a process that results in degradation of sea turtle nesting habitat well beyond the structures themselves (Conant *et al.* 2009, NMFS and USWFS 2020, 2023). Armoring structures can effectively eliminate a turtle's access to upper regions of the beach/dune system (Conant *et al*. 2009). Consequently, nests on armored beaches were generally found at lower elevations than those on non-walled beaches. Nests laid at lower elevations are subject to a greater risk of repeated tidal inundation and erosion, which can drown or destroy nests or alter thermal regimes within the nest cavity and thereby affect sex ratios of hatchlings (Ackerman 1997; Limpus *et al.* 2020; Martins *et al*. 2022). Beach armoring structures are present on several ocean-facing beaches in Virginia and include sea walls, jetties, groins and rock revetments.

Beach renourishment is often used to manage beach erosion by adding or redistributing sand; however, renourishment can result in diminished nesting and hatching success (Long *et al.* 2011; Hays 2012; Cisneros 2017). The renourishment process disrupts nesting beaches and may result in changes to beach characteristics such as sand grain size, compaction, and moisture content, *etc.* that can affect nesting, hatching success, and hatchling emergence success long after the renourishment process (Reine 2022). The Army Corps of Engineers recommends guidelines for proper mitigation, sand replacement choices and observations when renourishing sea turtle nesting beaches (Reine 2022). The guidelines are based on research primarily conducted in Florida but are relevant to Virginia.

In Virginia, beach armoring and renourishment that may negatively affect sea turtle habitat is permitted by state and federal regulatory agencies. Shoreline planning and project development is implemented by municipalities for land owned privately and by local government. Permitting agencies entities provide guidance and information for preferred actions (*e.g.* living shorelines and dune restoration as opposed to hard structures where possible). State agencies and other entities comment on permit applications to ensure species, habitats, and other resources are appropriately considered prior to permit issuance.

Beach use by human beings

Beach use by human beings in Virginia includes a variety of activities such as wading, walking, sun bathing, beach combing, surf fishing, beach driving, and resort activities such as festivals, sporting events, and concerts. Management of human beach use requires municipal beach cleaning and trash pickup, life guard and police patrols, and other maintenance activities. Many of these activities can contribute to the degradation of sea turtle habitat quality due to factors such as increased human presence, modification of nesting substrate, light pollution and accumulation of trash and beach debris.

Nesting beaches within the city limits of Virginia Beach all have some degree of exposure to vehicular traffic, in the form of lifeguard vehicles, trash collecting trucks, beach cleaning equipment, municipal, state or federal patrol vehicles, or private vehicles permitted to use the beach as a roadway. In the commercial section of Virginia Beach's resort area, the beach is raked and graded daily during the summer months while the beaches in the residential areas are raked less regularly. Presence of vehicles on the beach has the potential to negatively impact sea turtles by running over nesting females, hatchlings, and nests. Ruts left by vehicles in the sand may prevent or impede hatchlings from reaching the ocean following emergence from the nest. Hatchlings impeded by vehicle ruts are at greater risk of death from predation, fatigue, desiccation, and being crushed by additional vehicle traffic (NMFS and USFWS 2020, 2023). In addition, beach driving and cleaning may change the sand albedo (light or radiation that is reflected by a surface) and affect temperature dependent sex determination (Hays *et al.* 2001). Vehicle lights and vehicle movement on the beach after dark can deter females from nesting and disorient hatchlings. Driving directly above incubating egg clutches can cause sand compaction, which may decrease hatching success and directly kill pre-emergent hatchlings. Additionally, vehicle traffic on nesting beaches may contribute to erosion, especially during high tides or on narrow beaches where driving is concentrated on the high beach and foredune (NMFS and USFWS 2020, 2023).

Beach cleaning to collect debris and trash may damage turtle nests and hatchlings. Mechanical methods used to clean and rake beaches involve heavy machinery that can repeatedly run over nests and potentially compact the sand above them (NMFS and USFWS 2020, 2023). Beach cleaning vehicles also may leave ruts along the beach that hinder or trap emergent hatchlings. Mechanically pulled rakes and hand rakes, particularly if the tongs are longer than 10 cm, penetrate the beach surface and may disturb incubating nests or uncover pre-emergent hatchlings near the surface of the nest (NMFS and USFWS 2020, 2023).

Beaches with higher historical nest presence are surveyed daily prior to beach cleaning and sand raking. Within the highly developed commercial section of the resort area which radiates the most significant nighttime lighting, the beach is cleaned daily before daylight and only patrolled by equipment operators who receive annual training from nest monitors. Only five nests have been recorded in the commercial section, four of which were laid prior to 1997. All detected nests laid in Virginia are marked and thus are protected from being run over by vehicles, but ruts from vehicles are a problem for hatchlings in most areas. Each season, some fresh sea turtle nesting crawls may be obscured by wind and/or rain prior to daily morning nest patrols. Therefore, some clutches may not be detected during morning patrols and go unmarked, and thus are exposed to damage or destruction from vehicular traffic.

Beach goers often leave large items such as sun shades and tents on beaches overnight or fail to properly discard broken items such as beach umbrellas, chairs, tents, *etc.* Depending on the municipality, these large items may not be immediately removed leaving potential hazards for sea turtles. Large beach debris items pose threats both to nesting females and hatchlings as obstacles and/or potential entangling items (Triessnig *et al.* 2012; Fujisaki and Lamont 2016). In the three years of seasonal monitoring for nests on public beaches of northern Virginia Beach, observers noted large objects (*e.g.*, beach chairs, tents, sun shades) on beaches 94 of 364 days (26%; VAQS *unpublished data,* May 2024).

Light pollution

Both nesting and hatchling sea turtles are adversely affected by the presence of artificial lighting on or near the beach (NMFS and USFWS 2023). Artificial lighting deters adult female turtles from emerging from the ocean to nest (Witherington and Bjorndal 1991). Both loggerhead turtle nest site selection and hatchling disorientation can be negatively affected by artificial lighting (Witherington and Martin 1996; Price *et al.* 2018). Because adult females rely on visual brightness cues after nesting, those turtles that nest on lighted beaches may become disoriented (unable to maintain constant directional movement) or misoriented (able to maintain constant directional movement but in the wrong direction) by artificial lighting and have difficulty finding their way back to the ocean. Hatchling sea-finding behavior is also guided strongly by visual cues (Witherington and Bjorndal 1991; Salmon *et al*. 1992; Witherington and Martin 1996; Lohmann *et al*. 1997; Lohmann and Lohmann 2003). Although the mechanism involved in seafinding is complex, involving cues from both brightness and shape, it is clear that intense, bright stimuli can override other competing cues (Witherington and Martin 1996).

Prior to 2001, all sea turtle nests laid on the southern mainland beaches in southeastern Virginia were moved into a hatchery at BBNWR where human disturbance was virtually nonexistent and light pollution was relatively minimal. Current nest management strategies in Virginia include leaving all nests not threatened by regular tidal inundation *in situ*. This means that hatchlings emerging from nests laid on the heavily developed beaches may be exposed to significant artificial lighting and will need to be monitored for dis-orientation and mis-orientation. Efforts to assess and manage artificial lighting on military and municipal-owned beaches in Virginia are in place and have been implemented in cases when a manageable number of bright lights are visible to turtles on otherwise dark beaches. Moreover, municipal landowners, businesses, and homeowners are encouraged to turn off, dim or shield artificial lights in the vicinity of nests near the time of predicted hatching. While large scale management of outdoor lighting on developed nesting beaches is highly desirable from a sea turtle conservation perspective, it has not been gained traction in Virginia largely because the state's nesting population is so small.

Military activities

Military activities along the shoreline and in the waters of Virginia that involve beach disturbance, vessel use and/or aquatic acoustic disturbances (*e.g.,* hovercraft maneuvers, shore-based and in-water training exercises involving explosives, the use of low frequency sonar, *etc.*) have the potential to disrupt or injure sea turtles in the area. In-water military maneuvers involving explosives and/or active sonar may potentially harm sea turtles in all life stages, but information on the scope and extent of the impacts is not well known (NMFS and USFWS 2023; Ciminello *et al.* 2012). Like other permitted activities, the military is expected to report observed takes but total takes are usually estimated based on estimations of density and abundance. Military training activities are permitted and subject to both NEPA, MMPA and ESA oversight/consultation/review. Moreover, the DNNB and JEBFT have Integrated Natural Resource Management Plans in place that provide protections for sea turtle nests, nesting females and hatchlings that are reviewed annually by state and federal natural resource agencies.

Inshore and offshore energy development

Effects of wind energy development, gas and oil exploration, and drilling and production activities on sea turtles is a concern. The Deepwater Horizon (DWH) oil spill and the effects of oil, dispersant, burning, and clean up on sea turtle mortality, fitness, nesting, *etc.* is still being determined (DWH Natural Resource Damage Assessment Trustees 2016; Lauritsen *et al.* 2017; Mitchelmore *et al.* 2017; Stacy *et al.* 2017; Frasier *et al.* 2020; Shaver *et al.* 2021). Excessive noise pollution, increased vessel traffic, increased recreational fishing, sediment and oceanographic changes, potential contaminants entering the ocean environment, and offshore lighting are just some of the potential impacts that may result from the construction and operation of offshore wind (OSW) and gas and oil exploration and production infrastructure. Examples of energy development activities and infrastructure include installation and operation of pipelines used to transport fossil fuels from the offshore platform to land, construction and operation of drill platforms, drill ship anchoring systems, construction and operation of wind turbines, installation of subsurface transmission lines from the turbines to land, and wind turbine anchoring systems. The installation of underwater infrastructure in migratory corridors will likely attract prey, which may disrupt sea turtle migratory behavior, but could also encourage epibiota and benthic invertebrates that turtles feed on. In addition, cumulative impacts from multiple inshore and offshore energy facilities in NW Atlantic waters could have a significant range-wide impact on sea turtles which should be taken into account during the siting and design phases. The Regional Wildlife Science Collaborative for Offshore Wind (RWSC) has developed a Science Plan which describes recommendations for data collection, research, and coordination for environmental monitoring of OSW following more than a year of information gathering and discussion with subject matter experts (RWSC 2024). The RWSC sea turtle recommendations included a need for increased baseline data collection and collaborative investigations into shelf-wide sea turtle distribution and abundance, and to investigate behavioral responses to construction (*e.g.*, pile driving, vessel activity) and operational activities (*e.g.*, electromagnetic fields from cabling, vessel activity, and reef effects from biofouling on turbine supports). The Sea Turtle Chapter of the Science Plan also called attention to the lack of state funding for states such as the Commonwealth of Virginia which do not have state utilities which own and manage the transmission grid and thus have no ability to negotiate powersharing agreements that could provide funding for offshore wind research. The Plan encouraged federal funders to bridge the funding gap among states without these lucrative powersharing funds. Dominion Power began installation of a 179 turbine Coastal Virginia Offshore Wind (CVOW) development in May 2024 which is expected to be completed in 2026. In spring 2024, Dominion Power acquired development rights for a second lease area off Virginia for future development and acquired a northern North Carolina wind lease area, Kitty Hawk Wind, the onshore cabling for which will make landfall in southern Virginia Beach. Of the three projects, only CVOW has an approved Construction and Operation Plan and Final Environmental Impact statement. There are no mitigation requirements for sea turtles in the plans, but CVOW is expected to monitor for sea turtles during vessel and construction operations.

Navigational channel and beach replenishment dredging

Hopper dredging is a major source of mortality for sea turtles in channels along the southeast coast of the U.S. (Joyce 1982; Dickerson *et al*. 1991; Dickerson *et al*. 2004). Harbor and channel dredging can directly affect sea turtles by either entraining sea turtles in the dredge's draghead as it moves across the seabed or by support vessels striking turtles. Indirect effects of hopper dredging include degrading habitat by altering benthic foraging areas, decreasing the number and abundance of prey species, and/or reducing water quality by increasing turbidity and releasing potential contaminants into the water column (Dickerson *et al.* 2004; Ramirez *et al.* 2017). The most documented effects of dredging involve direct injury to and mortality of turtles, and this threat is discussed more extensively under the second factor.

When sand is dredged for beach renourishment, it is sometimes collected as part of existing dredging projects and other times mined for the sole purpose of renourishment. The risks associated with hopper dredging apply to sand mining and are similarly regulated. There are a number of beaches in South Hampton Roads that have and will continue to request renourishment. Some areas are renourished as needed and as funding allows, and others are renourished on a regular schedule based on special taxes.

In Virginia, most navigational dredging using hopper dredges is initiated as a federal action through the Army Corps of Engineers (ACOE). These large projects are permitted and reviewed by federal agencies, and the state has the ability to comment. Municipalities can initiate dredging in smaller water bodies and, depending on the location and water body these are regulated by state agencies.

Noise pollution from sources other than military activities

In-water noise pollution from sources other than military activities (*e.g.,* vessels, marine construction, offshore energy development and operation) may have negative non-lethal effects on sea turtles of all life stages such as alteration of migration routes and avoidance of foraging areas (Lavender *et al*. 2012, 2014; Piniak *et al.* 2012; NMFS and USFWS 2020, 2023;). A study on ambient noise levels near the mouth of the Chesapeake Bay and surrounding waters showed that sea turtles are dealing with very high levels of ambient noise in many of their prime mid-Atlantic estuarine habitats (Bort and Barco 2014). Moreover, noise levels increased with the amount of human activity during certain times of year, particularly at the height of the summer recreational boating season. The addition of anthropogenic noise in sub-surface waters, on top of natural levels to which sea turtles have likely adapted, may automatically push ambient levels to the point where they may actively select quieter habitats over ones that may be better suited to their ecological needs (Samuel *et al.* 2005; Bort and Barco 2014). As marine construction associated with OSW increases, use of mitigation measures during the noisiest phases of construction will be employed as part of the federal permitting process. Effects of OSW operational noise on sea turtles is unknown (RWSC 2024).

2) Excessive mortality or serious injury from commercial, recreational, scientific, or educational activities

In contrast to the previous factor which focused on change in habitat, this factor addresses activities that can directly harm sea turtles. It is inevitable that some sea turtles will be affected by the human use of habitats on which they depend. Some of the highest priority threats that directly affect sea turtles include commercial and recreational fishery bycatch, vessel strikes, hopper dredging, light pollution, marine debris ingestion, and oil pollution (Gleason *et al.* 2020; Lutcavage *et al.* 2017; Pham *et al.* 2017). More recent threats likely to directly affect sea turtles include inshore and offshore energy development and effects of climate change that directly impact animals as opposed to climate change effects on sea turtle habitat (Patricio *et al.* 2021; Hawkes *et al.* 2007; Hays *et al.* 2003).

In this section, we discuss takes of sea turtles in relation to human activities. The ESA defines a take as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.” Under the ESA, a take has the same meaning whether the turtle is discovered alive and apparently unharmed, alive and injured, or dead. Certain federal actions are legally allowed to take turtles under Section 7 of the ESA, and Biological Opinions are issued specifying the number and type of takes allowed under the provisions of the Opinion. Some activities require independent Protected Species Observers (PSO) to document and report takes. Shifts in both turtle behavior and distribution (*e.g.,* recent nesting activity in the Chesapeake Bay, turtles occurring in Virginia waters earlier and leaving later in the year, *etc*.) combined with changes in human activities that likely affect sea turtles (*e.g.,* the deployment of new fishing gear or gear configurations, changes in dredging locations, gear or techniques, emerging forms of energy development, new vessel sizes and design, *etc*.) requires careful surveillance of how these co-occurring alterations are affecting the overall recovery of sea turtle populations.

Documenting non-anthropogenic mortalities, injuries and, in some cases takes, is one form of surveillance that has been on-going in Virginia since 1979 by way of the Virginia Sea Turtle Salvage and Stranding Network (VSTSSN). From 2008 to 2022, the VSTSSN responded to an average of 250 (range 173 – 325) sea turtle strandings per year (VAQS *unpublished data,* May 2023).

Two threats, fishery and vessel interactions, may have been responsible for at least 41% (221 of 538) of sea turtle strandings in 2021 and 2022. In Virginia, turtles that died from acute vessel or fishery interaction were more likely to be healthy and in better body condition than those that died from other causes, suggesting that these types of interactions are removing otherwise healthy turtles from the population (Barco *et al.* 2016). Lastly, recent work on identifying mortality from decompression sickness, which occurs when turtles captured in deep water nets are pulled up too fast, released immediately, and die 24 to 48 hours later, suggests that fishery-related mortality associated with gear set in deeper water (>30m) may be considerably higher than previously observed (Garcia-Párraga *et al.* 2014).

Commercial fisheries

Historic stranding, entanglement, and observer data from Virginia indicate that sea turtles may experience serious injury and/or mortality through encounters with the following gear types: gillnet, pound net, longline, crab and whelk pot, and trawl gear (VAQS *unpublished data,* May 2023; MRC *unpublished data,* September 2024). Although both recreational and commercial crab pot and gillnet gear are deployed in Virginia, net and pot gear recovered with identifying buoys from stranded and entangled turtles was exclusively identified as commercial gear. There is also potential for interactions with other net gear, including purse seines and haul seines, as well as dredge gear for mollusks and crustaceans. Structures associated with aquaculture could also cause entanglement or entrapment.

From 2008 to 2022 fishery interactions were reported with several gear types including pound nets (all turtle species), commercial crab and whelk pots (loggerhead and leatherbacks), hooks (J-hooks, circle hooks, and treble hooks) consistent with both recreational angler (all hard-shelled species) and commercial long line gear (loggerhead), gill net (all hard-shelled species). In 2021 and 2022 reporting protocols and human interaction categories for sea turtle strandings changed. Thus, the discussion of stranding data below applies to 2021 and 2022 data. In 2021 and 2022, 38% (n=207) of strandings in Virginia showed obvious signs of human interaction thought to have contributed to the stranding event (*i.e.,* not healed vessel and fishery interaction scars or incidental debris ingestion), primarily fishery interactions (n-110) and vessel strikes (n=95; Table 1).

Table 1. Human interaction categories for stranded sea turtles in Virginia in 2021 and 2022. All *fishery interactions were reported by recreational anglers, most of which* (n=90) occurred on commercial fishing piers.

Human interaction category	Green	Kemp's ridley	Leatherback	Loggerhead	Unidentified	Totals
Caught on hook/line by recreational angler	3	79	0	9	18	**109**
Found in dredge equipment	0	2	0	9	0	**11**
Vessel strike (probable & suspect)	4	33	1	57	0	**95**
Unidentified trauma (vessel or dredge)	1	2	0	4	0	**7**
Entangled (monofilament twine)	0	1	0	0	0	**1**
Other	1[1]	0	0	1[2]	0	**2**
Totals	**9**	**117**	**1**	**80**	**18**	***207***

[1]The green turtle was netted by a recreational angler for personal consumption.
[2]The loggerhead turtle was entrapped in a marine construction project that escaped unharmed.

Among the 538 total strandings reported in Virginia in 2021 and 2022, nine loggerheads, 80 Kemp's ridleys, and three green turtles had ligature marks on their bodies, attached or ingested gear, or other evidence of interactions with recreational fishing gear (Table 1; Costidis *et al.* 2022; Epple *et al.* 2023). It should be noted that estimating the frequency of fishery interactions by way of the stranding record is complicated by the fact that ligature marks and other evidence of entanglement are not always discernible on the thick skin of sea turtles. As such, determining the root sources of fishery interactions continues to elude state and federal management agencies.

The picture of fishery interaction with sea turtles from the state-run observer program differs from stranding data. The observer program was developed in 2016 to monitor Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). During the 620 observed trips conducted by the MRC Protected Species Observer Program from 2016 to August 2024, the program recorded a total of 13 sea turtle takes. Six takes occurred on the ocean side of the Eastern Shore in gill nets, four occurred on the ocean side of Virginia Beach in beam trawls, two were observed in gill nets in the Chesapeake Bay, and one in a gill net in the James River. The takes included six loggerhead, six green, and one Kemp's ridley turtle (MRC *unpublished data,* September 2024). Although the overall take rate appears to be low, seven takes occurred in gill nets observed off the eastern shore of Virginia in May 2024 and four in beam trawls targeting shrimp during a three-week period from late October to early November of 2023. This significant increase in takes is concerning and warrants closer examination and analysis.

All federally managed fisheries are monitored by federal fishery observers who document catch of targeted species as well bycatch of protected species and other non-target species. Federal fishery observers are assigned to vessels operating in either state or federal waters. The level of coverage is based on gear type, region, and mesh size (*e.g.*, anchored gillnet with >7 inch stretch mesh, fishing in the Mid-Atlantic). From 2013 - 2022, there were at least 28 sea turtle takes recorded by federal observers in state and federal waters from Cape Lookout, North Carolina to the Virginia/Maryland border (NOAA Fisheries Northeast Fisheries Observer Program, *unpublished data,* April 2023). The takes included all sea turtle species that occur in Virginia. Most of the takes (n=23) occurred in the first five years while the remaining five occurred in the second five-year period. Takes were documented in all months except April, July, and August with most observed from November through January, suggesting they may have occurred in the southern region of the coverage area. Murray (2023) reported that from 2017 to 2021, a total of 44 loggerhead, 46 Kemp's ridley and 15 leatherback takes were observed in small mesh gillnet gear in the Southern Mid-Atlantic Management area which extends from Delaware through North Carolina. This level of take was a significant decline from the previous five-year period but no cause of the decline was suggested (Murray 2018). There were also an estimated 155 sea turtle takes in the Mid-Atlantic sea scallop fishery from 2001-2019 with 53 takes confirmed as mortalities (Murray 2021).

Recreational fisheries

While federal and state regulations address some concerns posed by commercial fishing, interactions with recreational fisheries, especially the hook and line fishery, remain largely unreported, unregulated, and unaddressed. Rose *et al.* (2022) characterized recreational hook and line sea turtle bycatch in Virginia between 2014 and 2018. During that time, 250 turtles (162 Kemp's ridley, 45 loggerhead, 4 green, 39 unidentified turtle species) were reported caught on hook and line gear, of which 94% were hooked by anglers fishing from commercial piers. Most turtles interacted with baited hooks that were either bitten or swallowed. The remaining 25% of turtles were hooked externally in the flippers, neck or carapace or were entangled in fishing twine without being hooked. Many turtles recovered during the study either had multiple hooks from different interactions or were recovered more than once in the same year or in subsequent years suggesting seasonal residency near piers or habituation to feeding from baited hooks. The monitoring of take by recreational anglers along with outreach efforts that instruct anglers how to respond to and report hook and line captures that started in 2014 are still on-going in Virginia (Barco *et al.* 2015; Rose *et al.* 2022).

Other recreational gear, such as recreational crab pots, may also negatively affect sea turtles. Because recreational crab pots are often tied to docks and bulkheads or deployed in smaller and shallower waterways than commercial pots, incidental take may be nominal. In Virginia, commercial crab pot gear must be marked with the fisher's permit number, whereas recreational gear requires no such marking. This allows investigators to assign Virginia pot interactions to either the commercial or recreational fishery with some degree of accuracy. To date, no crab pot buoys recovered from sea turtles in Virginia were identified as recreational gear.

Vessel strikes

Propeller and collision injuries from boats and ships are common in sea turtles. From 1997 to 2005, 15% of all stranded loggerheads in the US Atlantic and Gulf of Mexico were documented as having sustained some type of propeller or collision injuries although it is not known what proportion of these injuries were post- or ante-mortem (NMFS and USFWS 2020, 2023). Recent research in Florida dispels the likelihood that vessel strike injuries among decomposed turtles are mostly post-mortem (Foley *et al.* 2019). In Virginia, evidence of vessel interactions has been observed among all species of sea turtles, and the number of stranded turtles diagnosed with injuries consistent with vessel strike remains high. In 2021 and 2022 alone, 108 strandings (68 loggerheads, 35 Kemp's ridleys, four green turtles and one leatherback) showed evidence of vessel strikes (Costidis *et al.* 2022; Epple *et al.* 2023). Twenty percent of all reported strandings in Virginia exhibited injures consistent with vessel strikes and it is the second most commonly assigned cause of stranding behind fishery interactions (VAQS *unpublished data,* May 2023). The number of post-mortem strikes in the Virginia stranding record is unknown, but gross necropsy and histopathology conducted on carcasses have confirmed pre- and peri-mortem strikes in all of the 22 samples analyzed as of September 2024 (VAQS *unpublished data*, September 2024; B. Stacy *pers. comm*.).

Santos *et al.* (2018) identified the lower Chesapeake Bay as a hot spot for vessel strike mortality during the month of June when high turtle presence and high levels of recreational boat traffic coincide. In 2021 and 2022, seasonal patterns of vessel interactions among stranded turtles in Virginia exhibited the typical spring peaks in May and June and remained elevated August through October with a surprisingly low number in July. Although the exact size of a propellor that hits a turtle is difficult to identify, marks on carcasses that range from several centimeters in length to complete bisection of large individuals suggest that both large and small propellors on vessels of varying sizes have caused serious injury and mortality in the region (VAQS *unpublished data,* May 2023).

Because some debilitated turtles become abnormally buoyant and may have trouble diving, there has been some speculation that vessel-struck turtles are often compromised prior to the strike. Analysis of body condition and pathology reports from fresh dead turtles stranded in Virginia indicates that turtles with acute vessel strike injuries are significantly less likely to have underlying health conditions and are in similar body condition to those considered healthy in the wild population (Barco *et al.* 2016).

Use of Hopper Dredges for Channel Maintenance and Beach Replenishment

Hopper dredges, which are known to take sea turtles, are used for large scale and deep water dredging which includes most federally permitted navigational channel dredging in Chesapeake Bay and the ocean waters of Virginia as well as sand mining for beach renourishment. According to the US Army Corps of Engineers' (USACOE) Operations and Dredging Endangered Species System (ODESS, accessed May 15, 2024), at least 78 lethal dredge-related sea turtle takes occurred in Virginia from 2000 through 2023, 88% of which were loggerheads. According to ODESS, most of the dredge takes observed in Virginia occurred in Chesapeake Bay navigational channels where the majority of dredging has occurred. Annual lethal takes since 2000 along the Atlantic US coast reported in ODESS vary widely from one take in 2010 to 41 takes in 2017 with a mean of 21 per year for the 24-year period. Numbers of takes are affected by dredging effort, location, and time of year. Comparing dredge takes in Virginia since 2000 to other

Atlantic coast states with greater than 100,000 cubic yards of material removed by hopper dredge, Virginia had a relatively low number of takes but had the second highest rate of take based on dredge effort measured as cubic yards of material removed (Table 2; calculated from ODESS, accessed May 15, 2024). ODESS is a relatively new system and not all data have been entered and verified for accuracy. Number of takes is likely to be accurate since it is entered by PSOs, but the total amount of material removed may have been estimated by dredge companies or the USACOE. In analysis that resulted in the data presented in Table 2, lethal takes from projects with zero or null entered in the material removed field were not included in the take rate calculations (*e.g.*, take per 100,000 cubic yards of material) and instead were listed as additional takes in the final column. Regarding the calculations for the high take rates in Virginia, it is important to note: 1) Chesapeake Bay takes that occurred in shipping channels are often assigned only to Virginia despite some occurring in Maryland waters possibly inflating the rate for Virginia; and 2) No Virginia projects from 2015-2023 had information on project effort (*i.e.*, cubic yards of material removed) entered into the ODESS database and thus were not included in the calculations. If rates have been reduced by increasing the efficiency of dredge operations in recent years, that would not be reflected in the Virginia data (S. Reinheimer, Norfolk Division USACOE *Pers. Comm*., Nov. 22, 2023). A more thorough examination of hopper dredge-related take and effort data in Virginia is warranted. If the take rate from ODESS data are accurate, then Virginia's take rate in a temperate climate where sea turtles are not present year-round may rise even higher given the substantial volume of navigational channel widening and deepening planned through the remainder of this decade (NMFS 2018). The ACOE has self-imposed restrictions from September 1 through November 14 for avoiding times of year when takes are thought to be most likely. These restrictions were imposed following dive behavior studies in the early 2000s which found that in the Chesapeake Bay, turtles spent more time below the surface and near the bottom of the water column in the fall than at other times of the year potentially increasing the risk of dredge takes at a time when they were likely to be moving toward the mouth of the Bay for fall migration (Mansfield and Musick 2004; Mansfield *et al.* 2009). Of the 78 lethal sea turtle takes reported in Table 2, take details were provided for 47 takes (41 loggerheads, and 5 Kemp's ridley and 1 green turtle; Table 2). The green turtle take was in February and may have been carried on the dredge from its previous job in South Carolina (S. Reinheimer, *pers comm.*). Of the remaining 46 takes, 85% (n=40) occurred from May through August with July having the highest number (n=14; Figure 13). Without data on dredge effort during these months, it is difficult to interpret the differences in monthly takes, but further analysis may provide possible mitigation measures.

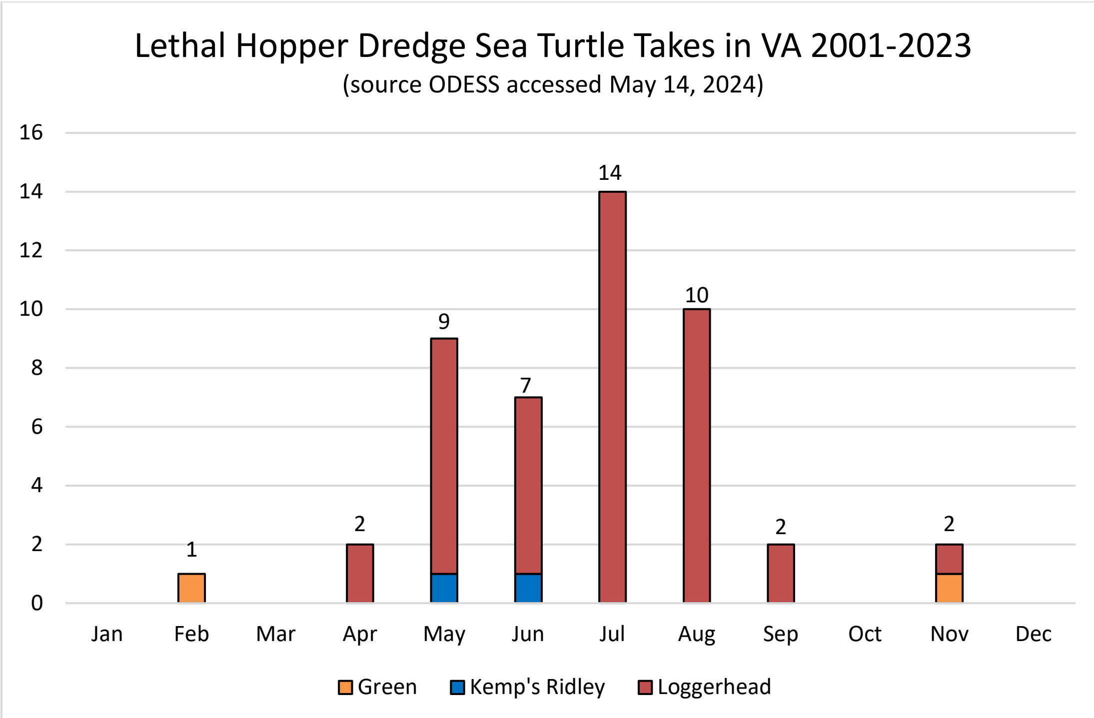

Figure 13. Monthly frequency of lethal sea turtle takes in Virginia by hopper dredge from 2001-2023 for 47 of 78 reported takes for which take details were available. The information in this table was downloaded from the US Army Corps of Engineers' Operations and Dredging Endangered Species System (ODESS) on May 14, 2024.

In most cases, a NOAA Fisheries approved PSO must be on board a hopper dredge any time it is operating to detect interactions with sea turtles. While it is likely that not all sea turtles killed by dredges are detected by onboard PSOs, onboard monitoring is considered the best method for estimating the level of dredge-related takes. In Virginia, however, there is a threat of unexploded ordinance (UXO) in the substrate which poses a human safety concern if suctioned into the draghead and/or deposited in the hopper. To keep UXO from being entrained, small mesh UXO screening is placed on the underside of the draghead where it makes contact with the substrate. The screening only allows small sized material to pass through the screen meaning that lethal takes must be identified from small turtle parts such as soft tissue (*e.g.*, intestine, muscle, *etc.*) or small, fragmented pieces of shell or bone, making detection by an observer less likely if the screen is installed properly (Ramirez *et al.* 2017). Under these circumstances, the volume of material removed from the action area serves as a proxy for monitoring actual take (*i.e.,* an estimate of one sea turtle entrained for every 320,000 cubic yards of material dredged; NMFS 2012, 2018). This estimate provides a proxy for monitoring the number of incidental takes during hopper dredging operations when UXO screening is in place because the UXO screen at the bottom of the draghead precludes direct observations of impingements. Dredges working in most of the commercial shipping lanes of Chesapeake Bay and in the ocean approach to the Bay use UXO screening, making accurate take estimates using PSOs difficult. For projects using UXO screening, NOAA Fisheries does not require PSOs. Regardless of NOAA requirements, the

Table 2. Total number of lethal sea turtle takes reported during hopper dredging operations from Atlantic Florida to Virginia, 2000-2023. No Takes were recorded in Maryland, New York and Maine, less than 5 takes were recorded in Delaware and New Jersey. The information in this table is from the dredge project summary data from the US Army Corps of Engineers' Operations and Dredging Endangered Species System (ODESS) and was, accessed on May 14, 2024. Note that ODESS is a relatively new system and historic accuracy of Total Cubic yards of material has not been verified for all states including Virginia.

State	Lk	Cc	Cm	Dc	All turtle takes	Cubic yds material removed	Takes/100k cu yd	Additional lethal turtle takes [1]
FL[2]	4	145	53	0	202	82,495,664	0.24	8
GA	74	190	42	0	306	102,750,681	0.30	38
SC	7	38	2	0	47	50,122,059	0.09	19
NC	14	49	11	1	75	80,032,575	0.09	4
VA	5	41	1	0	47	18,866,978	0.25	46
Total	**104**	**463**	**109**	**1**	**677**	**334,267,957**		**115**

[1]Projects for which no data was entered in the cubic yards of material removed field (47% of VA projects, 17 of 36, were missing material removed data)
[2]Atlantic coast only

Norfolk District of USACOE requires PSOs for other types of data collection. Thus, despite the use of UXO screens and use of cubic yards of material moved being used a proxy for observed takes, PSOs have recovered and reported sea turtle takes on projects where UXO screens were in use (S. Reinheimer, USACOE *pers comm*.). The number of observed takes for projects where takes were theoretically difficult to detect raises questions about the proper use of UXO screening, its effect on the ability for takes to be observed, and on how the total number of takes should be calculated (observed and unobserved).

Marine debris

Sea turtles, especially those inhabiting oceanic habitats during the early stages of their lives, ingest a wide variety of debris items, such as plastic bags, raw plastic pellets, plastic and Styrofoam pieces, tar balls, balloons and monofilament line (Witherington 2002; Barco *et al.* 2015; Kühn *et al.* 2020; Warner *et al.* 2020; NMFS and USFWS 2023). In addition to marine debris ingestion, animals can become entangled in debris (Kühn *et al.* 2020; Warner *et al.* 2020). At least one live stranded green turtle in Virginia suffered from an esophageal blockage caused by numerous pieces of debris including fragments of hard and soft plastic pieces, Styrofoam, and latex balloon (Walton *et al*. 2009). The ingestion of balloons with ribbon attached caused the death of at least one loggerhead and one Kemp's ridley turtle. A live Kemp's ridley was found severely entangled in a woven Tyvek seafood bag and had to undergo flipper amputation to remove the bag, and single use weather balloons entangled and killed at least two Kemp's ridleys (VAQS *unpublished data,* May 2023; Daniel *et al*. 2023). In many cases, however, debris ingestion is not the primary cause of a stranding. This is because effects of debris ingestion can be either lethal (*e.g.*, direct obstruction of the gastrointestinal [GI] tract) or sublethal (*e.g.*, absorption of toxic byproducts, reduced absorption of nutrients across the GI wall because the amount or size of plastic, especially plastic film such as thin bags and wrappers, blocks absorption; Balazs 1985). While small pieces of ingested plastic may pass through the digestive system without creating an obstruction, sublethal effects are currently unknown. Leatherbacks appear to be especially susceptible to GI tract blockage resulting from ingested plastic bags or plastic film because they may resemble jellyfish, a favorite prey item, when floating in the water. The ingestion of plastic or similar debris by other sea turtle species inhabiting the neritic zone is relatively rare but has been documented in the stranding record at a low level of regularity (Warner *et al.* 2020). Out of 278 GI samples collected from stranded loggerheads in Virginia, nine (3%) contained visible plastic debris (>0.5 cm), and of the 81 Kemp's ridley GI tracts sampled, six (7%) contained plastic or latex debris (Seney *et al.* 2014; VAQS *unpublished data,* May 2023). Presence of microplastics was not determined. Persistent marine debris in convergence zones and drift lines where young sea turtles congregate may expose them to debris ingestion and entanglement (Witherington 2002). Hatchlings emerging from their nests may become entangled in marine debris washed up on nesting beaches, which can prevent them from reaching the ocean (NMFS and USFWS 2020, 2023).

Microplastics are an emerging concern for all marine species but can seriously affect post-hatchling sea turtles. Eastman *et al.* (2020) described microplastics found in the GI contents of post-hatchling loggerhead turtles that stranded in Florida. Of the 42 GI tracts examined, over 90% (n=39) contained plastic fragments less than 5 mm in length (*i.e.,* microplastics), and the number of microplastics found in a single turtle ranged from one to over 250. The ingested microplastics were mixed in with natural prey items indicating they were likely floating in the surface biofilm where neonatal turtles are known to feed. A global study of stranded sea turtles from different regions, including North Carolina, revealed all GI tracts examined had microplastics present (Ducan *et al.* 2019). Considering the results in these studies, it is likely that microplastics are a concern for turtles in Virginia although no specific studies have been conducted.

3) Predation and disease

Natural predation and disease are expected in any wild animal population but occurrences of harmful algal blooms, invasive species, range expansion due to climate change, and the occurrence of marine viruses, bacteria, parasites, and other disease-causing agents are increasing worldwide. Human exploitation of terrestrial and marine resources has greatly changed the food chain and predator/prey relationships are continually in flux. This factor addresses how these changes may affect turtles in Virginia.

Predation

Sea turtle nest predation in Virginia appears to be minimal compared to levels observed in states to the south where nesting occurrences are considerably higher. Over 230 nests have been documented in Virginia, and, of those, only five showed evidence of fox predation (unknown species), two were partially depredated by Atlantic ghost crabs (*Ocypode quadrata*) and one nest was partially depredated by a raccoon (*Procyon lotor*; DWR, *unpublished data*). This may be due in part to the fact that there are so few sea turtle nests present at any given time and naive predators have not learned the cues needed to find the eggs. Moreover, every nest that is discovered is either covered by a 2 in. x 4 in. wire mesh screen or a partially buried 5-sided cage made of the same material to deter ground predators from digging into the nest. On-going predator management efforts on the barrier islands, specifically on Assateague Island where most of the nesting activity occurs along the island chain, may also be contributing to the lack of predation by mammalian predators. Placing screens or cages over nests are not effective deterrents against ghost crabs which can access the nest cavity by burrowing under the screen or cage. Despite the lack of any protection against ghost crabs, they mostly seem to ignore the few nests that are laid on Virginia's beaches. This may be attributed to the fact that there is plenty of other food the crabs can locate without much difficulty.

Raccoons, foxes, ghost crabs, and various species of gulls are all known predators of sea turtle hatchlings on land. Nests hatching on the southern mainland beaches often have volunteer nest sitters present who count the number of hatchlings that emerge from the nest cavity, keep the public a safe distance from the nest and hatchlings, and make sure the hatchlings find their way to the ocean safely without inference from potential predators. Nests that hatch on the barrier islands typically do not have nest sitters present; as such, hatchlings are exposed to various levels of predation as they crawl towards the ocean. Once hatchlings enter the ocean, they are extremely vulnerable to predatory fish as they swim towards the north Atlantic gyre (Witherington and Salmon 1992).

Disease and parasites

Sea turtles suffer from a variety of health problems including infections caused by bacterial, viral, parasitic, and fungal agents (George 2017; Innis and Staggs 2017; Manire *et al.* 2017; NMFS and USFWS 2020, 2023), as well as loggerhead turtle chronic debilitation syndrome, which is characterized by emaciation, lethargy and heavy barnacle load (Stacy *et al.* 2018). Sea turtle fibropapillomatosis, a disease which, in advanced stages, causes cauliflower-like tumors on sea turtles, sometimes severe enough to affect the turtles' ability to see, eat, and swim, reached epidemic proportions in some wild green turtle populations (Patrício *et al.* 2012; Seminoff *et al.* 2015; Manes *et al.* 2022) and has now been documented in loggerheads and Kemp's ridleys as far north as Massachusetts, including cases in North Carolina where loggerheads tested positive for the virus but were tumor-free (Page-Karjian *et al.* 2015, 2021). Diseases documented in turtles that stranded in Virginia from 2017 to 2023 have been dominated by lung disease from a variety of causes (VAQS *unpublished data,* May 2023*;* A. McNaughton, DVM *pers. comm* July 2023). While neither loggerhead turtle chronic debilitation nor fibropapillomatosis have been definitively detected in Virginia, live, debilitated loggerheads have become more prevalent in the Virginia stranding record since the mid-2010s (McNaughton *et al.* 2022), and there had been very little surveillance for fibropapillomatosis of turtles stranded in Virginia and cryptic cases such as those in North Carolina could have occurred.

Harmful algal blooms (HABs)

Harmful algal blooms (HABs) in the US are becoming more toxic and are expanding into new areas of the country. Moreover, the number of toxic species and toxins are increasing as well (Anderson *et al.* 2021). Green, Kemp's ridley and loggerhead turtles have all been affected by brevetoxin from HABs on the gulf coast of Florida (Capper *et al.* 2013; Fauquier *et al.* 2013; Perrault *et al.* 2014). Although the organism that produces brevetoxin, *Karenia brevis*, has not been documented in Virginia HABs, increasing presence of other toxic algal species have been documented in the lower Chesapeake Bay (Li *et al.* 2020; Lin *et al.* 2018). Toxins produced during HAB events affect animals through respiration, ingestion, or absorption and can affect breathing, digestion, or cognition depending on the neurotoxin, pathway into the body, and level of exposure. HABs have caused debilitation and death in green and olive ridley turtles off the Pacific coast of El Salvador (Amaya *et al.* 2018). Extensive, persistent HAB events that produce toxins can cause mass sickness and mortality in a number of marine species similar to those generated by chemical and fossil fuel spill events and require preparedness and training for appropriate, safe response.

Even when toxins produced during a HAB event do not directly affect turtles, the blooming algae can cause the water to become anoxic by robbing it of oxygen when it dies and decomposes. As air breathers, sea turtle respiration is not directly affected by anoxic conditions, but low dissolved oxygen levels in the water have a significant impact on fish and lungless marine organisms, including many of the lower trophic species on which sea turtles feed (Jackson *et al.* 2001; NMFS and USFWS 2023). Moreover, HABs increase water turbidity and block sunlight which can result in seagrass die-offs. Seagrasses are a food resource for the herbivorous green turtle, provide habitat for other sea turtle prey species, absorb wave energy and nutrients, produce oxygen, and improve water clarity. The loss of submerged aquatic vegetation can lead to altered ecosystem functions, which in turn can affect sea turtles, but to what degree remains unknown (Jackson *et al.* 2001; Milton and Lutz 2003).

In Virginia, VIMS researchers are addressing HABs in Chesapeake Bay by investigating the toxicity of various HAB organisms and their effects on local shellfish, submerged aquatic vegetation and specific estuarine habitats.

4) Other natural or human-induced factors affecting sea turtles

These factors include more subtle, often indirect threats to sea turtles and their habitats. For example, cumulative impacts from low levels of contaminants such as heavy metals, fossil fuels, fire retardants, polyfluoroalkyls (PFAs), and chemicals found in prescription drugs, dyes, and optical brighteners may not directly kill, injure, or sicken animals but can affect overall fitness by interfering with reproduction, immunity, and/or growth and development. Moreover, when combined with other stressors such as low dissolved oxygen, increased background noise, and low prey abundance or poor prey quality, the presence of contaminants can have compounding effects on local populations. The Chesapeake Bay Preservation Act of 1988 is a critical element in the fight to mitigate nonpoint source pollution and improve water quality in Chesapeake Bay. Under the Bay Act framework, the Chesapeake Bay Preservation Area Designation and Management Regulations provide the required elements and criteria that local governments must adopt and implement in administering their Bay Act programs. These include designating Chesapeake Bay Preservation areas; zoning and ordinance measures to protect the quality of state waters; assessment and limitation of development impacts on Bay waters. The Chesapeake Bay Preservation Program is administered by the Virginia Department of Environmental Quality.

Climate change

Climate change impacts on sea turtles, specifically ocean warming and sea level rise, are likely to become more apparent in future years (Hawkes *et al*. 2007, 2009; NMFS and USFWS 2020, 2023; Van Houtan and Halley 2011; Patrício *et al*. 2021). There is substantial new evidence that suggests observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, ocean acidification, and circulation. These changes include shifts in the range, distribution, and abundance of submerged aquatic vegetation, plankton including gelatinous macroplankton, invertebrates and other marine organisms (IPCC 2007; Orth *et al.* 2017; Hammer *et al.* 2018) which, in turn, will affect the distribution and abundance of sea turtles and their prey (NMFS and USFWS 2020 2023). The Virginia strandings data already reflect changes in the timing of the annual arrival and departure of loggerhead and Kemp's ridley turtles. Comparing the first springtime dates of sea turtle strandings for five-year increments from 2003 -2022, the first seasonal strandings of both species in the most recent five-year period (2018-2022) occurred an average of approximately 12 days earlier in the spring than 20 years ago (2003-2007; VAQS *unpublished data,* May 2023). Extended fall occurrence exhibits more interannual variability than spring arrival and may be more impacted by annual weather and storm patterns than long term climactic changes, but the fall weather variability such as warm fall water temperatures (*e.g.*, >60 °F) into November punctuated by significant cooling events is correlated with increasingly consistent strandings of cold stunned sea turtles over the past 20 years (VAQS *unpublished data,* May 2023). In the early and mid-2000s cold stun events occurred every two to five years, but in the past five years, one or more cold stunned turtles stranded in Virginia each year.

In addition to in-water changes associated with climate change, the demand for sand replenishment and the placement of hardened structures on sea turtle nesting beaches to counter the effects of beach erosion are likely to increase in the face of projected sea level rise and more intense storm activity associated with global climate change (Conant *et al*. 2009; Hamann *et al.* 2013; Hawkes *et al.* 2007, 2009; Pike 2013; Patrício *et al.* 2021). See Category 1 "Human caused destruction, modification or curtailment of habitat or range" of this section for further discussion of the impacts of beach renourishment, beach hardening, and dredging. Moreover, sea level rise and the increase in frequency and severity of storm events are significant climate change related threats to sea turtle nesting habitat and nests. In Virginia, the cause of most nest losses and poor hatch success has been attributed to severe storms and frequent and prolonged tidal inundation (DWR, *unpublished data*).

The Commonwealth of Virginia Priority Climate Action Plan (VDEQ 2024) focuses on strategies to: reduce greenhouse gas emissions in transportation sectors; increase energy efficiency in homes, businesses, and institutions; reduce production of greenhouse gasses in agriculture, industry, and energy sectors; and protect and restore high-carbon habitats in Virginia. Various coastal bird species, terrestrial reptile and amphibian species were the focus of Virginia's strategy for safeguarding species of greatest conservation need from the effects of climate change (VDGIF *et al.* 2009). Although sea turtles were not listed in the plan, strategies to preserve ocean beach nesting habitat for shore and waterbirds will positively affect sea turtle nesting habitat as well.

Eutrophication in Chesapeake Bay

Eutrophication in aquatic ecosystems occurs when excessive concentrations of minerals and nutrients, particularly nitrogen and phosphorus become present, which stimulates excessive plant and/or algal growth that can result in harmful algal blooms as discussed above and general habitat degradation such as low dissolved oxygen, increased turbidity, algal overgrowth, *etc.* (NMFS and USFWS 2023). Human activities and population growth are known to accelerate eutrophication by increasing the rate at which nutrients and organic substances enter aquatic ecosystems. Agricultural runoff, urban runoff, failing septic systems, and sewage discharges are common sources of excessive nutrient pollution in the Chesapeake Bay and have resulted in hypoxic (dissolved oxygen concentrations <0.2 mg/L) and anoxic (no measurable dissolved oxygen) conditions (Kemp *et al.* 2005). Chesapeake Bay hypoxia has been linked to bacterial disease in fishes, changes in copepod vertical distribution (to avoid hypoxic water masses which led to increase predation), and increased mortality of macrobenthic invertebrate communities (Elliott *et al.* 2013; Sturdivant *et al*. 2013; LaPointe *et al.* 2014). Hypoxia in Chesapeake Bay is so pervasive in deeper waters that there is an established dead zone which has precipitated "Daily Dead Zone Forecasts" and an annual "Dead Zone Report Card" (https://www.vims.edu/research/topics/dead_zones/forecasts/report_card/index.php; accessed

Sep 5, 2023). Loggerhead turtles, which tend to forage in the deeper waters of the Bay (DiMatteo *et al.* 2022), have likely been affected by changes in the distribution of prey generated by the dead zone. The consequences of persistent eutrophication and the resulting hypoxia in the Bay may represent a growing threat to sea turtles and warrants further investigation.

Trophic changes from fishery harvest and benthic alteration

Selective and intense harvest of marine species by fisheries, coupled with declining water quality due to eutrophication, and changing temperature and salinity associated with climate change may result in significant changes to trophic interactions within an ecosystem. These changes may affect availability of prey for higher trophic species such as sea turtles, and sea turtles may undergo increasing stress due to food-web alterations. Lutcavage and Musick (1985) found that Atlantic horseshoe crabs (*Limulus polyphemus*) were the predominant prey item of juvenile loggerheads in the Chesapeake Bay from 1980-1981. Subsequently, the harvest of Atlantic horseshoe crabs over the next 17 years increased significantly with a peak of nearly 6 million pounds reportedly taken in 1997 (ASMFC 1998). The over-harvest of horseshoe crabs may have led to diet shifts among juvenile loggerheads, from predominantly horseshoe crabs to blue crabs (*Callinectes sapidus*) in the late 1980s and early 1990s, to mostly finfish in the late 1990s and early 2000s (Seney and Musick 2007). The latter data suggest that turtles began foraging in greater numbers in or around fishing gear and/or on discarded bycatch in response to local declines in Atlantic horseshoe crab and blue crab populations (Seney and Musick 2007). The implementation of reduced Atlantic horseshoe crab and blue crab catch limits in the last decade may may have enabled their populations to increase in Virginia to the point where loggerheads are able to return to a more traditional diet. Analyses of GI tract contents collected from 192 stranded loggerheads in Virginia from 2008 to 2012 revealed that over 59% of the turtles foraged on blue crabs and 45% consumed Atlantic horseshoe crabs (Barco *et al.* 2015). Thirty-nine percent of the turtles sampled had large gastropods remains in their GI tracts followed by 32% with fish remains and 5% with elasmobranch (shark, ray or skate) remains. Novel species including several insects were identified in the GI tracts of 81 Kemp's ridley turtles that stranded in Virginia from 2010 through 2013. Blue crab was present in 19% of the samples and constituted 50% of the observed diet within the dataset. When prey presence, number and weight of prey were combined into an index of prey importance, the highest diet importance after blue crabs were for mud snails (20%), spider crabs (14%), bony fishes (5%), hermit crabs (4%), and horseshoe crabs (3%). Mud snail and other small gastropod shells found in GI tracts were counted as gastropods but may have contained hermit crabs when ingested by the turtles (Seney *et al.* 2014; Barco *et al.* 2015). Thus, hermit crabs may be a more important prey item than indicated by the index of importance values. Diet of green turtles stranded in Virginia has not been studied very intensively but among twelve green turtle GI tracts that underwent examination, a variety of vegetation along with one observation of crab parts was found in their GI tracts (VAQS *unpublished data,* May 2023). Given the rapidity of the observed shifts in diet and the compounding effects of climate change and eutrophication in Virginia's coastal waters, intensive diet studies that incorporate fishery harvest data in the analyses should be conducted at least every 5 to 10 years.

Shoreline development and coastal armoring result in benthic habitat alteration including reduction in quantity and quality of saltmarsh and shallow water habitats that support submerged aquatic vegetation and shellfish (Seitz *et al*. 2006; Gittman *et al.* 2016). Likewise, disturbance by shellfish and finfish aquaculture, stationary and mobile fishing gear, and nearshore breakwaters may have significant effects on marine biodiversity and habitat quality, with the effect of marine biodiversity being generally positive and the effects on habitat quality being negative (Dauer *et al.* 2000). The effects of these potential changes on turtle populations, and specifically on prey abundance and distribution, have not been determined, but are of concern (NMFS and USFWS 2023). Mobile bottom net gear for commercial fishing (*e.g.*, trawls) are banned in Virginia's Chesapeake Bay to preserve bottom habitat, and increased use of bottom lands for clam and oyster aquaculture and improving hard bottom for oyster habitat appear to have improved water clarity and quality over time in the region (Murphy *et al.* 2016; Turner *et al.* 2019).

Contaminants

Field and laboratory studies to determine the effects of petroleum on the development and survival of sea turtle embryos indicate that an oil spill resulting in the contamination of nesting beaches before the nesting season may affect nesting success for a short period, if at all. On the other hand, a spill that occurs during the nesting season may result in extremely low hatch success or cause the abnormal development of hatchlings if washed-up surface oil makes contact with eggs or pools on the top of nests (NMFS and USFWS 2020, 2023). Oil cleanup activities can also be harmful. Earth-moving equipment can destroy nests, containment booms can entrap hatchlings, and lighting from nighttime activities can misdirect turtles and dissuade females from coming ashore to nest (Shigenaka *et al.* 2021).

In-water exposure to petroleum products can be fatal to all life stages of sea turtles. Surface oil and tar balls that collect in oceanic drift lines and in mats of free-floating *Sargassum* are especially dangerous for young, oceanic stage sea turtles actively select and use these convergence areas as developmental habitats (Lutcavage *et al*. 1997; Witherington 2002). Prolonged physical contact with floating oil can occur when turtles become entrained in oil slicks (NMFS and USFWS 2008). This contact can cause significant changes in respiration, diving patterns, energy metabolism, and blood chemistry. Sea turtles may also suffer from esophageal impactions and lesions, inflammatory dermatitis, salt gland dysfunction or failure, red blood cell disturbances, compromised immune response, and digestive disorders (Lutz and Lutcavage 1989; Lutcavage *et al*. 1995; NMFS and USFWS 2020, 2023). The 2010 Deepwater Horizon oil spill and the subsequent use of dispersants and burning of surface oil impacted all sea turtle species and age classes that occur in the Gulf of Mexico (Frasier *et al.* 2020).

Like with many other species including human beings, contaminants can enter an organism's system in a variety of ways (*e.g.,* external contact, ingestion, inhalation). Little is known about the compounding and confounding effects of non-lethal exposure to a variety of contaminants on sea turtle immune systems, growth and development, reproduction, foraging behavior and other critical functions. Chemical contaminants that may affect sea turtles includes persistent organic pollutants such as polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), polychlorinated hydrocarbons (PCHs), along with numerous metals, and other chemical classes such as per- and polyfluoroalkyls (PFAs) also known as "forever chemicals" (NMFSUSFWS 2020, 2023). There are emerging concerns about contamination from ingested anthropogenic debris, especially those leached from macro- and microplastics. Long-lived carnivorous species, such as sea turtles, tend to bioaccumulate some of these compounds (Lutcavage *et al*. 1997; Keller 2013). However, I-60 organochlorine concentrations found in sea turtles have been much lower than those found in marine mammals and birds (George 2017), probably due to the much lower metabolic rates of sea turtles. Keller *et al*. (2004) found significant correlations between contaminant levels and a wide variety of biological functions, suggesting, for example, changes in the immune system, liver function, and alterations in protein and carbohydrate regulation could be affected by contaminants in sea turtles. However, the authors cautioned that the correlations suggest, but do not prove, a cause-and-effect link.

Perfluorinated compounds (PFCs) are persistent environmental contaminants. O'Connell *et al.* (2010) examined concentrations of PFCs in juvenile loggerheads from Florida Bay, Florida to the Chesapeake Bay, Maryland. PFC concentrations varied significantly by site, with Maryland and Florida Bay turtles having the highest values. One of the most common PFCs found was perfluorooctane sulfonate (PFOS) despite a decrease in its production and regulatory restrictions that were imposed in the early 2000's. Loggerheads in Maryland had the highest concentrations of PFOS; thus, the Chesapeake Bay is considered a good study area for assessing PFOS health effects on sea turtles, which are largely unknown (O'Connell *et al.* 2010). Using a combination of satellite tracks and contaminant levels in eggs and blood, levels of persistent organic pollutants increase in loggerhead populations as post-nesting females (Alava et al. 2011; Keller 2013) and adult males (Ragland et al. 2011; Keller 2013) move north to forage in mid-Atlantic waters. Differences in contaminant levels in between southern and mid-Atlantic foraging areas was speculated as the cause of this result.

Sea Turtle Conservation Strategy

Sea turtles that occur in the Mid-Atlantic waters of the US are highly migratory and belong to widely distributed populations with complex life histories. As such, policies and protections provided by any one state should ideally reflect larger, regional collaborative conservation efforts and support, extend, and enhance federal conservation and management The DWR Board adopts federal ESA status and population unit designations via regulatory action on a periodic basis. The DWR follows national sea turtle nest monitoring and management guidelines that are appropriate for Virginia (DWR *unpublished report*s 2017, 2020; September 2024). In addition, the state provides support through grants for a scientifically based Sea Turtle Stranding and Salvage Network administered through the Virginia Aquarium & Marine Science Center Foundation (VAQF) and applies for competitive grant funds to support the Network and sea turtle conservation efforts more broadly. Finally, Virginia's on-going ocean planning efforts and history of regional partnership with the Mid-Atlantic Regional Council on the Ocean (MARCO) provide a foundation for regional cooperation on many of the threats facing sea turtles in the state, such as changing water temperatures, shifting prey distributions, increasingly volatile weather events, habitat degradation, energy development, marine debris, and other sources of pollution.

Below is a conservation outline listing this plan's goals and strategies, followed by the conservation narrative which adds details to the listed strategies, a list of actions that address the strategies, the agency assigned to take the lead on each action in **bold** lettering along with supporting organizations, timelines (where appropriate), and affected habitats.

Finally, the Conservation Outline includes reference to similar federal conservation and recovery recommendations from the four US sea turtle recovery plans. Note that the format of the plans for the Kemp's ridley, leatherback and green turtles were similar and actions are listed together. Actions in the Loggerhead plan followed a different format and are listed separately.

Conservation Outline

The overarching goal of this plan is to enhance the survival and conserve the habitats of sea turtles in Virginia.

Conservation Goal 1: Maintain a permanent and effective Sea Turtle Stranding and Salvage Network in Virginia

Strategy 1.1. – Establish one or more consistent funding sources to sustain a permanent and effective VSTSSN.

Strategy 1.2. – Establish an Interagency Stranding Event Network (ISEN).

Strategy 1.3. – Establish one or more consistent funding sources to support the operation and maintenance of the Darden Marine Animal Conservation Center (DMACC).

Strategy 1.4. – Integrate Virginia's historical stranding records into the national stranding database.

Actions listed in the Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle that align with the Virginia Plan (NMFS and USFWS 2008):

1. Determine demographic parameters, refine population genetic structure, and monitor distribution, abundance, and trends.
    17. Maintain and improve the Sea Turtle Stranding and Salvage Network.

While not directly addressing the actions below, a strong, science-based stranding network provides monitoring and assessment of the following actions:

6. Minimize other causes of disturbance, harassment, injury, and mortality.
    62. Minimize loggerhead bycatch in domestic fisheries using a gear-based strategy.
    64. Develop and implement a strategy to assess, monitor, and minimize effects of trophic changes on loggerheads from fishing and habitat alteration.
    65. Develop and implement a strategy to minimize the effects of marine debris ingestion and entanglement.
    66. Develop and implement a strategy to reduce vessel strikes.
    67. Monitor and minimize mortality from channel dredging activities.

Actions listed in step down outline of the Kemp's ridley (NMFS *et al.* 2011), Leatherback (NMFS and USFWS 1992) and Green turtle (NMFS and USFWS 1991) recovery plans that align with the Virginia Plan:

2. Protect and manage population
    23. Maintain a stranding network

Conservation Goal 2: Identify and mitigate risks to sea turtle populations and habitats in Virginia through cost-effective monitoring, research, and best practices.

Strategy 2.1. – Collect, analyze and compare commercial fishery effort, observed sea turtle takes, and stranding data for state managed fisheries known to or likely to interact with sea turtles.

Strategy 2.2. – Continue to assess trends in sea turtle population demographics in Virginia over time and compare them to trends observed throughout the mid-Atlantic region.

Strategy 2.3. – Continue to monitor the health, diet, and nutritional status of sea turtles in Virginia.

Strategy 2.4. – Continue to monitor sea turtle nesting activity in Virginia.

Strategy 2.5. –Assess, protect, and/or enhance sea turtle nesting and in-water habitats through engagement with state and regional initiatives and partnerships.

Strategy 2.6. – Incorporate the foraging and habitat needs of sea turtles in the development of or revisions to relevant fishery management plans, regulations, and best practices.

Actions listed in the Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle that align with the Virginia Plan (NMFS and USFWS 2008):

1. Determine demographic parameters, refine population genetic structure, and monitor distribution, abundance, and trends.
    12. Monitor nesting abundance and trends by recovery unit.
    13. Monitor in-water population abundance and trends.
2. Assess, monitor, and protect habitats.
    21. Ensure beach sand placement projects are conducted in a manner that accommodates loggerhead needs and does not degrade or eliminate nesting habitat.
    27. Inventory and protect neritic habitats used by loggerheads
    28. Inventory and protect oceanic habitats used by loggerheads.
3. Prevent overutilization for commercial, scientific, or educational purposes.
4. Assess and manage disease and predation.
    41. Reduce nest predation.
    42. Develop diagnostic health assessment protocols and establish baselines for wild populations.
    48. Develop a strategy to recognize, respond to, and investigate mass strandings, disease episodes, or unusual mortality events.
6. Minimize other causes of disturbance, harassment, injury, and mortality.
    62. Minimize loggerhead bycatch in domestic fisheries using a gear-based strategy.
    64. Develop and implement a strategy to assess, monitor, and minimize effects of trophic changes on loggerheads from fishing and habitat alteration.
    65. Develop and implement a strategy to minimize the effects of marine debris ingestion and entanglement.
    66. Develop and implement a strategy to reduce vessel strikes.
    67. Monitor and minimize mortality from channel dredging activities.

Actions listed in step down outline of the Kemp's ridley (NMFS *et al.* 2011), Leatherback (NMFS and USFWS 1992) and Green turtle (NMFS and USFWS 1991) recovery plans that align with the Virginia Plan:

1. Protect and manage habitats
    11. Protect and manage nesting habitat
    12.Protect marine habitat
2. Protect and manage population

21. Protect and manage nesting population
22. Protect and manage populations in the marine environment

Conservation Goal 3. Promote sea turtle conservation in Virginia through social marketing and information dissemination.

Strategy 3.1. – Promote sea turtle conservation in Virginia through effective social marketing.

Strategy 3.2. – Develop sea turtle educational materials for a variety of audiences.

Strategy 3.3. – Prepare and regularly update permitting guidance documents to assist with the review of proposed human activities that may negatively affect sea turtles in Virginia.

Actions listed in the Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle that align with the Virginia Plan (NMFS and USFWS 2008):
7. Facilitate recovery through public awareness, education, and information transfer.
   71. Develop and distribute educational materials.

Actions listed in step down outline of the Kemp's ridley (NMFS *et al.* 2011), Leatherback (NMFS and USFWS 1992) and Green turtle (NMFS and USFWS 1991) recovery plans that align with the Virginia Plan:

3. Sustain Education and Partnership Programs 31. Educate the public
   32. Develop community partnerships
   33. Maintain and develop local, state and national government partnerships

Conservation Narrative

The Conservation Narrative provides an implementation roadmap for the goals and strategies presented in the Conservation Outline. More precisely, the narrative identifies each strategy's (1) justification and need; (2) specific actions and corresponding lead agencies; (3) timeline for completion; and (4) additional resource requirements (*e.g.*, funding, extra staff), as needed. Many of the strategies in this plan rely on the willingness of conservation agencies, academia, and affected stakeholders to weigh actions that affect human beings, wildlife, and ecosystems equally. This approach will require a paradigm shift in management that acknowledges the connection between human and marine ecosystem concerns and emphasizes the need to advance sea turtle conservation and habitat protection while sustaining homeland security and human economic interests, safety, and recreation.

Conservation Goal 1: Maintain a permanent and effective Sea Turtle Stranding and Salvage Network in Virginia

In 1979, VIMS established the Virginia Sea Turtle Stranding and Salvage Network (VSTSSN or Network) to assess and monitor trends in sea turtle mortality within the Chesapeake Bay and coastal waters of Virginia. For over 20 years, VIMS coordinated and managed the VSTSSN and served as the primary repository for Virginia's sea turtle stranding data. In 2002, VIMS began sharing VSTSSN coordination responsibilities with VAQS and by 2009, VAQS assumed the role of VSTSSN coordinator.

Sea turtle stranding and incidental take data from permitted activities such as dredging, marine construction and fishing activities provide the only available index of sea turtle mortality and morbidity available to resource management agencies. All data collected by the VSTSSN are entered into a national stranding database maintained by NOAA Fisheries. That agency has then assisted state and federal conservation agencies with the implementation and evaluation of regulations and management strategies for sea turtles along the eastern seaboard.

Maintaining an effective VSTSSN allows for the collection of other types of information that are critical to the management and recovery of sea turtles. For example, health, diet, and nutrition indices are important tools for monitoring the overall health of sea turtle populations and assessing the quality of the sea turtle foraging habitat and food resources in Virginia. Most health and diet data collected in Virginia have been obtained largely by way of the recovery of live turtles incidentally captured in recreational hook and line gear and presumed healthy turtles that recently died from acute trauma or underwater entrapment.

Stranding data also provide an opportunity to monitor changes in sea turtle demographics in state waters. Evaluation of Virginia data have revealed shifts in size and age class proportions, sex ratios, and seasonal occurrences over time. Warming temperatures are likely to produce higher frequencies of female hatchlings due to temperature dependent sex determination during incubation. Increasing numbers of nesting females in slow-to-mature species such as loggerhead and green turtles will not appear on nesting beaches until 30 or more years after hatching but may be observed in stranded and bycaught juvenile turtles much sooner. Likewise, changes in distribution and population size may first be detected as trends observed in stranding data.

Lastly, the effectiveness of a single state stranding network is greatly enhanced when contact with other state sea turtle stranding networks and the national STSSN is maintained over the long term. This involves attending relevant meetings and conferences for the purpose of remaining current with stranding data collection techniques, data reporting and management protocols, and collaborative research and monitoring opportunities.

Strategy 1.1. – Establish one or more consistent funding sources to sustain a permanent and effective VSTSSN.

Despite its importance to sea turtle management in the Commonwealth and the mid-Atlantic region, there has never been sustained, sufficient support for the VSTSSN. The Network has had to rely on small on-going grants from the CZM, periodic funding from the DWR (including State Wildlife Grant funds), and small project funding and supplies as well as competitive grants from the NOAA Species Recovery Grants to States Program. Collectively, these funds have supported stranding data management, volunteer training, carcass recovery, live stranding response and rehabilitation, and several short-term health, diet, and mortality studies to determine cause of stranding and mortality, including potential sublethal causes such as debris and fishing gear ingestion, abnormal parasites, and evidence of disease or infection. This approach, however, is untenable over the long term, especially as administrative, operating and staff costs and needs continue to increase. The VSTSSN funding needs extend beyond basic administrative and operational costs and include expenditures associated with conducting detailed necropsies on fresh carcasses and collecting biological samples from live and fresh dead turtles to determine cause of death or morbidity. Presently, cause of death or morbidity is unknown for the majority of strandings in Virginia and represents a significant data gap in the development of management strategies designed to reduce sea turtle mortality.

VAQS, the current administrator of the VSTSSN, is part of the Virginia Aquarium & Marine Science Center's (VAMSC) Veterinary Science and Research Division. VAMSC is a collaboration between the City of Virginia Beach and the Virginia Aquarium & Marine Science Center Foundation (VAQF), a non-profit 501 (c3) organization. VAQF is responsible for maintaining VAQS along with other VAMSC-sponsored conservation and scientific research efforts. Because the VSTSSN is led and managed by a non-profit organization and is almost entirely reliant on soft money, it is vulnerable to economic vagaries that may result in inconsistent stranding response or at worst, the collapse of the Network. It is for these reasons that one of the actions under this strategy involves exploring the feasibility of establishing a state supported position within the VSTSSN (see action 1.1.2). Such an action will reinforce the state's support for the VSTSSN and help ensure its permanency.

<u>Action 1.1.1</u>. -Identify all existing and potential revenue streams to permanently fund the operation of the VSTSSN (Lead agencies: **DWR***, CZM, MRC, VAQS and NOAA Fisheries).

<u>Action 1.1.2</u>. -Develop the justification for and explore the feasibility of establishing a state supported position within the VSTSSN. This position will also oversee Virginia's sea turtle nesting monitoring programs (see Strategy 2.3 under Conservation Goal 2). (Lead agencies: **DWR**, VAQS and CZM).

Action 1.1.3. -Assemble a temporary working group tasked with recommending and/or establishing one or more revenue streams that will permanently sustain operational funding and establishment of a permanent state position to sustain the VSTSSN. The working group should include representatives from government agencies, non-profit organizations, and other partners with a vested interest in sea turtle conservation and/or stranding (Lead agencies: **DWR**, CZM, VAQS, MRC, NOAA Fisheries).

Action 1.1.4. – Seek the necessary support from the Virginia General Assembly and/or the Virginia Secretary of Natural and Historic Resources to safeguard the permanency of the VSTSSN (Lead agencies: **DWR**, MRC, CZM).

Action 1.1.5. – Develop a Cooperative Agreement among the DWR and the City of Virginia Beach, the VAMCS, and/or the VAQF which clearly defines VSTSSN-related roles and responsibilities of the state supported position and includes a contingency plan should VAQS lose its capacity to manage the day-to-day operations of the VSTSSN (Lead agencies: **DWR**, and City of Virginia Beach, VAQS, VAMSC, VAQF).

Action 1.1.6. – Support maintaining contact with other state sea turtle stranding networks, the national STSSN, and entities conducting relevant sea turtle research and management by attending meetings and conferences to remain current with data collection techniques, reporting and management protocols and collaborative research and monitoring opportunities (Lead agencies: **DWR**, VAQS).

Strategy Timeline: Actions 1.1.1 through 1.1.3 should be initiated within six months of the completion of this Plan. Actions 1.1.4 and 1.1.5 should be completed within 2 years of the completion of this Plan, and 1.1.6 is ongoing.

Strategy 1.2. – Establish an Interagency Stranding Event Network (ISEN).

Currently, there is no institutional framework in place for detecting and responding to unusual sea turtle stranding events that require resources and staff beyond capacity of the VSTSSN, VAQS, or any single agency. These events may involve large numbers of sick, injured or dead turtles washing ashore on publicly- and privately-owned shorelines, in marinas, waterfront communities, military installations, or other heavily populated areas over a short or extended period of time. A very likely scenario that could occur in Virginia is a mass cold-stunning event involving hundreds of turtles becoming hypothermic due to exposure to sudden and substantial drops in water temperature. Cold-stunned turtles can develop a number of health conditions such as lung, intestinal, skin and eye disorders that may result in death if not addressed immediately. Other potential causes of mass mortality/morbidity events include disease outbreaks, interactions with fishing gear, harmful agal blooms, oil/hazardous material spills, and sustained declines in food resources.

Unusual stranding events do not always involve large numbers of turtles but may only involve one or several individuals that become entrained or trapped within the footprint of a marine construction project, a nuclear power plant, or some other infrastructure or human activity that necessitates their immediate capture and removal. In-water recovery of live and dead turtles can be logistically difficult and often require resources and authorizations not afforded to the VSTSSN. Dealing with these kinds of unusual stranding events compels the cooperation, coordination and sharing of resources among federal, state, and local agencies as well as nongovernmental stakeholders that are impacted by these occurrences.

Action 1–2.1. - Identify and contact stakeholders that may be willing and able to participate in an ISEN and determine the extent to which each stakeholder can: (1) contribute funds, staff, equipment, or other resources; (2) assist with stranded turtle searches, transport or disposal during unusual stranding events; (3) provide expertise to help identify cause or direct response efforts (*e.g.*, pathologists, veterinarians, fishery gear experts, marine construction companies) and/or (4) provide the necessary authorizations to establish working relationships, necessary training, and points of contact (Lead agencies: **DWR**, CZM, VAQS, MRC and NOAA Fisheries).

Action 1.2.2. – Convene regular meetings with stakeholders who have committed to being part of the ISEN to develop response plans, a communication plan, task and resource assignments, and a post-event evaluation process (Lead agencies: **DWR**, MRC, VAQS).

Action 1.2.3. – Develop a sea turtle stranding response Memorandum of Understanding between DWR and MRC to outline expectations for state assistance with unusual sea turtle stranding events (Lead agencies: **DWR**, MRC).

Action 1.2.4. – Convene annual ISEN meetings to update plans and task and resource assignments (Lead agencies: **DWR**, MRC, VAQS).

Strategy Timeline: Actions 1.2.1 – 1.2.3 should be completed within 3 years of the completion of this Plan. Action 1.2.4 will be ongoing.

Strategy 1.3. – Establish one or more consistent funding sources to support the operation and maintenance of the Darden Marine Animal Conservation Center (DMACC).

One of the most costly and public-facing functions of the VSTSSN is the recovery, treatment and care of sick or injured sea turtles. In 2021, the Virginia Aquarium and Marine Science Center opened the DMACC, a state-of-the-art facility that provides holding pools and animal care space for sea turtle and seal rehabilitation as well as examination rooms and laboratory space for diagnostic and forensic investigations of stranded animals. The location of the facility provides direct access to a natural seawater supply for aquarium systems and vessel access to the Atlantic Ocean. Currently, all

DMACC expenditures are covered by the City of Virginia Beach and the Virginia Aquarium & Marine Science Center Foundation (Foundation). Given the uncertainties and financial pressures surrounding municipal and non-profit organization budgets and the high costs associated with maintaining saltwater plumbing and filtration systems, there is a need for a secondary revenue stream dedicated to the operation and maintenance of the DMACC to ensure it remains functional over the long term.

Action 1.3.1. – Assemble a temporary working group tasked with identifying and establishing one or more revenue streams to help cover expenditures associated with the operation and maintenance of the DMACC. The working group should include representatives from the City of Virginia Beach Budget and Management Services, Virginia Senate District 6, 100th District of Virginia House of Delegates, non-profit organizations, and other partners with a vested interest in sea turtle conservation (Lead agencies: **DWR**, VAQF).

Strategy Timeline: Action 1.3.1 should be completed within 5 years of the completion of this Plan.

Strategy 1.4. – Integrate Virginia's historical stranding records into the national stranding database.

Sea turtle stranding data are currently entered into the NOAA Fisheries STSSN Database which came online in 2021. NOAA Fisheries plans to upload historic stranding data, however, the VSTSSN has over 10,000 historic stranding records that will require considerable verification and no resources are currently available to complete the necessary one-time review and editing.

Action 1.4.1. – Seek CZM or other funding to support the verification of historic stranding data and ensure it is in the correct format for uploading into the national stranding database (Lead agency: DWR).

Action 1.4.2. – Identify (and hire as appropriate) a qualified individual with the necessary knowledge base, computing skills and tools to prepare the historic stranding data for uploading into the national stranding database under the guidance of the VSTSSN and NOAA Fisheries database managers (Lead agencies: **DWR**, VAQS).

Action 1.4.3. – Upload verified and reformatted historic stranding data into the national stranding database (Lead agency: VAQS).

Action 1.4.4. –Maintain contact with other state sea turtle stranding networks and the national STSSN by attending relevant meetings and conferences for the purpose of remaining current with stranding data collection techniques, reporting and management protocols and collaborative research and monitoring opportunities (Lead agencies: **VAQS**, DWR).

Strategy Timeline: Actions 1.4.1 and 1.4.2 should be completed within 1 year of the completion of this Plan, Action 1.4.3 should be completed within 5 years of engaging a qualified individual, and Action 1.4.4 is ongoing.

Conservation Goal 2: Identify and mitigate risks to sea turtle populations and habitats in Virginia through cost-effective monitoring, research, and best practices.

Most sea turtles that occur in Virginia are juveniles that spend their time feeding and resting in the Commonwealth's polyhaline and mesohaline waters. Virginia also supports a small breeding population of primarily loggerhead turtles that has been monitored annually since 1970 (DWR, *unpublished data*, September 2024). Sea turtles typically begin arriving in Virginia in May and remain until cooling water temperatures trigger their southward migration sometime in mid to late fall. Rising ambient and sea temperatures will likely prolong their length of stay and may even lead to an increase in future nesting activity. These possibilities combined with unknown impacts of sea level rise, increased weather variability, shifting prey distribution, invasive species and pathogen introduction, offshore wind energy development, fishery interactions, and eutrophication in the Chesapeake Bay makes the identification, evaluation and mitigation of these and other risks an immediate need in Virginia. The most effective approaches for addressing this goal are to (1) support existing sea turtle research and monitoring efforts; (2) collaborate with experts specializing in climate change, harmful algal blooms (HAB), forage fish ecology, commercial and recreational fisheries, marine contaminants and other risk categories to ensure sea turtle concerns and research needs are addressed in each of these disciplines; and (3) support the development and implementation of science-based best management practices and to provide science-based regulatory and enforcement recommendations, as needed.

Strategy 2.1. – Collect, analyze and compare commercial fishery effort, observed sea turtle takes, and stranding data for state managed fisheries known to or likely to interact with sea turtles.

<u>Action 2.1.1</u> – Develop and submit application and maintain the proper federal agreements and permits to operate a state observer program for protected species including sea turtles (Lead agencies: **MRC**, DWR)

<u>Action 2.1.2</u> - Provide guidance and training for observers to handle, resuscitate, collect data and samples from turtle takes (Lead agencies: **MRC**, DWR, VAQS)

<u>Action 2.1.3</u> - Calculate and compare bycatch rates, by fishery and with similar gear in federal waters or in other states, and share sea turtle take details, effort data, and bycatch

rates with other agencies in the Commonwealth and other stakeholders (Lead agency: MRC)

Action 2.1.4 - Review takes regularly to assess trends and needs for management actions (Lead agencies: **MRC**, DWR)

Strategy Timeline: Action 2.1.1 and 2.1.2 should be completed as soon as possible. Actions 2.1.3 and 2.1.4 should be completed within 1 year of the completion of actions 2.1.1 and 2.1.2 and should be repeated semi-annually (mid-year and end of calendar year). Completion of 2.1.1 is dependent on staff availability, and more importantly NOAA Protected Resources review and approval. 2.1.2 should be completed no later than the next NOAA approved training course is available.

Additional Resource Requirements: Actions 2.1.2 and 2.1.3 will require additional staff time for data analysis.

Strategy 2.2. – Continue to assess trends in sea turtle population demographics in Virginia over time and compare them to trends observed throughout the mid-Atlantic region.

Long-term stranding data provide an opportunity to monitor changes in sea turtle demographics in state waters and allow for comparisons to be made with regional trends. Previous evaluation of Virginia data has revealed species-specific shifts in size/age class proportions, sex ratios, and seasonal occurrences over time (Barco *et al.* 2015). Limited capture-release (Barco *et al.* 2016; VIMS and VAQS, *unpublished data*, May 2023) and observed dredge and fishery incidental take data (USACOE and NOAA Fisheries, *unpublished data,* May 2023) collected in the Commonwealth and the mid-Atlantic region are also available for future analyses. Lastly, incorporating relevant environmental co-variates and predictive modeling in the recurring sea turtle population trend analyses of existing data is a cost-effective way to detect and interpret state and regional demographic shifts over time and inform future management decisions.

Action 2.2.1. – Conduct a comprehensive population trend analysis every 10 years using Virginia and mid-Atlantic stranding and incidental take data and incorporating environmental co-variates and predictive modeling in the recurring sea turtle population trend analyses. (Lead agencies: **DWR**, VAQS, VIMS, CZM, NOAA Fisheries, USACOE, USFWS-VFO).

Action 2.2.2. – Foster collaborations with academic institutions and other entities with expertise in time series and/or climactic trend analysis/modeling to assist with Action 2.2.1 (Lead agencies: **DWR**, VAQS, VIMS, NOAA Fisheries).

Action 2.2.3.– Identify and secure funding for recurring sea turtle population trend data collection and analyses including aerial surveys, satellite tagging and research described in Actions 2.2.1 and 2.2.2 (Lead agencies: **DWR**, CZM, NOAA Fisheries).

Strategy Timeline: Actions 2.2.1 and 2.2.2 should be completed within 1 year of the completion of this Plan. The next population trend analysis (Actions 2.2.3) should be conducted in 2026-27.

Strategy 2.3. – Continue to monitor sea turtle demographics, health, diet, distribution, and nutritional status in Virginia

Demographic data as well as health, diet, and nutritional indices are important indicators of the overall status of sea turtle populations; however, collecting samples from turtles in the wild is expensive and logistically challenging. Live turtles incidentally captured via recreational hook and line gear and subsequently examined for ingestion of secondary hooks and other undetected anomalies were shown to have blood and body condition values similar to those obtained from presumed healthy turtles in the wild population (Rose *et al.* 2022). This confirmed the notion that incidentally captured turtles without secondary injury can contribute baseline demographic research and health values that accurately reflect those found in the wild population. Similarly, presumed healthy turtles that recently died from acute trauma or underwater entrapment can be used as a proxy for healthy wild turtles for diagnostic tests that are able to be conducted post-mortem (Barco *et al.* 2016).

The most recent long-term analysis of sea turtle health, diet, and nutrition in Virginia was completed in 2015 using live and fresh dead stranded turtles recovered by the VSTSSN from as far back as the 1980s. Findings from this work revealed that springtime blood and body condition values acquired from wild turtles incidentally captured in pound nets and trawl operations conducted during dredge projects as well as those captured independent of other gear were considerably different from published values obtained from turtles incidentally captured in Virginia pound nets in late summer and fall (Davis *et al.* 2010; Barco *et al.* 2015). This result suggests that turtles arriving in the spring appear to be more nutritionally compromised than those that have spent the summer foraging in Virginia waters (George *et al.* 1997; Barco *et al.* 2015).

Another example of management information that can be gleaned from stranded sea turtles is variations in prey consumed over time. Diet analyses based on gastrointestinal (GI) contents collected from loggerhead and Kemp's ridley turtles revealed a shift from decapod crustaceans to fish discarded from fishing gear in the early 2000s (Seney and Musick 2005, 2007) followed by a return to a more traditional diet of primarily blue crabs for Kemp's ridleys and horseshoe crabs for loggerheads that closely mimicked data collected from turtles in the 1980s and 1990s (Seney *et al.* 2014; Barco *et al.* 2015).

New techniques have been developed (*e.g.*, microbiome analysis) to assess diet and nutritional status of turtles and baseline health index protocols have changed since the completion of the 2015 study. As such, there is a need to determine the most appropriate methodology that is comparable to previous work and one that will generate the most accurate baselines for future trend analyses. Once baselines are established, subsequent monitoring of these parameters through continued sampling of live and fresh dead strandings will provide the information needed to detect shifts in health status, diet and food availability over time, and to assess the quality of the foraging habitats within and outside of Virginia's waters.

Action 2.3.1. – Convene a temporary working group with subject matter experts to (1) determine the most appropriate methodologies for establishing accurate health, diet and nutritional baseline indices; (2) develop sampling protocols designed to generate health and diet data for trend analyses, and (3) identify the lead entity for this project (Lead agency: **DWR**, VAQS).

Action 2.3.2. – Identify and secure funding for (1) hiring a project lead; (2) establishing accurate health, diet and nutritional baseline indices; (3) subsequent collection and monitoring of key health and diet parameters; and (4) and conducting health and diet trend analyses every five years (Lead agency: DWR).

Action 2.3.3. – Establish accurate health, diet and nutritional baseline indices and initiate the collection of health and diet data (including plastics/microplastics) following the methodologies developed under Action 2.2.1 (Lead agency: **To be determined [TBD]**)

Action 2.3.4. – Conduct a health and diet trend analysis every 5 years (Lead agencies: **TBD**, DWR, VAQS).

Strategy Timeline: Actions 2.3.1 and 2.3.2 should be completed within 3 years of the completion of this Plan. Action 2.3.3 should commence within 4 years of the completion of this Plan. The next health and diet trend analysis (Actions 2.3.3 and 2.3.4) should be conducted following the most recent 5-year data collection period.

Strategy 2.4. – Continue to monitor sea turtle nesting activity in Virginia.

Although Virginia's loggerhead turtle nesting population is small (see Loggerhead Reproductive Activity and Virginia Sea Turtle Nest Monitoring sections), it does present unique opportunities to detect and monitor changes in nesting demographics within the NRU. When habitat and physiological stressors emerge from phenomena such as rising sea surface temperatures, sea level rise, shifting prey distribution, invasive species and the introduction of pathogens, phenological changes are often greatest and first to occur at the fringes of the range. The timely detection of and management responses to these changes requires sound monitoring, data gathering, and protection of nests, hatchlings and post-hatch outcomes. This in turn requires coordination and oversight of Virginia's sea turtle nest monitoring programs. Currently, the DWR coastal nongame biologist assumes this role. However, this position encompasses a number of other responsibilities and as such, does not have the capacity to adequately manage the nest monitoring programs. Therefore, there is a need for an additional state-supported staff to assume these responsibilities which will go a long ways towards ensuring that the monitoring programs deploy standardized monitoring and reporting protocols over the long term.

Action 2.4.1. – Develop the justification for and explore the feasibility of establishing a state supported position within the VSTSSN (see strategy 1.2 under Conservation Goal 1) and assign the management and coordination of Virginia's sea turtle nest monitoring programs to this position. (Lead Agency: DWR).

Action 2.4.2. – Review and assess the current level of sea turtle nest monitoring effort on the southern mainland beaches and barrier islands, to establish best practices and participating/lead agencies for each segment. (Lead agencies: **DWR**, BBNWR, VAQS, DNNB, JEB-FS, CNWR, ESNWR, NASA Wallops).

Action 2.4.3. – Reconvene annual meetings with agencies engaged in monitoring sea turtle nesting activity in Virginia to debrief concerns from the previous season, plan for the upcoming season, and discuss emerging monitoring needs and research opportunities (Lead agency: DWR).

Action 2.4.4. – Enter all Virginia sea turtle nesting data in the current sea turtle nest data portal (Lead agency: DWR).

Action 2.4.5. – Establish and maintain contact with other states in the Loggerhead Turtle NRU by attending relevant meetings and conferences for the purpose of remaining current with (1) nest monitoring methods, data collection and reporting protocols; (2) nest and nesting habitat management strategies; and (3) collaborative research opportunities (Lead agency: DWR).

Action 2.4.6. – Adhere to sea turtle nest monitoring methods and data collection protocols established for the NRU to maintain consistency throughout the recovery unit and include protocol updates in the Virginia Sea Turtle Nesting Handbook to ensure their implementation (Lead agency: DWR).

Action 2.4.7. – Adopt sea turtle nesting habitat protection and management strategies established by other states within the NRU, when possible, to maintain consistency throughout the recovery unit (Lead agency: DWR).

Action 2.4.8. – Participate in regional research projects that will inform management decisions related to sea turtle nesting activity and the protection and enhancement of nesting habitat (Lead agencies: **DWR**, BBNWR, VAQS, CNWR, USFWS-VFO).

Strategy Timeline: All actions except for 2.4.1 are either ongoing or should commence within 1 year of the completion of this plan and continue through the foreseeable future. The timeline for Action 2.4.1 is dependent on the approval and hiring of the state supported position.

Strategy 2.5. –Assess, protect, and/or enhance sea turtle nesting and in-water habitats through engagement with state and regional initiatives and partnerships.

There are a number of state and regional initiatives and partnerships that conduct and coordinate relevant monitoring and research of marine wildlife and ecosystems. Some focus on mitigating specific challenges such as offshore wind energy (*e.g.*, Regional Wildlife Science Collaborative) and marine debris (*e.g.*, VIMS Trap, Removal, Assessment, and Prevention Program (TRAP)) while others consolidate available data to help inform conservation planning and management decisions (*e.g.*, Mid-Atlantic Regional Council on the Ocean (MARCO). These types of initiatives often stem from or can result in the formation of effective partnerships that can yield cost-effective, broad scale conservation benefits that cannot be achieved by a single state or organization.

Action 2.5.1. – Identify, participate in and contribute data to state and regional initiatives and partnerships that promote the assessment, protection and/or enhancement of sea turtle nesting and in-water habitats (Lead agencies: **DWR**, VAQS, CZM, MRC).

Action 2.5.2. – Support and promote strategies and actions in the Marine Debris Reduction Plan for Virginia (Register 2021) and the regional 2021 Mid-Atlantic Marine Debris Action plan (NOAA Marine Debris Program 2021) that will help reduce sea turtle mortality and entanglement and reduce the amount of marine debris on sea turtle nesting beaches and in-water habitats (Lead agencies: **CZM**, DWR, Virginia Clean Waterways).

Action 2.5.3. – Enhance and restore green turtle foraging habitats by supporting ongoing efforts to reestablish submerged aquatic vegetation in the lower Chesapeake Bay and seaside lagoon system (Lead agencies: **VIMS**, CZM, TNC, MRC, DWR).

Strategy Timeline: All actions should be initiated immediately upon the completion of this Plan and remain on-going.

Strategy 2.6. – Incorporate the foraging and habitat needs of sea turtles in the development of or revisions to relevant fishery management plans, regulations, and best practices.

Virginia waters provide important foraging habitat primarily for migratory juvenile loggerheads and Kemp's ridleys. In Virginia, loggerheads forage primarily on large whelks, horseshoe crabs and a variety of true benthic crabs, including blue crabs, whereas Kemp's ridleys feed mostly on blue crabs and spider crabs. Whelks, blue crabs and horseshoe crabs are commercially important species in the Commonwealth and are managed intensively for the purpose of maintaining commercially sustainable populations. Equally important, however, is the need to ensure that these harvested populations are viable enough to support sea turtles and other marine wildlife that prey on these species. There is also a need to minimize the bycatch of blue crabs, horseshoe crabs and other benthic organisms in pot and bottom fishing gear to help sustain diverse prey resources over the long term. While the impact of clam aquaculture on sea turtles is currently unknown, it is possible that the emerging modifications to the benthic environment to protect artificially seeded clams from predators may displace sea turtles or their prey. Additional research will be needed as new aquaculture sites are selected or considered.

Action 2.6.1. – Assess and incorporate the foraging needs of loggerhead and Kemp's ridley turtles in horseshoe crab, blue crab, whelk and other commercially important sea turtle prey species' management plans, harvest limits, regulations, and by-catch reduction measures (Lead agencies: **MRC**, DWR).

Action 2.6.2. – Assess bycatch of important sea turtle prey species in commercial pot and bottom fishing gear and develop science-based by-catch reduction measures and best practices (Lead agencies: **MRC**, VIMS).

Action 2.6.3. – Study the impacts of shellfish aquaculture on the use of benthic habitats by sea turtles (Lead agencies: **DWR**, VIMS, MRC).

Action 2.6.4. – Develop science-based best practices for existing and new shellfish aquaculture leases based on results from Action 2.5.2 and 2.5.3 that reduce or mitigate impacts on sea turtle habitats (Lead agencies: **DWR**, VIMS, MRC).

Action 2.6.5. –Assess potential effects of emerging aquaculture and commercial fisheries on sea turtle habitats and/or prey abundance and availability and develop science-based best practices, designed to avoid, or reduce identified risk factors (Lead agencies: **DWR**, VIMS, MRC).

Strategy Timeline: Actions 2.6.1 and 2.6.2 should be completed within 3 years of the completion of this Plan; Actions 2.6.3 and 2.6.4 should be completed within 5 years of the completion of this Plan; and Action 2.6.5 should be implemented whenever novel aquaculture and fisheries are being proposed.

Additional Resource Requirements: The impact assessments and/or development of best practices described in each of the actions will require additional funding from sources such as Virginia Sea Grant, NOAA Fisheries and the National Fish and Wildlife Foundation (Lead agencies: **DWR**, VIMS, MRC, CZM).

Conservation Goal 3. Promote sea turtle conservation in Virginia through social marketing and information dissemination.

Sea turtle conservation fundamentally includes human beings, and the most successful conservation actions are those aligned with the values, wellbeing, and perspectives of people. When conservationists work to address the needs of threatened or endangered species, they are often trying to change or reinforce human behavior that will benefit the targeted species.

Because of their empathy and curiosity, children are often the most effective promoters of behavioral change making them excellent endangered species ambassadors, especially for highly charismatic species such as sea turtles (Young *et al*. 2018). Getting children engaged in sea turtle conservation at an early age can result in lasting and cascading conservation behaviors that often touch and influence parents, siblings, and other family members.

Another important component of effective sea turtle conservation and management is to ensure that regulatory agencies receive accurate up-to-date information on the biology, distribution, behavior, and habitat use of marine turtles in Virginia to inform project reviews, Environmental Assessments, Environmental Impact Statements, Biological Opinions, and other related documents.

Strategy 3.1. – Promote sea turtle conservation in Virginia through effective social marketing techniques

Because sea turtle nesting activity is rare in Virginia, especially on municipally owned beaches, beachfront communities and commercial stakeholders are reluctant to adopt restriction on artificial lighting or large nighttime public events such as concerts, festivals, and sports competitions during the nesting season. Strategic use of social marketing can increase the adoption of evidence-based conservation practices and behaviors through effective messaging that targets beachgoers and owners/managers of beachfront businesses, hotels, vacation rentals and private residences.

Similar social marketing techniques can also be used to change the behavior of recreational boaters, anglers and other water enthusiasts in ways that reduces human-sea turtle interactions on the water. Creative, and targeted messaging can persuade and educate the public how to properly report sea turtle strandings, hook and line captures and other situations that require an immediate response by the VSTSSN, law enforcement or some other entity.

Action 3.1.1. – Convene a temporary working group made up of sea turtle biologists, education/outreach staff, and social marketing experts to: (1) review existing materials, and identify those that warrant updating and public dissemination; (2) update existing education/outreach materials and tools where needed; (3) identify specific audiences, messages, and information dissemination pathways and platforms (*e.g.*, public service announcements, websites, social media, blogs, fishing club newsletters and other outlets); and (4) develop new messaging materials, tools and outlets (Lead agencies: **DWR**, CZM, BBNWR, CNWR, ESNWR, TNC, VAQS).

Action 3.1.2. – Contract with a marketing organization to develop, test, and implement a social marketing campaign to promote human behaviors (including safe boating practices) and conservation practices that minimize disturbance and injury/mortality to nesting females, nests, and hatchlings and to sea turtles in the water and document recreational bycatch, harassment, and other concerns affecting sea turtles (Lead agency: DWR).

Action 3.1.3. – Launch and periodically update state social marketing campaigns (Lead agencies: **DWR**, CZM, CZM, BBNWR, CNWR, ESNWR, TNC, VAQS).

Strategy Timeline: Actions – 3.1.1 - 3.1.2 should be completed within 2 years of the completion of this Plan; Action 3.1.3 should be completed within 3 years of this plan and maintained long term.

Additional Resource Requirements: Additional funding will be needed to engage a social marketing company and to develop, disseminate and evaluate all forms of outreach materials (Lead agencies: CZM, DWR).

Strategy 3.2. – – Develop sea turtle educational materials for a variety of audiences and messages.

Sea turtles are highly charismatic and well loved by people of all ages. The most effective means of ensuring the adoption of relevant conservation practices and behaviors is through the early exposure to a well-developed educational curriculum about sea turtle conservation, demography and ecological roles.

Action 3.2.1. – Identify and review existing sea turtle curricula for K-12 schools and update as needed or develop a new one(s) that includes information on the important roles sea turtles play in marine ecosystems, such as controlling prey species or providing food to larger predators, and the possible effects of the disappearance of sea turtles from the marine environment (Lead agencies: **DWR**).

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Action 3.2.2. – Identify and review other existing sea turtle educational materials and curricula that target adults, children, and underserved populations in a variety of settings and update, or develop new materials, as needed (Lead agencies: **DWR**).

Strategy Timeline: All actions should be completed within 5 years of the completion of this plan.

Additional Resource Requirements: Additional funding will be needed to contract with educational resource specialists to help develop educational curricula, *etc.* (Lead agency: DWR).

Strategy 3.3. – Prepare and regularly update permitting guidance documents to assist with the review of proposed human activities that may affect sea turtles in Virginia.

The accurate review of human activities and projects that may impact sea turtle nesting beaches, nesting females, nests, hatchlings, and in-water habitats requires accurate up-to-date information on sea turtle demographics, distribution and ecology that is specific to Virginia. This is especially true for beach renourishment projects in the City of Virginia Beach which are complex, involve multiple review agencies and require close monitoring of nesting activity and strict adherence to numerous environmental provisions. Similar sea turtle biological and ecological information is required for the development of NEPA documents, biological opinions, and project best practices. Providing regulatory agencies, developers, and action agencies with the necessary information upfront will help streamline and provide transparency in permitting process and promote consistency among regulatory agencies.

Action 3.3.1. –Develop an adaptive sea turtle guidance document for regulatory agency use specifically for ocean beach renourishment projects that includes science-based recommendations, information extracted from relevant Biological Opinions, protocols and provisions for the monitoring of nesting activity, nest protection, project lighting, equipment placement and mobilization, and other specifications designed to minimize impacts to nesting turtles and their habitat (Lead agencies: **DWR**, USFWS, USACOE, MRC).

Action 3.3.2. - Develop a general adaptive guidance document that includes information on sea turtle biology and ecology, the distribution and number of nests in Virginia, known seasonal occurrences in state coastal waters, in-water habitat preferences, and other key pieces of information needed to develop environmental documents and inform project reviews. This guidance document will be updated periodically and undergo review by appropriate federal agencies to ensure consistency (Lead agency: DWR).

Action 3.3.3. - Upload and maintain the most current sea turtle-related permitting guidance documents compiled under actions 3.3.1 – 3.3.2 on the online DWR portal that is accessible to all state and federal regulatory agencies and permit applicants (Lead agency: DWR).

Action 3.3.4. - Conduct an information session with MRC Fisheries and Habitat divisions, DEQ, and CZM to reestablish baseline knowledge of each agency's roles and responsibilities concerning sea turtles (Lead agency: **DWR**).

Strategy Timeline: Actions 3.3.1 and 3.3.2 should be completed within 2 years of the completion of this Plan; Action 3.3.4 should occur after completion of Actions 3.3.1 and 3.3.2; and Action 3.3.3 should be ongoing as documents are completed.

Summary

Sea turtles are a natural resource shared across national and international borders. Their conservation requires coordinated efforts among many entities. Chesapeake Bay and Virginia coastal waters are an important habitat for U.S. Atlantic coast populations, especially for threatened loggerhead and endangered Kemp's ridley turtles.

Oversight and implementation of this Plan will be conducted by the DWR with assistance from other key state and federal partners. The DWR will also be managing the Virginia Marine Mammal Conservation Plan, which includes many strategies and actions similar to this Plan. Much of the work described in these Plans require new or redirected resources which will be critical in accomplishing the Actions listed in each Plan. Conservation plan updates are recommended every ten years, and interim assessment of progress toward achieving conservation goals and associated strategies and actions will be ongoing. Adoption and implementation of the Virginia Sea Turtle Conservation Plan will encourage inner-departmental coordination, align Virginia's conservation planning with regional and federal efforts, and promote efficient use of resources to provide sea turtles in Virginia with a sustainable future.

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Appendix – 2022-2027 Agent of State designation for VAQS

COMMONWEALTH of VIRGINIA
Department of Wildlife Resources

Travis Voyles
Acting Secretary of Natural and Historic Resources

Ryan J. Brown
Executive Director

August 5, 2022

Allyson McNaughton, DVM
Chief of Veterinary Science and Research
Virginia Aquarium and Marine Science Center
717 General Booth Blvd.
Virginia Beach, VA 23451

Dear Dr. McNaughton:

This letter shall serve to designate the Virginia Aquarium and Marine Science Center Stranding Response Program and the positions listed below (hereafter collectively referred to as VAQSRP) as agents of the Virginia Department of Wildlife Resources (VDWR), under the terms of our Endangered Species Act Section 6 Cooperative Agreement with the US Fish and Wildlife Service and provisions set forth in 50 CFR 17.31(b) and 50 CFR 17.21(c)(5). Under this designation, the VAQSRP is authorized to engage in the following activities that pertain to the conservation, rehabilitation, monitoring and public outreach of sea turtles in the Commonwealth of Virginia:

1. The administration and coordination of the Virginia Sea Turtle Stranding and Salvage Network. Activities include:
    a. Receiving and screening statewide reports of stranded sea turtles from the public and VAQSRP cooperators (*e.g.,* federal, state and municipal employees);
    b. Coordinating the response to and recovery of live and dead stranded sea turtles;
    c. Transporting live and dead stranded sea turtles for purposes related to medical assessment, treatment and rehabilitation, release back into the wild, postmortem examination, and/or final disposition;
    d. Rehabilitating live sick or injured sea turtles at a VA Aquarium Marine Science Center (Virginia Aquarium) facility or, when necessary, at a collaborating off-site diagnostic or treatment facility in a manner that is in compliance with the "U.S. Fish and Wildlife Service's Standard Conditions for Care and Maintenance of Captive Sea Turtles" (version November 13, 2019 or later);
    e. Performing postmortem examinations (necropsies) to help determine cause of death, assess pre-mortem health status, determine gender of immature turtles, and collect and archive tissue, blood and other biological samples for permitted recovery research activities, establishing cause-of-death, and evaluating rehabilitation techniques; and

7870 VILLA PARK DRIVE, SUITE 400, P.O. BOX 90778, HENRICO, VA 23228
Equal Opportunity Employment, Programs and Facilities

f. Euthanizing moribund stranded turtles that are deemed untreatable or unlikely to recuperate or survive in the wild, are carrying a transmissible disease that likely poses a threat to wild populations or captive turtles, or are undergoing severe pain and suffering for which euthanasia is the only humane option available.

The VAQSRP will enter all stranding records in the National Sea Turtle Stranding and Salvage Network database as required by the NOAA Fisheries Greater Atlantic Regional Fisheries Office (GAR). The VAQSRP's sea turtle stranding and salvage activities will be coordinated, as appropriate, with the GAR Sea Turtle Stranding and Disentanglement Coordinator.

2. Research on the rehabilitation and subsequent release of live-stranded sea turtles. Allowable actions under this activity include:
   a. Collecting and archiving blood and tissue samples for diagnostic and prognostic assessments, assessing efficacies of rehabilitation techniques and determining causation of strandings; and
   b. Applying external tags (flipper tags), internal tags (Passive Integrated Transponder or PIT tags) and telemetry tracking devices on rehabilitated sea turtles prior to release.

3. Implementation and administration of the Virginia Pier Partners Program developed by the VAQSRP to document, assess, remove embedded or ingested hooks, provide post-treatment care (when needed), and/or release of sea turtles incidentally captured by recreational pier fishers in the tidewater area. This program involves providing pier managers with the necessary equipment and information on how to report and safely recover and temporarily hold live, hooked turtles until they can be picked up and transported to a Virginia Aquarium facility by trained VAQSRP staff or volunteers.

4. Sea turtle nest monitoring and relocation along beaches owned by the City of Virginia Beach. All activities shall be carried out as described in the Virginia Sea Turtle Nesting Handbook and include:
   a. Conducting daily nest searches between sunrise and 0900;
   b. Confirming the presence of eggs;
   c. Relocating confirmed nests laid below the high tide line;
   d. Marking in situ and relocated nests;
   e. Conducting post-hatch nest excavations and quantifying hatching success; and
   f. Entering annual nesting data in the VDWR sea turtle nesting database.

Communications regarding nest locations, monitoring and relocation (as needed) will follow the attached Communications Plan.

5. The Virginia Aquarium and Marine Science Center (Virginia Aquarium) will be permitted by the VDWR to continue displaying, for educational purposes only, those sea turtles already in possession and any sea turtles that are placed at the Virginia Aquarium by the U.S. Fish and Wildlife Service or that are determined, in consultation with NOAA and the U.S. Fish and Wildlife Service, to be non-releasable following rehabilitation. Animals will be held, displayed and reported on following the "U.S. Fish and Wildlife Service's Standard Conditions for Care and Maintenance of Captive Sea Turtles" (version 11/13/2019 or later). State authorization will continue as long as the Virginia Aquarium complies with all terms and conditions of its state-issued Exhibitor permits.

6. Reporting requirements.
   a. The VAQSRP will be required to submit an annual report to the VDWR by June 1 of each year covered under this letter. The report shall contained a detailed summary of activities 1 – 5 outlined above.
   b. The VAQSRP will be required to submit to the VDWR an annual report generated from its Sample Management Database list that (1) lists and tracks the purpose and disposition of sea turtle tissue, blood and other biological samples collected from live and dead stranded sea turtles requested by and sent to other researchers for scientific and conservation purposes and (2) lists and tracks the purpose and disposition of sea turtle tissue, blood and other biological samples archived in-house for establishing cause-of-death and evaluating rehabilitation techniques.

Location where authorized activities may be conducted:

Rehabilitation, necropsies and euthanasia: All Virginia Aquarium facilities.

Field-based stranding response, necropsies and euthanasia: Virginia Beach, Norfolk, Portsmouth, Chesapeake, Hampton, Suffolk, Newport News and Poquoson; Accomack, Northampton, Isle of Wight, York, Matthews, Surry, Gloucester, King and Queen, Lancaster, Middlesex, Northumberland, Westmoreland and all other counties east of the fall line.

Sea turtle nest confirmation, management and monitoring: Public beaches of the City of Virginia Beach and other locations upon the request or permission of the VDWR.

Authorized VAQSRP entities:

Chief of Veterinary Science and Research
Senior Scientist Stranding Response Program Coordinator
Stranding Response Program Rehabilitation Manager
Stranding Response Program Response Manager
Sea Turtle Nesting Coordinator
Associate Veterinarian

Allyson McNaughton, DVM
August 5, 2022
Page 4

Veterinarian technician(s)
Trained VAQSRP staff, interns and volunteers
Staff from state-owned parks and natural area preserves under the direction of the VAQSRP

Term of this Agent of the State Designation: July 1, 2022 – June 31, 2027. Sixty days prior to the expiration of this term, the VDWR and the VAQSRP may consider the option of renewing this designation during which time, modifications to the existing authorized activities and terms and conditions contained herein shall be reviewed and amended, as needed. In addition, this letter may be reviewed and amended during the term as needed to ensure all authorized activities meet the most current conservation, management and monitoring needs of sea turtles in Virginia.

Consequences of non-compliance: The VAQSRP shall comply with all terms and conditions listed under each authorized activity. Failure to do so may render this letter null and void and rid the VAQSRP of its status as a designated agent of the state. Lastly, this letter does not support any activities outside of those contained herein.

I look forward to this unique and very important partnership and very much appreciate the VAQSRP willingness to continue carrying out these essential activities as a designated agent of the state. Please let me know if you have any questions or need more information (becky.gwynn@dwr.virginia.gov; 804.389.3953).

Sincerely,

Rebecca K. Gwynn
Deputy Director

Cc: Ruth Boettcher, Coastal Nongame Biologist
Martin Miller, USFWS, North Atlantic-Appalachian Region
Abby Gelb, USFWS, North Atlantic-Appalachian Region
Emily Argo, USFWS, Virginia Field Office