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Virginia Sea Turtle & Marine Mammal Stranding Network 2020 Grant Report

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VIRGINIA AQUARIUM & MARINE SCIENCE CENTER

Virginia Coastal Zone MANAGEMENT PROGRAM

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VIRGINIA AQUARIUM FOUNDATION STRANDING RESPONSE PROGRAM

Virginia Sea Turtle and Marine Mammal Stranding Network 2020 Grant Report

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The mission of the Virginia Aquarium & Marine Science Center is to inspire conservation of the marine environment through education, research and sustainable practices. The Aquarium is operated by the City of Virginia Beach in cooperation with the Virginia Aquarium Foundation (VAQF).

The Virginia Aquarium Research & Conservation Section is responsible for directing the organization's efforts in these areas. With primary support from the VAQF, the Section's Stranding Response Program is dedicated to conservation of marine animal species through stranding response, research, rehabilitation and education.

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Introduction

All marine mammals and sea turtles are designated as protected species by the Marine Mammal Protection Act (1972) and/or the Endangered Species Act (1973). The Virginia Aquarium & Marine Science Center Stranding Response Program (VAQS) holds permits from state and federal authorities for all activities in this report related to marine mammal and sea turtle stranding response and research. VAQS has been responding to marine mammal and sea turtle strandings (more than 9,500) in Virginia since 1987. The Aquarium and the VAQS Stranding Center are located in Virginia Beach, VA. VAQS responds to all marine mammal strandings in Virginia and currently maintains the state marine mammal stranding database. In addition, VAQS and their cooperators coordinate the Virginia Sea Turtle Stranding and Salvage Network throughout Virginia. All sea turtle stranding data are recorded by VAQS into the state sea turtle stranding database. For the purposes of this report, VAQS uses the following definition: *Sometimes marine animals wash ashore sick, injured or dead. At other times, they become entrapped or entangled and are unable to return to their natural habitats without assistance. These events are known as Strandings*.

VAQS uses staff, volunteers and other organizations (cooperators) to report, record, document, recover, examine and/or rehabilitate stranded animals. The organization and training of primary response cooperators is crucial to the stranding network. Rapid response to strandings can result in the rescue of live animals and the collection of valuable data from dead animals that may otherwise be lost due to decomposition and/or scavenging. Formed in 1991, the VAQS Stranding Response Team (Team) is composed of staff and volunteers trained to respond to stranded animals. VAQS staff provides training programs for approximately 65 Team volunteers and personnel from cooperating agencies and organizations. Instruction in biology, ecology and both live and dead stranding response protocols are provided for marine mammal and sea turtle species found in Virginia. These cooperative training efforts have included the U.S. Coast Guard, U.S. Fish and Wildlife Service (USFWS), NOAA Fisheries Service (NMFS), The Nature Conservancy, Virginia Marine Resources Commission, Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Institute of Marine Science (VIMS), state parks, national wildlife refuges, regional law enforcement authorities and lifeguards. As a result of these long-standing efforts, VAQS continues to maintain and improve statewide marine animal stranding response networks.

Marine mammal groups and species found in Virginia include cetaceans (dolphins, porpoises and whales), pinnipeds (seals) and sirenians (manatees) (Appendix V: Virginia Species Lists). Marine mammal strandings occur in all months of the year. During the 1990s, Virginia averaged 63 marine mammal strandings per year with a high of 106 in 1994. Since then, stranding numbers have increased dramatically. For the years 2000-2012, Virginia

averaged 100 marine mammal strandings per year. This could represent increasing marine mammal mortality, though it also may partially be the result of an improved state-wide stranding response network. The years since 2012 have continued with high numbers of marine mammal strandings in Virginia, including the historic total from 2013 (427 strandings) that included a bottlenose dolphin unusual mortality event (UME), and an annual average of 98.4 strandings for 2014-2020 (Figure 1).

It is important for organizations such as VAQS to examine stranded marine mammals because these species are very challenging to study in the wild. Stranding trends, including probable causes of marine mammal mortalities, are monitored through stranding records. Little is known about the natural history of many marine mammal species and strandings provide a rare opportunity to thoroughly examine these animals. With the advent of new techniques such as molecular genetic analyses, stranded animals provide a wealth of information about wild populations that are difficult and very costly to study *in situ*. In some species, such as pygmy/dwarf sperm whales and beaked whales, data collected from stranded animals often provides the best and only information available on the species' natural history. Stranding records can represent viable measures of the biological diversity and the spatial and temporal changes that are occurring in adjacent waters, especially when long-term datasets are developed and maintained (Pyenson 2010; Pyenson 2011; Pikesley *et al* 2012). In addition, stranding data can indicate seasonal trends in presence and suggest areas of high concentration of marine mammal species such as bottlenose dolphins and harbor porpoises (Read and Murray, 2000). Spatial and temporal trends in marine mammal mortalities, such as those caused by unusual mortality events and/or fisheries interactions, can also be monitored from stranding records. Each stranded marine mammal is thoroughly examined, whenever possible, including body measurements, external appearance and internal condition (via necropsy). Data and tissues are collected for life history, histology, bacteriology, virology and toxicology studies. Samples are collected by VAQS and have been supplied to the Smithsonian Institution, Armed Forces Institute of Pathology, NMFS, and numerous other research organizations.

In addition to dead strandings, the VAQS Team responds to live marine mammals each year. The level of response depends on the type of animal. Sick or injured baleen whales and toothed whales larger than eight feet in length are virtually impossible for VAQS to rescue and often must be humanely euthanized. Some smaller cetaceans can be relocated and released or rescued if found quickly and in suitable condition. They must be supported in water as soon as possible and treated for shock. Successful cetacean rehabilitation requires large tanks, experienced personnel and access to sophisticated equipment. VAQS is not equipped to conduct long-term rehabilitation of a cetacean. As soon as possible, animals that are good candidates for rehabilitation are transferred to other qualified

facilities. Pinnipeds (seals), on the other hand, are amphibious animals and can be transported in dry containers such as canine kennels. The VAQS Stranding Center has a seal holding pen adequate for short-term triage and a seal rehabilitation unit capable of holding one animal. The seal triage area includes a 4'x 4' dry pen with gated entry into a 4'x 4' pool. Following triage, animals are placed in a seal rehabilitation area (large enough for one animal) or are transferred to other facilities in the stranding network that specialize in long-term rehabilitation and release of pinnipeds. The VAQS Team also responds to live marine mammal emergencies in northeastern North Carolina.

Five species of sea turtles (loggerhead, Kemp's ridley, leatherback, green, and hawksbill) have been recorded in Virginia (Appendix V: Virginia Species Lists). Sea turtle strandings occur primarily in the late spring, summer and fall. The VAQS Team responded to an average of 86 sea turtle strandings per year during the 1990s. Since then, strandings have increased dramatically. Since 2000, Virginia has recorded more than 5,500 sea turtle strandings, with an average of 251 per year for the last ten years 2011-2020.

Sea turtles are examined in much the same way as marine mammals. Data are recorded for all strandings, and necropsies are performed on many stranded carcasses. Sea turtle stranding trends, including probable causes of mortalities, are monitored through stranding records. Stranded sea turtles are checked for flipper and PIT tags and results are reported to NMFS. A small number of sea turtles nest on Virginia beaches each year, primarily loggerheads, though several green and Kemp's ridley sea turtles have been recorded nesting recently in Virginia. The VAQS Team participates in a nesting beach monitoring program in Virginia Beach with the USFWS, Back Bay National Wildlife Refuge, and VDGIF. Live strandings of sea turtles have also increased and the VAQS Team has successfully rehabilitated and released many of the stranded turtles. In recent years, VAQS developed the Virginia Pier Partner Program to better respond to the large numbers of sea turtles that are incidentally caught by pier anglers each year. This program has been very successful in promoting safe handling, recovery and rehabilitation of hooked sea turtles and providing outreach to anglers and pier owners about proper hooked sea turtle response techniques. The program has also allowed for the collection of data on fishing practices that are associated with hooked sea turtles. As a result of its success, other stranding network organizations in the region are contacting VAQS to learn more about the program. From 2000-2012, an average of 11.5 live sea turtle strandings were recorded in Virginia each year. Since that time and the development of the Pier Partner Program, Virginia has averaged 61 live strandings per year, with a peak of 92 live sea turtle strandings in 2017. In addition, VAQS Team expertise in sea turtle rehabilitation has resulted in many turtles (more than 65) that have stranded outside Virginia being transferred to VAQS for rehabilitation and release. In 2020, 34 sea turtles stranded alive in VA and were reported to VAQS. Of those, 2 are

currently in rehabilitation, one (a leatherback) was euthanized in the field, three were not able to be recovered, seven did not survive in rehabilitation, eight either broke the fishing line or were released by the fisher who hooked them, and 13 sea turtles were successfully rehabilitated and released. Four additional turtles rescued in 2019 were successfully released, and one more from 2019 was deemed non-releasable and was transferred to the Cook Museum of Natural Science in Alabama for permanent placement.

In addition to stranding response, VAQS conducts research on marine mammals and sea turtles. Photo-identification is a non-invasive technique that takes advantage of naturally occurring marks on animals. Photo-ID is used to study both bottlenose dolphins and large whales, primarily humpback whales, in the nearshore waters of Virginia and North Carolina. VAQS has also been conducting research on loggerhead sea turtles since 1990. Early research involved the study of growth potentials of loggerhead hatchlings in *ex-situ* controlled environments. Post-release satellite tracking of young, aquarium-reared loggerheads was initially conducted with the help of VIMS in the 1990s and continues today under the guidance of Aquarium staff and other research collaborators. Growth and nutritional studies continue with hatchling loggerheads and non-releasable loggerhead, Kemp's ridley and green sea turtles. With the support of additional grants and donations in recent years, VAQS has been able to conduct numerous satellite and acoustic tagging projects with yearling loggerheads and rehabilitated sea turtles.

VAQS Team staff and volunteers present the results of their research at national and regional workshops, at professional meetings, and in numerous publications (Appendix I: Professional and Education Activities). In addition, VAQS research has been presented to more than 16 million people through innovative Aquarium exhibits and public programs. In 2015, a major new exhibit area, *Stranded*, devoted to the stranding response program opened at the Aquarium. Staff and volunteers present educational programs for the public related to stranding events and provide outreach on response and research throughout the year during active stranding response efforts. On a continual basis, staff provide training/assistance and gain valuable experience in live animal rehabilitation and response by cross-training and working with staff at other stranding network facilities. VAQS staff also serves on federal management and scientific teams studying the interactions of protected species with commercial fisheries and other potentially threatening human activities. They regularly use their expertise and data to comment on projects that may have an impact on regional marine mammal and sea turtle populations, including a proposed naval undersea training range off Virginia's eastern shore, the potential to open mid-Atlantic areas to offshore oil and gas drilling, and offshore wind energy development. Virginia stranding data was included in the mid-Atlantic Ocean data portal developed to support the Mid-Atlantic Ocean Action Plan. Finally, public and private organizations conducting natural resource

surveys and environmental assessments routinely utilize the VAQS stranding database and expertise for information regarding protected species in Virginia.

Stranding Response Methods

When examining dead stranded marine mammals and sea turtles, the VAQS Team follows data collection protocols developed by NMFS (Appendix IV: Stranding Network Datasheets) and by VAQS staff. For marine mammals, Level A data are collected on all strandings and recorded in the marine mammal stranding database. Level A data include:

- observer
- date
- location
- species
- total body length
- gender
- condition
- weight
- findings of human interaction *
- sample collection and dissemination
- disposition of carcass

(* Findings of human interaction consist of clues on a carcass that the animal had previously interacted with humans or human activities, sometimes resulting in injuries and/or the death of the animal. The most common types of human interactions are fishery entanglements, vessel strikes, and marine debris ingestion. Special data collection protocols and forms have been developed by VAQS for assessing human interactions in marine mammal and sea turtle strandings).

Level B and C data are collected from fresh to moderately decomposed carcasses. Level B and C data are recorded on specialized data sheets and are often shared with other collaborating research organizations. These more involved data can include:

- age
- extensive body measurements
- descriptions and photographs of external & internal appearance
- parasite and pathology occurrence
- stomach contents
- reproductive status
- genetic information

- tissue contaminant levels
- information for specific research

In order to provide timely, accurate, and usable information, VAQS compiles these data in a relational database. The computer system, database, and software allow for analytical study of the data, including GIS mapping. When combined with the extensive VAQS photo and video catalogs, the long-term marine mammal stranding database can be an invaluable tool for scientists, natural resource managers, and other state and federal agencies.

Sea turtle data are collected in much the same manner as for marine mammals (Appendix IV: Stranding Network Datasheets). In addition to the Level A, B, and C data listed above, the VAQS Team also examines sea turtle carcasses for several types of tags. PIT tags and wire tags require specialized equipment in order to be detected. Fresh to moderately decomposed turtles are examined for stomach contents, gender, and findings of human interaction.

Live marine mammals and sea turtles have become an increasing part of stranding response for the VAQS Team. Live stranding response is quite different from responding to dead animals. While time is important when responding to a fresh dead stranding, timely response is crucial to the welfare and survivability of live stranded animals. Once a live stranding is confirmed, staff and volunteers respond as quickly as possible. Cooperating agencies, especially on Virginia's eastern shore, have immensely improved the VAQS Team's ability to efficiently respond to live strandings. Whenever possible, live stranded animals that are candidates for rehabilitation are brought to the Stranding Center where they are immediately treated for life-threatening conditions. VAQS veterinary staff and live animal care personnel have developed protocols and data sheets for live animal response and rehabilitation. VAQS staff have established an excellent working relationship with medical diagnostic service companies and with local vet clinics that provide valuable support services in the form of blood and sample analyses, diagnostic imaging, and supplies of less common drugs. In addition, the medical team works with several specialized veterinarians and technicians, including eye specialists and advanced diagnostic technicians, on special cases.

VAQS' sea turtle rehabilitation experience has been put into action on many occasions, including during response to the BP Deepwater Horizon Oil Spill in the Gulf of Mexico in 2010 and the mass cold-stun events in the northeast since 2014. VAQS staff were deployed over a total period of more than six weeks to assist sea turtle recovery and rehabilitation efforts in Louisiana and Florida from the oil spill, and for more than six weeks in Massachusetts for the 2014-15 event. In 2016, trained staff were deployed to southern California to assist with the ongoing issue of large numbers of stranded, juvenile California

sea lions. In spring of 2019, VAQS staff were requested by The Marine Mammal Center in Sausalito, CA, to assist with a prolonged sea lion mortality event. VAQS staff deployed to CA and provided their expertise for two weeks.

Discussion of 2020 Stranding Data

Marine Mammals

A total of 95 marine mammal strandings were recorded during 2020 (Table 1). In the past ten years, the number of marine mammal strandings has varied from 75 (2012) to 116 (2019), not including the historic year of 2013, when Virginia experienced the highest number of marine mammal strandings in the state's history due to a bottlenose dolphin Unusual Mortality Event (UME) (Figure 1). Temporally, marine mammal strandings occur in all months of the year, but numbers typically drop in late fall and winter. Some marine mammal species (*i.e.* large whales, harbor porpoises, common dolphins and seals) tend to strand seasonally, while others (*i.e.* bottlenose dolphins) can occur at any time of the year (Figure 2) with, but peak in spring and summer. Bottlenose dolphins comprise the majority of the marine mammals that strand each year, but the Virginia stranding database is very diverse and now includes 32 species (Appendix V: Virginia Species Lists). In 2020, bottlenose dolphin strandings were slightly less than average, but due to slightly decreased numbers of overall strandings, they still comprised 74% of total marine mammal strandings (Figure 3). Spatially, marine mammal strandings occur throughout Virginia's ocean and bay waters. Strandings most commonly occur along Virginia's eastern shore, the southern shore of the Chesapeake Bay mouth, and the southern Atlantic coast (Figure 4). Strandings in 2020 followed those patterns, with eastern shore strandings more focused along the southern tip (e.g. Fisherman's Island and Kiptopeke State Park) and northeast coastlines of the eastern shore. Pictures and descriptions of notable marine mammal strandings from 2020 are included in Appendix II: Highlights of the Year – Marine Mammals.

Marine mammals are divided into seven data groups for analyses. These data groups are: (1) bottlenose dolphin – the most common marine mammal in Virginia, (2) harbor porpoise – a common small cetacean that occurs in late winter and spring, (3) common dolphin – a primarily oceanic species, (4) large whales – primarily baleen whales such as humpback, fin, minke, and North Atlantic right whales, (5) other delphinids – primarily oceanic species with low stranding rates such as pilot whales, and pelagic dolphins, (6) other kogiid and ziphiid – pygmy and dwarf sperm whales, and beaked whale species, (7) unknown delphinids – used when decomposition, scavenging or other factors precludes identification, (8) pinnipeds – harbor, harp, hooded, and gray seals, (9) manatees – these animals have previously been rare sightings with limited seasonal presence, however recent

increases in stranding occurrences may indicate range expansion for this species. Live stranded animals are included in these analyses and are also addressed separately below.

Live strandings

In 2020, Virginia had 3 known live marine mammal strandings (Table 2). These strandings occurred at different times of the year and included a bottlenose dolphin, a minke whale, and a neonate short-finned pilot whale. The minke whale stranding occurred February 12, 2020. The animal was reported as alive and stranded in the surf at Naval Station Norfolk, but visual contact with the animal was lost 90 minutes after the report. The animal was presumed to have refloated and left the area, however it was re-sighted later that afternoon deceased in the same location. The incoming tide had likely overtaken the animal and obscured it from view. The following day, the animal was towed to an accessible location for a full necropsy, which grossly revealed multiple types of human interaction as well as substantial infectious processes. The animal had significant healed scars from a previous propeller wound, several mostly healed entanglement lesions, and an ingested plastic bag was found in the stomach. Additionally, it had evidence of severe chronic infection of the cardiovascular and pulmonary systems. The bottlenose dolphin was reported on July 22, 2020 as free-swimming but entangled in green monofilament. The caller provided photographs to document the entanglement which involved at least one line of monofilament wrapping from the left gape over the left eye and crossing over top of the animal and two lines wrapping from the left gape crossing over the blowhole. There was a large bundle of green monofilament and other unidentified material/gear clustered on the right side of the animal. This animal was re-sighted in August by the Outer Banks Marine Mammal Stranding Network in Roanoke Sound with the gear still attached. The neonate pilot whale was reported as alive and stranded in the surf of Chincoteague National Wildlife Refuge on August 31, 2020, but within minutes of calling the park ranger reported that the animal no longer had any signs of life. The animal was collected for necropsy the following day. See Appendix II: Highlights of the Year – Marine Mammals for additional information and necropsy findings.

Bottlenose dolphin

Bottlenose dolphins (*Tursiops truncatus*) are the most common marine mammals sighted in Virginia waters. They are also the most commonly stranded marine mammal in the state. Historically, most bottlenose dolphins have stranded from April to October, which is concurrent with their seasonal appearance in Virginia coastal waters (Barco *et al*. 1999; Figure 2). In recent years, bottlenose dolphin strandings have occurred in all months of the year. In 2020, 70 bottlenose dolphin strandings were recorded in Virginia (Figure 5),

however none occurred in January. This is a slightly lower than the average number of strandings for a single year in Virginia and significantly less than the UME years of 1987 and 2013. The UME that began in 2013 impacted bottlenose dolphins from New York to Florida and continued into April of 2015. Bottlenose dolphin strandings in 2020 occurred primarily along the Atlantic Ocean, lower Chesapeake Bay, and southern half of the eastern shore (Figure 4). Of the 70 bottlenose dolphin strandings in 2020, 31% (n=22) of the strandings occurred in Virginia Beach, 29% (n=20) on the eastern shore, 7% (n=5) in Norfolk, and 33% (n=23) in other parts of the Chesapeake Bay. Gender was determined for 39 of the stranded dolphins. Females comprised 19% (n=13) and males comprised 37% (n=26) of the known gender animals (n=31 could not be determined). Of the 41 stranded dolphins with recorded lengths (includes estimated lengths and observer descriptions), 20% (n=14) were less than 160 cm (known as "young of the year", YOY), the approximate size of a one-year old dolphin (Figure 5; Urian *et al.* 1996). Past examination of YOY has revealed evidence of infanticide in the form of broken bones, hemorrhaging and organ damage (Dunn *et al.* 2002). Of the dolphins that were fresh to moderately decomposed (n=60), signs of human interaction could not be determined in 72% (n=43), were positive in 18% (n=11), and were not observed in 10% (n=6). Of the 11 human interaction animals, seven were positive for fisheries interaction.

Harbor porpoise

Harbor porpoises (*Phocoena phocoena*) were observed only occasionally in Virginia stranding records during the 1980s. Increases in harbor porpoise strandings occurred along the mid-Atlantic coast in 1993-1994, and the increases were most dramatic in Virginia (Cox *et al.* 1998, Swingle *et al.* 1995). In some years, harbor porpoises have been the second most commonly stranded marine mammals in Virginia. Harbor porpoises typically strand in late winter and early spring (Figure 2), and occur along the ocean shorelines (Figure 4). During 1999, 40 harbor porpoise strandings were recorded in Virginia, but in 2000, that number dropped precipitously to only four. Strandings increased again in 2001 with 30 strandings, followed by only six harbor porpoise strandings in 2002. Subsequent years have seen the numbers vary widely, from a high of 22 strandings in 2005, to a low of two strandings in 2011 and 2012. There were five harbor porpoise strandings in Virginia in 2017, and only one in 2018 (Figure 6). In 2019, six harbor porpoise stranded, however there were no identified harbor porpoise strandings in 2020. How these stranding patterns relate to fluctuations in abundance of the population or stocks, threats that are cyclical in nature (such as potential fisheries bycatch), or other factors is constantly under review.

Large whales

Large whales strand in Virginia on an annual basis. With the exception of the sperm whale, large whales are typically baleen whales such as humpback, fin, or minke. Some of the large whales normally found in Virginia are endangered species. Because of the logistics involved in examinations of large whales, an extensive large whale response protocol was created (Blaylock *et al.* 1996). The protocol was developed in response to increased strandings of humpback whales in Virginia and North Carolina in the early 1990s (Swingle *et al.* 1993, Barco *et al.* 2002). The response protocol has since been further modified and is specifically applied to North Atlantic right whales (McLellan *et al.* 2004).

Overall, an average of two large whale strandings occurred in Virginia between 1991 and 2015, and 5.4 large whale strandings have occurred annually in Virginia during the last ten years (Figure 7). The average from 2016-2020 is now 8.4 whales. In 2016, six large whale strandings occurred. In 2017, VAQS responded to eight humpback whales, one fin whale, and two minke whales in Virginia. This number of large whale strandings (n=11) represents the record year for Virginia. As a result of the number of humpback whales stranding in 2016 and 2017 throughout the northeast region, Unusual Mortality Events were declared by the National Oceanic and Atmospheric Administration for multiple large whale species. In 2018, Virginia had eight large whale strandings recorded, including a North Atlantic right whale (*Eubalaena glacialis*) and in 2019, Virginia had nine large whale strandings. In 2020, Virginia had eight large whale strandings that occurred in winter, spring and fall; they consisted of four humpback whales (*Megaptera novaeangliae*) and four minke whales (*Balaenoptera acutorostrata*).

Therefore, large whale strandings in 2020 have continued on their concerning trend and highlight the importance of funding for management of such costly events, as well as the need for a statewide logistics plan for dealing with such events (e.g. towing/landing sites, disposal, etc.). While UME federal funds have helped offset some of the costs associated with these responses, those federal funds are temporary and only cover reimbursement of expenses unrelated to salary. In addition to costly equipment rentals and purchases, large whale strandings require considerable human capital to manage competently and safely. Therefore, the financial and workload burdens of this upward trend in large whale strandings are alarming.

Large whale strandings also occasionally involve live, free-swimming entangled large whales to which VAQS staff also respond. VAQS staff have been qualified to respond to entangled whales by the Center for Coastal Studies in MA. Specialized whale disentanglement gear and supplies are stored at the VAQS Stranding Center for use in the

mid-Atlantic region. This equipment and training has been essential in the successful disentanglement of humpback whales in the waters off Virginia Beach, as well as for smaller cetacean and sea turtle disentanglement efforts. Thankfully, there were no reported live, entangled large whales in 2020.

Other delphinids / Other kogiids & ziphiids

Other delphinid species generally include pelagic delphinids (e.g. pilot whale, spotted dolphin, Risso's dolphin, etc.). Other kogiid and ziphiid species includes all *Kogia* and beaked whale species. These strandings typically occur along the ocean and lower bay shorelines and sometimes involve live animals. In 2020, other delphinids accounted for three animals, two short-finned pilot whales (*Globicephala macrorhynchus*) and one striped dolphin (*Stenella coeruleoalba*). There were no strandings of other kogiids or ziphiids in 2020.

Pinnipeds

Pinniped strandings have generally increased in Virginia since the early 1990s, although 2020 was a slower than average stranding year for pinnipeds. There were two pinniped strandings recorded in Virginia during 2020 (Figure 4 & Figure 8). The pinniped species stranded in Virginia in 2020 included one harbor seal (*Phoca vitulina*) and one unidentified pinniped species. Both of these animals stranded deceased.

Regular sightings of seals in Virginia continue to be common occurrences in winter and early spring and there is current interest in studying the growing winter aggregations of pinnipeds. Improved education and training of stranding network personnel have decreased the unwarranted interference with otherwise healthy seals which have hauled-out to rest on Virginia shorelines, piers, jetties and rock islands. Harbor and gray seals are currently included in the Northeast U.S. Pinniped Unusual Mortality Event declared in 2018. The UME declaration was based in part on significantly elevated harbor and gray seal stranding numbers, as well as coinfections with morbillivirus virus (a form of distemper) and avian influenza virus. Though technically still active, the number of pinnipeds stranding as part of this UME has greatly decreased.

Manatees

Florida manatees (*Trichechus manatus)* have been sighted seasonally, typically mid-summer to early fall, in Virginia waters since the early 1990s. Frequency and volume of reported sightings has increased over the last decade, with an average of 10 reported sightings annually from 2010 through 2020. Seasonality of presence is also broadening, as recent year sightings have occurred as early as March and as late as December. Though

sightings data implies an increased presence in Virginia waters, manatee strandings had been infrequent occurrences. This trend may be changing, however.

In October 2018, Virginia conducted its first stranded manatee necropsy in over 30 years. The necropsy exam revealed that the cause of death for this animal was likely blunt trauma inflicted via impingement by the gate of a canal lock. In early November 2019, a manatee stranded "out of habitat" by persistent presence in the warm water effluent of a power plant in the Elizabeth River. A rescue team from SeaWorld mobilized to attempt to capture and relocate the animal due to concern for its susceptibility to cold stress, but were unsuccessful. The animal was no longer sighted in the area and it is not known what became of it. In December 2019, a manatee was sighted for several consecutive days in Lake Wesley, Virginia Beach and was reported as lethargic and traveling minimal distances. VAQS staff responded to the animal to document it, observe behavior, and monitor for visible cold stress lesions. The animal's respiration rate and activity level were normal and there were no visible signs of cold stress despite the ambient water temperature. Due to inability to capture without out of state resources (special equipment and trained crews), VAQS did not immediately intervene. VAQS contacted USFWS and Florida-based manatee rescue crews to discuss a capture plan, however, while discussing plans, the manatee was never re-sighted. Unfortunately, scar patterns matched this animal to a deceased manatee reported on January 10, 2020. See Appendix II: Highlights of the Year – Marine Mammals for more information on necropsy findings.

These mortalities in conjunction with sightings reports in VA strongly suggest that manatees are expanding their range to include regular seasonal residence in VA. Due to the rapid temperature drops and unfamiliar territory, manatees traveling to VA are likely to experience regular challenges related to cold stress. Additionally, state laws and practices in VA do not incorporate measures to reduce manatee morbidity and mortality. As a threatened species under the Endangered Species Act, increasing and prolonged presence of manatees in Virginia's waterways may lead to significant conflicts between manatees and human activity.

Sea Turtles

During 2020, there were an average number of sea turtle strandings (216) in Virginia (Table 3). Since 2000, Virginia has experienced both extremely high (531 in 2003) and relatively low (173 in 2011) numbers of sea turtle strandings. With an average of 251 annually in the last ten years, Virginia remains an area of high sea turtle mortality as measured by strandings (Figure 9). The VAQS Team handled 205 sea turtle strandings during 2020 and an additional 11 strandings were reported by stranding network cooperators trained by VAQS (Table 3). Cooperators' reports are entered into the state sea turtle stranding database and the responder's affiliation is listed. In some cases, unique numbers

are sometimes provided by responding groups and these numbers are also recorded in the stranding database. This year cooperator reports originated from Chincoteague, Eastern Shore National Wildlife Refuge, The Nature Center, and VDGIF, but previous years also included Back Bay National Wildlife Refuge, Kiptopeke State Park and False Cape State Park.

June was the busiest month of 2020 with 66 strandings (31%), followed by October with 30 (14%), August with 25 (12%), and July with 22 (10%). May, which saw the highest number of strandings last year, saw its lowest number this year since 2013. Despite being mostly within two standard deviations of the 5-year average, sea turtle stranding numbers peaked beyond two standard deviations in early January, mid-June, and early August, and fell below two standard deviations for one week in mid-May. Nonetheless, the overall 2020 stranding season showed a bimodal distribution similar to the historic patterns.

Loggerheads (*Caretta caretta*, n=141) continued to be the most common sea turtle species to strand in Virginia. This was followed by Kemp's ridleys (*Lepidochelys kempii*, n=43), the numbers of which continued to decline after reaching a peak of 101 strandings in 2018. After experiencing an abnormally high year in 2019, green turtle strandings (*Chelonia mydas*, n=22) returned to near baseline numbers in 2020. Additionally, leatherbacks (*Dermochelys coriacea*, n=2), and individuals unidentified to species (n=8) were reported stranded in 2020 (Figure 11). The distribution of strandings was primarily along the southern eastern shore, southern ocean-facing beaches, and lower bay shorelines (Figure 12 & Figure 13). The eastern shore of Virginia was the area where 29% (n=62) of the statewide sea turtle strandings were found. Accomack County accounted for 5% (n=15) and Northampton County for 22% (n=47) of the statewide total. Strandings in Virginia Beach, Norfolk and other southside counties in Hampton Roads contributed to 48% (n=104) of the total. The remaining 23% (n=50) originated from the western shores of the Chesapeake Bay north of the James River. Turtles for which probable causes of stranding could be assessed (n=111), consisted of entanglements (n=23, 21%), watercraft injuries (n=50, 45%), cold-stunning (n=23, 21%) and disease (n=2, 2%). Additionally, 10 turtles (9%) had an unknown cause of stranding.

Improved efforts by VAQS to recruit and train cooperators have greatly enhanced stranding response on the eastern shore. Additionally, VAQS has continued to prioritize the recognition and documentation of human interaction in stranded sea turtles. In some cases, carcasses were fresh enough to conduct thorough necropsies, during which time vessel, dredge, or entanglement lesions can be thoroughly investigated. Necropsies of stranded turtles sometimes reveal internal signs of human interaction in the form of fish lures, hooks, line and plastic debris in the gastrointestinal tract. Fishing equipment can be from recreational or commercial (such as long-line) gear and may have been actively fishing

or “ghost” gear. Further understanding the impacts that recreational and commercial fishing have on turtles is needed. Pictures and descriptions of some of the notable sea turtle strandings in 2020 are included in Appendix III: Highlights of the Year – Sea Turtles.

Live strandings

In 2020, there were fewer live sea turtle strandings than Virginia had seen since 2014, with 34 live sea turtle strandings recorded – 14 Kemp’s ridleys, 13 loggerheads, one green, two leatherbacks, and eight of unidentified species (Table 4). Of these, 22 were successfully recovered for rehabilitation. This includes 13 that were rehabilitated and released by VAQS, and two that are still undergoing rehabilitation at VAQS. The most common cause of strand for rehab patients was incidental entanglement via recreational hook and line (n=12), followed by cold stunning (n=6) and disease (n=2). Seven turtles that were recovered alive either died during early stages of rehabilitation or were euthanized due to the severity of their injuries or debilitation. Eight unrecovered live sea turtles were incidentally hooked by recreational fishers and were subsequently released by the fishers or broke free of the gear before they could be landed. In addition, four sea turtles that stranded in 2019 were released (three by cooperating rehabilitation centers and one by VAQS) after successful rehabilitation. Throughout the year, the VAQS Team spent many hours responding to and performing medical treatments and husbandry tasks for live stranded sea turtles. Some of the sea turtles had stranded in previous years and had been in rehabilitation for many months prior to release.

Despite a record number of hooked turtle reports and admits for each consecutive year between 2014-2018, 2019 and 2020 each brought gradually fewer hooked turtle reports n=20 in 2020) and rehabilitation admits (n=12 in 2020). We were able to successfully implement our immediate release criteria (IRC), initiated in 2017, for several of these animals. This procedure has allowed us to conserve resources and limit rehabilitation time for otherwise healthy hooked turtles. The percentage of hooked turtles that met this criteria were 16% in 2018, 27% in 2019, and 25% in 2020.

VAQS Activities During 2020

VAQS conducted trainings on biology, ecology and stranding response protocols for sea turtles and marine mammals throughout the entire year. These trainings provide important information to Virginia Aquarium outreach instructors, VAQS Team volunteers and to other cooperators in the state stranding network including: Back Bay National Wildlife Refuge; Eastern Shore National Wildlife Refuge; Chincoteague National Wildlife Refuge; Kiptopeke and False Cape State Parks; Virginia Beach police, animal control, beach maintenance personnel and lifeguards; U.S. Coast Guard; Dam Neck and other military base natural resources personnel; personnel from VMRC and VDGIF; The Nature Conservancy and other natural resources groups. Additionally, lectures were presented on the topics of marine mammal and sea turtle necropsies, stranding response, marine mammal anatomy, forensics of watercraft-induced wounds, sea turtle rehabilitation, findings from sea turtle and marine mammal research, large whale status in ocean waters off Virginia, conservation biology, and federal efforts to manage and protect marine mammals. The aforementioned presentations were given to extremely diverse audiences ranging from K-12 groups, to graduate and undergraduate students, church groups, and professional and social groups. VAQS staff attended numerous conferences and workshops and shared knowledge of sea turtle and marine mammal biology, strandings, ecology and life history.

VAQS staff attended and made presentations at conferences and workshops including local, national and international venues on sea turtle biology, marine mammal stranding biology, marine mammal anatomy, sea turtle and marine mammal conservation planning meetings, STEM career development workshops and numerous other meetings. Many of these presentations were via virtual platforms in 2020 as a result of the COVID-19 pandemic. VAQS staff provided either informal or formal (e.g. graduate committee member) guidance to several undergraduate and graduate students in local (e.g. Old Dominion University) and out-of-state (e.g. University of North Carolina Wilmington) universities, and provided federal consultations for sensitive investigations related to human interactions and large whales. VAQS staff continue to participate as stranding network liaisons and investigative team members on four separate federally managed marine mammal unusual mortality events. Finally, a VAQS senior scientist was appointed by the secretaries of Commerce and the Interior as one of 12 members of the federal Working Group for Marine Mammal Unusual Mortality Events (WGMMUME), guiding investigations on a national scale. In addition, this staff member has been acting as the Working Group liaison to the Gulf of Mexico's stranding network dealing with the 2019 Northern Gulf of Mexico Bottlenose Dolphin Unusual Mortality Event. Furthermore, this scientist was also requested by NOAA-NMFS as a working group consultant for the 2019 West Coast Gray Whale Mortality Investigations Review.

Educational programs were presented at many local and regional environmental festivals, to school groups and civic organizations, as well as during special Aquarium events. VAQS outreach volunteers utilized a portable exhibit to present the activities of the Virginia stranding network, and promoted conservation of marine animal species and their habitats. Significantly, the permanent exhibition, *Stranded*, remains one of the most popular exhibits at the Virginia Aquarium. The exhibit tells the story of the Virginia marine mammal and sea turtle stranding networks through expansive graphics, videos and interactive experiences – including a live look at patients in the standing center. The new exhibit experience has already reached more than 2.5 million visitors since it opened in September 2015. A complete list of all professional, education and training activities is included in Appendix I: Professional and Education Activities.

Grant funds were used in conjunction with funds from the Virginia Aquarium Foundation to staff the Aquarium's Stranding Center with a full-time veterinary technician, husbandry and nesting manager, field response and volunteer manager, data and operations manager, stranding response technician, and several part-time stranding assistants. In recognition of the services VAQS provides to the city and state, the City of Virginia Beach's Aquarium budget now includes two VAQS staff, namely the stranding response coordinator who oversees sea turtle and marine mammal stranding response in Virginia, and the staff person responsible for field response and the Team's volunteers. The VAQS Team completed another calendar year using an on-call system developed to ensure that volunteers were available for stranding response seven days per week and 365 days for the entire year. Additional specialty responders continue to be trained to provide support and enhance response to special, predictable stranding events with increased logistical demands, such as live sea turtles caught by recreational anglers at fishing piers. Created and managed by the volunteer manager, the on-call system greatly enhances the Team's readiness and rapid response. VAQS Team volunteers logged more than 4,300 hours during 2020. This number was far less than previous years as a result of the need to limit personal contact during the COVID-19 pandemic.

VAQS continued several research projects that have been ongoing for many years. A 15-year synthesis of aerial survey and research vessel effort summarized seasonal occurrence and species-specific distribution patterns of baleen whales off Virginia's coast. Staff and interns participated in photo-identification and stock-ID research on bottlenose dolphins and humpback whales. Photo-ID catalogs contain sighting records of individuals, some of which are regular visitors to Virginia and have been observed in multiple years. VAQS continues to curate the Mid-Atlantic Humpback Whale Photo-ID Catalog (MAHWC), which contains images and sighting histories from stranded and live whales. VAQS and collaborators are developing a web-based MAHWC to streamline submissions and exchange

of sighting data, from researchers and whale watch operators between New York and Florida. Results of long-term matching efforts between the MAHWC and others from the western North Atlantic continue to provide new data about movement patterns and feeding ground origin of many whales observed in Virginia (Barco *et al.* 2002). The catalog contains images from stranded and live whales observed in coastal waters from New Jersey through North Carolina.

VAQS staff continues to conduct advanced necropsies on fresh-dead sea turtles and marine mammals to investigate causes of mortality and to determine baseline health information for regional populations. Satellite and acoustic tracking of individual sea turtles were also conducted in VA waters. Live seal captures were conducted in collaboration with the US Navy, the National Oceanic and Atmospheric Administration, and other researchers in order to begin to understand the movement and residency patterns of harbor seals on the Eastern Shore of Virginia. Captured seals have also been sampled for diagnostic tests and biomedical research into the health parameters of seals. Diagnostic tests have already provided insights related to the 2018 Northeast Coast Pinniped (harbor and gray seal) Unusual Mortality Event (UME) and showed that some infected individuals from the northeast are overwintering in Virginia. For more information about the UME, please visit NOAA Fisheries website..

Finally, VAQS staff discovered novel pathologies in bottlenose dolphins related to underwater entrapment in local fishing gear (gill nets, pound nets, etc.). First observed in 2016, these pathologies prompted VAQS staff to begin an investigation into their pathogenesis. After collecting data from 2016 to 2019 and presenting findings at multiple conferences and workshops, VAQS staff published a manuscript in a special issue on cetacean pathologies in *Frontiers in Marine Science*. The manuscript, detailing the never-before described pathologies and their association to fisheries interaction, was published July 2, 2020.

Summary

Data collected by VAQS and the Virginia stranding network continue to be critical to the long-term monitoring efforts for sea turtle and marine mammal populations in the mid-Atlantic region. Fresh-stranded cetaceans continue to be extensively sampled as part of cooperative research (involving the University of North Carolina at Wilmington, NOAA fisheries Take Reduction Teams, WGMMUME) to better assess marine mammal health. These studies are crucial to developing a better understanding of the overall health status of marine mammal populations in the wild. Stranding response and data collection from Virginia were crucial to the identification and response to the bottlenose dolphin UME that

began in July 2013 along the east coast. Virginia also experienced the highest number of bottlenose dolphin mortalities (n=382) associated with the UME. Studies associated with the vast amount of data and samples collected from stranded marine mammals will continue to help researchers better understand the impact of these mortalities on coastal bottlenose dolphin stocks. In addition, the unprecedented levels of mortalities have also provided a wealth of potential data for further understanding many aspects of the life history of these iconic regional marine mammals.

Marine mammal strandings, particularly bottlenose dolphins and humpback whales, remain very high, and a significant percentage of the mortalities are related to human activities such as commercial fishing and shipping. Beginning in 2016, VAQS staff noticed previously undescribed internal lesions in bottlenose dolphins. As a result of the dedicated efforts and staff expertise, VAQS identified novel lesions related to entanglement of bottlenose dolphins in fishing gear. These lesions have been combined with other pathologic findings to compose a forensic matrix for increasing confidence in fisheries interaction identification. Historic data from 2016 and 2019 have been analyzed to examine prevalence of such findings in fisheries interaction cases. Results have been presented at national stranding and marine mammal biology conferences in 2017 and 2019 and were published in July 2020 in a peer-reviewed veterinary journal. For these and other reasons, VAQS staff serve as expert members on three federal Take Reduction Teams working to reduce the incidental mortalities of marine mammals in commercial fishing operations. The changes to the rules regulating pound net leaders, supported by VAQS research efforts, are reducing the incidental takes of dolphins and sea turtles in Chesapeake Bay. One staff member is also one of only three federally recognized large whale necropsy team leaders on the Atlantic and Gulf coasts of the U.S and is currently serving as an investigative team member and stranding network liaison for National Marine Fisheries Service on all currently open unusually mortality events (UMEs) (e.g. North Atlantic right whale, minke whale, humpback whale, and seals).

Sea turtle strandings (n=216) in 2020 fell to the lowest numbers seen since 2011. Although there could be an ecological explanation for this, the impacts of the COVID-19 pandemic very likely played a role in how many tourists/residents were out on the beaches and the water reporting strandings. Although the effects of this pandemic will continue to be felt in 2021, monitoring Virginia sea turtle strandings in the future will continue to provide valuable information to help understand the causes of sea turtle mortalities and whether these decreasing numbers represent a significant and predictable trend or only a temporary change. The VAQS Team continues to work closely to monitor and investigate the high rates of sea turtle strandings on Virginia’s eastern shore.

Data collected from strandings provide excellent information on life histories of the many species of marine mammals and sea turtles that inhabit Virginia waters. Stranded animals are the only source of this type of scientific information for many species of marine mammals. The True's beaked whale stranding in 2003, the melon-headed whale strandings in 2008, the Sowerby's beaked whale strandings in 2009, and the pygmy killer whale strandings in 2013 provide excellent examples of the unique opportunities that strandings provide to study rare and previously unknown species from Virginia. Additionally, the January 2018 stranding of a critically endangered North Atlantic right whale resulted in documentation of a fisheries interaction take due to Canadian snow crab fisheries, highlighting the importance of such investigations.

The VAQS Stranding Center has continued to increase its role in the response, rescue and rehabilitation of sea turtles and seals. VAQS is working with the City of Virginia Beach to develop a fully functional 18,000 sq. ft. response and rehabilitation facility; completion is expected in April of 2021. The Darden Marine Animal Conservation Center will be a state of the art facility and will significantly increase rehabilitation, necropsy, and research capabilities to enable VAQS to meet the increasing demands and upward trends in stranding numbers.

Marine mammal and sea turtle strandings in Virginia were once again at high levels during 2020. As a result, managing the Virginia stranding networks for these federally and state protected species continues to be a priority for VAQS and is vitally important for the state and federal agencies who depend on this information. Federal funding from NOAA Fisheries for the marine mammal stranding network through the Prescott Stranding Grant Program is insufficient and always under threat of elimination, especially given current federal budget constraints as a result of the COVID-19 pandemic. Unfortunately, the federal UME contingency fund is dwindling and the multiple current and recurring UMEs are sure to deplete it without significant actions. It is possible that this funding stream will disappear unless Congress and NOAA continue to act to maintain the only federal funding available to the national marine mammal stranding network. This is especially concerning since the significant expenses involving large whale stranding events have largely been offset through reimbursements by this fund. Without this fund, annual large whale stranding events costing many tens of thousands of dollars may fall on state and municipal entities to support. At a time when marine mammal strandings are at record levels, and stranding data are crucial to monitoring ocean health and supporting fishery management and ocean resource-use planning efforts, stranding network organizations like VAQS are trying to operate with the continuing threat of declining or eliminated federal financial support. There remains much work to do and it is hoped that management efforts informed by quality stranding data will begin to reduce the high levels of sea turtle and marine mammal

mortalities related to human activities in Virginia and elsewhere in the region. Continued monitoring and reporting of trends in strandings of protected species will be priorities for the Virginia Aquarium Stranding Response Program in 2021.

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Tables

*Table 1: Marine mammal strandings in Virginia during 2020, n=95. Notes: length measured in centimeters; * indicates estimated length; ND=no data; F=female, M=male, U=unknown sex.*

Field Number	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20201001	1/10/2020	West Indian manatee	Virginia Beach	36.82320	-75.98320	dead	F	273
VAQS20201002	1/28/2020	Humpback whale	Accomack	37.66277	-76.15368	dead	M	950*
VAQS20201003	2/3/2020	Minke whale	Accomack	37.76012	-75.80677	dead	F	548
VAQS20201004	2/4/2020	Humpback whale	Northampton	37.08734	-75.94023	dead	M	1,035
VAQS20201005	2/5/2020	Humpback whale	Northampton	37.38500	-75.61800	dead	U	ND
VAQS20201006	2/7/2020	Bottlenose dolphin	Virginia Beach	36.66240	-75.90610	dead	F	203
VAQS20201007	2/7/2020	Common dolphin (short-beaked)	Virginia Beach	36.86673	-75.97845	dead	F	227
VAQS20201008	2/12/2020	Minke whale	Norfolk	36.95273	-76.27169	live	F	585
VAQS20201009	2/15/2020	Minke whale	Accomack	37.86019	-75.39472	dead	M	492
VAQS20201010	2/18/2020	Unidentified small cetacean	Virginia Beach	36.92904	-76.04391	dead	U	ND
VAQS20201012	3/3/2020	Common dolphin (short-beaked)	Accomack	37.89697	-75.33736	dead	F	200
VAQS20201011	3/3/2020	Bottlenose dolphin	Northampton	37.08335	-75.96009	dead	M	275
VAQS20201013	3/19/2020	Bottlenose dolphin	Northampton	37.47480	-75.94580	dead	M	ND
VAQS20201014	3/31/2020	Unidentified pinniped	Accomack	37.49278	-75.66139	dead	U	ND
VAQS20201015	4/7/2020	Unidentified delphinid	Northampton	37.29741	-75.78662	dead	U	ND
VAQS20201016	4/10/2020	Bottlenose dolphin	Northampton	37.50229	-75.95831	dead	M	206
VAQS20201017	4/10/2020	Bottlenose dolphin	Northampton	37.09024	-75.97881	dead	U	ND
VAQS20201018	4/16/2020	Harbor seal	Accomack	37.69928	-75.57787	dead	U	146*
VAQS20201019	4/20/2020	Bottlenose dolphin	Accomack	37.93466	-75.41879	dead	M	221
VAQS20201020	4/21/2020	Bottlenose dolphin	Accomack	37.88631	-75.34497	dead	M	206
VAQS20201021	4/24/2020	Bottlenose dolphin	Virginia Beach	36.87480	-75.98140	dead	F	112
VAQS20201022	4/25/2020	Bottlenose dolphin	Northampton	37.33008	-76.01396	dead	U	ND
VAQS20201023	4/27/2020	Bottlenose dolphin	Virginia Beach	36.91351	-76.07662	dead	M	103
VAQS20201024	5/1/2020	Bottlenose dolphin	Virginia Beach	36.69810	-75.92540	dead	M	105
VAQS20201025	5/3/2020	Bottlenose dolphin	Virginia Beach	36.82500	-75.96820	dead	F	203
VAQS20201026	5/5/2020	Bottlenose dolphin	Northampton	37.36159	-75.78420	dead	U	ND
VAQS20201027	5/7/2020	Striped dolphin	Northampton	37.09132	-75.94019	dead	M	233
VAQS20201028	5/7/2020	Bottlenose dolphin	Northampton	37.08536	-75.97211	dead	U	124
VAQS20201029	5/7/2020	Bottlenose dolphin	Northampton	37.08603	-75.97620	dead	U	225
VAQS20201030	5/9/2020	Bottlenose dolphin	Northampton	37.11820	-75.96710	dead	U	ND
VAQS20201031	5/10/2020	Bottlenose dolphin	Northampton	37.19260	-76.00370	dead	M	240
VAQS20201032	5/13/2020	Bottlenose dolphin	Virginia Beach	36.91730	-75.99270	dead	M	275
VAQS20201033	5/13/2020	Bottlenose dolphin	Virginia Beach	36.84041	-75.65908	dead	F	117
VAQS20201034	5/18/2020	Bottlenose dolphin	Norfolk	36.93660	-76.21260	dead	M	173
VAQS20201035	5/19/2020	Bottlenose dolphin	Lancaster	37.62916	-76.33117	dead	U	112
VAQS20201037	5/20/2020	Bottlenose dolphin	Norfolk	36.96064	-76.26040	dead	M	107
VAQS20201036	5/21/2020	Bottlenose dolphin	Virginia Beach	36.73936	-75.94095	dead	U	106
VAQS20201044	5/23/2020	Bottlenose dolphin	York	37.21728	-76.46252	dead	F	ND
VAQS20201038	5/23/2020	Unidentified delphinid	Virginia Beach	36.82496	-75.96755	dead	U	ND
VAQS20201039	5/23/2020	Bottlenose dolphin	Northampton	37.32844	-76.01473	dead	U	ND

Field Number	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20201040	5/23/2020	Bottlenose dolphin	Newport News	37.12232	-76.57056	dead	M	ND
VAQS20201041	5/24/2020	Bottlenose dolphin	Virginia Beach	36.70890	-75.92890	dead	U	114*
VAQS20201043	5/25/2020	Bottlenose dolphin	York	37.23217	-76.50042	dead	U	ND
VAQS20201042	5/25/2020	Bottlenose dolphin	Norfolk	36.93533	-76.20564	dead	F	236
VAQS20201045	5/31/2020	Bottlenose dolphin	Gloucester	37.25389	-76.39500	dead	U	ND
VAQS20201046	6/1/2020	Bottlenose dolphin	Hampton	37.03704	-76.29178	dead	F	119
VAQS20201048	6/2/2020	Bottlenose dolphin	Lancaster	37.62014	-76.30506	dead	M	ND
VAQS20201049	6/3/2020	Bottlenose dolphin	Northampton	37.20319	-76.01183	dead	U	ND
VAQS20201047	6/3/2020	Unidentified delphinid	Northampton	37.20695	-76.01213	dead	U	ND
VAQS20201051	6/4/2020	Unidentified delphinid	Northampton	37.37558	-75.71279	dead	U	ND
VAQS20201050	6/5/2020	Bottlenose dolphin	Newport News	37.08271	-76.53292	dead	U	ND
VAQS20201052	6/5/2020	Bottlenose dolphin	Northampton	37.29370	-75.77855	dead	U	ND
VAQS20201055	6/8/2020	Bottlenose dolphin	Northampton	37.32775	-75.75266	dead	M	335*
VAQS20201058	6/8/2020	Unidentified delphinid	Northampton	37.42950	-75.98106	dead	U	ND
VAQS20201053	6/8/2020	Unidentified delphinid	Northampton	37.32143	-75.75905	dead	U	ND
VAQS20201054	6/8/2020	Bottlenose dolphin	Northampton	37.32210	-75.75839	dead	M	ND
VAQS20201056	6/9/2020	Bottlenose dolphin	Virginia Beach	36.92120	-75.99580	dead	F	110
VAQS20201057	6/14/2020	Bottlenose dolphin	Virginia Beach	36.64680	-75.89850	dead	U	160.5*
VAQS20201059	6/16/2020	Bottlenose dolphin	Poquoson	37.15570	-76.38480	dead	M	274
VAQS20201062	6/19/2020	Bottlenose dolphin	Mathews	37.45539	-76.43680	dead	U	ND
VAQS20201060	6/20/2020	Bottlenose dolphin	Hampton	37.00292	-76.30285	dead	F	116
VAQS20201061	6/20/2020	Bottlenose dolphin	Virginia Beach	36.57782	-75.87353	dead	U	ND
VAQS20201063	6/21/2020	Bottlenose dolphin	Norfolk	36.96136	-76.27204	dead	M	242
VAQS20201064	6/23/2020	Bottlenose dolphin	Gloucester	37.36590	-76.46520	dead	U	172*
VAQS20201065	6/24/2020	Bottlenose dolphin	Northampton	37.47950	-75.93330	dead	M	ND
VAQS20201066	6/25/2020	Bottlenose dolphin	Mathews	37.51394	-76.29264	dead	F	121
VAQS20201067	6/26/2020	Bottlenose dolphin	York	37.24040	-76.51084	dead	M	109
VAQS20201068	7/2/2020	Unidentified delphinid	Norfolk	36.95435	-76.24960	dead	U	169*
VAQS20201071	7/4/2020	Bottlenose dolphin	Northumberland	37.83039	-76.25571	dead	U	ND
VAQS20201069	7/14/2020	Bottlenose dolphin	Norfolk	36.94587	-76.33138	dead	M	ND
VAQS20201070	7/16/2020	Bottlenose dolphin	Virginia Beach	36.92270	-75.99807	dead	U	265*
VAQS20201072	7/19/2020	Bottlenose dolphin	Virginia Beach	36.91412	-76.09214	dead	U	ND
VAQS20201073	7/22/2020	Bottlenose dolphin	Virginia Beach	36.84896	-75.97041	live	U	ND
VAQS20201074	8/3/2020	Bottlenose dolphin	Lancaster	37.62677	-76.28575	dead	U	ND
VAQS20201075	8/5/2020	Bottlenose dolphin	Northampton	37.09780	-75.98010	dead	U	ND
VAQS20201076	8/5/2020	Bottlenose dolphin	Hampton	37.02063	-76.29657	dead	U	ND
VAQS20201077	8/9/2020	Bottlenose dolphin	Virginia Beach	36.74639	-75.94194	dead	U	ND
VAQS20201078	8/31/2020	Short-finned pilot whale	Accomack	37.89250	-75.34056	live	F	169
VAQS20201079	9/5/2020	Bottlenose dolphin	Gloucester	37.27330	-76.51110	dead	M	220
VAQS20201082	9/6/2020	Bottlenose dolphin	York	37.20153	-76.37847	dead	U	ND
VAQS20201080	9/6/2020	Bottlenose dolphin	Gloucester	37.26895	-76.36062	dead	M	ND
VAQS20201081	9/7/2020	Bottlenose dolphin	York	37.20792	-76.40466	dead	U	ND
VAQS20201083	9/18/2020	Minke whale	Accomack	37.92207	-75.32063	dead	F	700
VAQS20201084	9/28/2020	Bottlenose dolphin	Virginia Beach	36.90240	-76.04700	dead	M	225
VAQS20201085	10/21/2020	Bottlenose dolphin	Virginia Beach	36.93200	-76.03080	dead	F	249
VAQS20201090	10/24/2020	Short-finned pilot whale	Northampton	37.09031	-75.97908	dead	U	ND
VAQS20201086	10/26/2020	Bottlenose dolphin	Virginia Beach	36.63700	-75.89380	dead	M	264*

Field Number	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20201087	10/26/2020	Bottlenose dolphin	Virginia Beach	36.89612	-75.98621	dead	U	200*
VAQS20201088	10/26/2020	Bottlenose dolphin	Virginia Beach	36.56495	-75.87089	dead	M	289*
VAQS20201089	10/26/2020	Unidentified delphinid	Hampton	37.09506	-76.29830	dead	U	ND
VAQS20201091	11/3/2020	Bottlenose dolphin	Virginia Beach	36.92300	-76.17600	dead	F	209
VAQS20201092	11/15/2020	Bottlenose dolphin	Hampton	37.05663	-76.28317	dead	M	292
VAQS20201093	11/30/2020	Bottlenose dolphin	Gloucester	37.25638	-76.43545	dead	F	223
VAQS20201094	12/11/2020	Humpback whale	Virginia Beach	36.88333	-75.86333	dead	U	ND
VAQS20201095	12/22/2020	Bottlenose dolphin	Accomack	37.93829	-75.31049	dead	U	237*

Table 2: Live stranded marine mammals recorded by VAQS in Virginia in 2019, n=3.

Field Number	Species	Strand Date	State	Final Disposition
VAQS20201008	Minke whale	2/12/2020	VA	Died naturally at site, necropsied.
VAQS20201073	Bottlenose dolphin	7/22/2020	VA	Left swimming, re-sighted following month in North Carolina
VAQS20201078	Short-finned pilot whale	8/31/2020	VA	Died naturally at site, necropsied.

*Table 3: Sea turtle strandings in Virginia during 2020, n=216. Notes: length measured in centimeters, * indicates estimated length; ND=no data; F=female, M=male, U=unknown sex.*

Field	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20202001	1/2/2020	Kemp's ridley	Virginia Beach	36.927733	-76.006265	dead	U	ND
VAQS20202002	1/5/2020	Kemp's ridley	Northampton	37.243526	-76.018151	live	U	21.5
VAQS20202003	1/6/2020	green	Norfolk	36.85746	-76.30686	dead	U	26.7
VAQS20202004	1/10/2020	green	Northampton	37.137923	-75.97238	dead	U	ND
VAQS20202006	1/10/2020	loggerhead	Northampton	37.312778	-76.019444	dead	F	72.7
VAQS20202005	1/11/2020	green	Virginia Beach	36.901903	-76.0281	live	M	26.2
VAQS20202008	1/11/2020	loggerhead	Northampton	37.178981	-75.991555	dead	U	ND
VAQS20202007	1/12/2020	green	Portsmouth	36.8538	-76.3417	dead	U	ND
VAQS20202009	1/14/2020	green	Norfolk	36.931867	-76.1944	dead	U	25.3
VAQS20202010	1/16/2020	green	Virginia Beach	36.863976	-76.00674	dead	M	28.9
VAQS20202011	1/23/2020	loggerhead	Accomack	37.6158	-75.8715	dead	F	54.7
VAQS20202012	3/5/2020	green	Accomack	37.882088	-75.348872	dead	U	ND
VAQS20202013	3/20/2020	loggerhead	Virginia Beach	36.8001	-75.9618	dead	U	ND
VAQS20202014	5/4/2020	unidentified	Virginia Beach	36.949833	-75.307667	dead	U	ND
VAQS20202015	5/15/2020	unidentified	Virginia Beach	36.843781	-75.969811	live	U	ND
VAQS20202016	5/16/2020	Kemp's ridley	Norfolk	36.962534	-76.258827	live	U	ND
VAQS20202017	5/16/2020	loggerhead	Northampton	37.139126	-75.972605	dead	U	ND
VAQS20202018	5/20/2020	loggerhead	Norfolk	36.953316	-76.247919	dead	F	80*

Field	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20202019	5/21/2020	loggerhead	Middlesex	37.571581	-76.342321	dead	U	ND
VAQS20202020	5/24/2020	Kemp's ridley	Virginia Beach	36.843704	-75.970402	live	U	36.1
VAQS20202021	5/25/2020	loggerhead	Virginia Beach	36.8381	-75.9707	dead	F	87*
VAQS20202022	5/26/2020	loggerhead	Norfolk	36.9423	-76.2292	dead	F	62.2
VAQS20202023	5/27/2020	loggerhead	Mathews	37.426243	-76.252393	dead	U	ND
VAQS20202024	5/27/2020	Kemp's ridley	Newport News	36.985011	-76.444151	dead	U	ND
VAQS20202025	5/29/2020	loggerhead	Middlesex	37.534	-76.3292	dead	U	ND
VAQS20202026	5/29/2020	Kemp's ridley	Virginia Beach	36.843743	-75.969975	live	U	30
VAQS20202027	5/29/2020	loggerhead	Middlesex	37.546713	-76.318983	dead	U	ND
VAQS20202028	5/31/2020	unidentified	Hampton	37.001094	-76.3072	live	U	ND
VAQS20202029	5/31/2020	loggerhead	Norfolk	36.988889	-76.159444	dead	U	ND
VAQS20202030	6/1/2020	Kemp's ridley	Norfolk	36.9687	-76.2833	dead	U	49.2
VAQS20202031	6/1/2020	loggerhead	Lancaster	37.614486	-76.281185	dead	U	ND
VAQS20202032	6/1/2020	loggerhead	Portsmouth	36.884664	-76.353092	dead	M	71.5*
VAQS20202033	6/2/2020	loggerhead	Lancaster	37.649411	-76.3358	dead	U	ND
VAQS20202034	6/2/2020	loggerhead	Virginia Beach	36.9206	-76.0644	live	U	57.2
VAQS20202035	6/2/2020	Kemp's ridley	Virginia Beach	36.9206	-76.0644	live	U	24.1
VAQS20202048	6/2/2020	loggerhead	Northampton	37.12448	-75.91678	dead	U	ND
VAQS20202036	6/4/2020	loggerhead	Northampton	37.344725	-76.002265	dead	U	ND
VAQS20202038	6/4/2020	loggerhead	Virginia Beach	36.951433	-75.3691	dead	U	ND
VAQS20202039	6/4/2020	loggerhead	Northampton	37.328783	-76.014767	dead	U	ND
VAQS20202037	6/5/2020	loggerhead	Northampton	37.225342	-76.00977	dead	U	ND
VAQS20202050	6/5/2020	loggerhead	Newport News	36.980532	-76.442571	dead	U	ND
VAQS20202040	6/6/2020	loggerhead	Virginia Beach	36.917	-76.0602	dead	M	84.8
VAQS20202044	6/6/2020	loggerhead	Northampton	37.11211	-75.922121	dead	U	ND
VAQS20202045	6/6/2020	Kemp's ridley	Northampton	37.137047	-75.932133	dead	U	ND
VAQS20202041	6/7/2020	loggerhead	Virginia Beach	36.843636	-75.970597	live	U	ND
VAQS20202042	6/7/2020	loggerhead	Northampton	37.50945	-75.98355	dead	U	ND
VAQS20202043	6/7/2020	Kemp's ridley	Suffolk	36.8932	-76.4727	live	U	ND
VAQS20202046	6/7/2020	loggerhead	Virginia Beach	36.80639	-75.80833	dead	U	ND
VAQS20202047	6/8/2020	Kemp's ridley	Hampton	37.00056	-76.306959	live	U	24.8
VAQS20202049	6/8/2020	loggerhead	Virginia Beach	36.996733	-76.039183	dead	U	ND
VAQS20202052	6/8/2020	loggerhead	Hampton	37.000912	-76.308126	dead	U	ND
VAQS20202051	6/9/2020	Kemp's ridley	Virginia Beach	36.878	-75.981	dead	M	46.8

Field	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20202056	6/10/2020	loggerhead	Northampton	37.13758	-75.877971	dead	U	ND
VAQS20202053	6/12/2020	loggerhead	Northampton	37.216042	-75.806422	dead	U	ND
VAQS20202054	6/12/2020	loggerhead	Northampton	37.365838	-75.768873	dead	U	ND
VAQS20202055	6/12/2020	loggerhead	Northumberland	37.839349	-76.24965	dead	U	ND
VAQS20202057	6/13/2020	Kemp's ridley	Norfolk	36.962505	-76.258861	live	U	41.6
VAQS20202058	6/13/2020	loggerhead	Gloucester	37.264375	-76.391354	dead	U	ND
VAQS20202059	6/13/2020	loggerhead	Northampton	37.42264	-75.98289	dead	U	ND
VAQS20202060	6/15/2020	Kemp's ridley	Accomack	37.819043	-75.501717	dead	U	ND
VAQS20202061	6/15/2020	Kemp's ridley	Hampton	37.00056	-76.307224	live	U	25.5
VAQS20202062	6/15/2020	loggerhead	Virginia Beach	36.652222	-75.90111	dead	U	88.6
VAQS20202063	6/15/2020	loggerhead	Mathews	37.507628	-76.281678	dead	U	ND
VAQS20202064	6/15/2020	loggerhead	Gloucester	37.253737	-76.450891	dead	U	ND
VAQS20202065	6/16/2020	loggerhead	Middlesex	37.573775	-76.358527	dead	U	ND
VAQS20202067	6/17/2020	loggerhead	York	37.215975	-76.467144	dead	U	ND
VAQS20202066	6/18/2020	loggerhead	Lancaster	37.629104	-76.331003	live	U	60.6
VAQS20202068	6/18/2020	Kemp's ridley	Mathews	37.426089	-76.252469	dead	U	ND
VAQS20202069	6/18/2020	loggerhead	Northampton	37.09159	-75.97998	dead	U	ND
VAQS20202070	6/19/2020	loggerhead	Northampton	37.372578	-75.991769	dead	U	ND
VAQS20202071	6/19/2020	Kemp's ridley	Virginia Beach	36.843733	-75.969923	live	U	29.6
VAQS20202082	6/19/2020	green	Northampton	37.191246	-75.82263	dead	U	ND
VAQS20202072	6/20/2020	loggerhead	Northumberland	37.853225	-76.248631	dead	U	ND
VAQS20202073	6/20/2020	leatherback	Virginia Beach	36.82505	-75.781058	live	U	ND
VAQS20202074	6/21/2020	loggerhead	Virginia Beach	36.800133	-75.9619	dead	U	43.5
VAQS20202075	6/21/2020	loggerhead	Virginia Beach	36.831564	-75.975194	dead	F	78.6
VAQS20202076	6/21/2020	loggerhead	Accomack	37.59925	-75.61724	dead	U	ND
VAQS20202077	6/21/2020	loggerhead	Mathews	37.3139	-76.2878	dead	U	ND
VAQS20202078	6/21/2020	loggerhead	Northumberland	37.733	-76.307	dead	U	ND
VAQS20202079	6/21/2020	loggerhead	Lancaster	37.623903	-76.342893	dead	U	ND
VAQS20202080	6/22/2020	loggerhead	Accomack	37.891111	-75.33056	dead	U	ND
VAQS20202081	6/23/2020	loggerhead	Lancaster	37.606843	-76.28477	dead	F	63.4
VAQS20202083	6/24/2020	loggerhead	Northampton	37.286377	-76.015442	dead	U	ND
VAQS20202084	6/25/2020	green	Virginia Beach	36.7654	-75.950433	dead	U	ND
VAQS20202085	6/25/2020	loggerhead	Northumberland	37.813553	-76.2742	dead	U	ND
VAQS20202089	6/25/2020	loggerhead	Virginia Beach	36.810933	-75.926133	dead	U	ND

Field	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20202086	6/26/2020	loggerhead	Northampton	37.379527	-75.985767	dead	U	ND
VAQS20202087	6/26/2020	unidentified	Northampton	37.271585	-76.022349	dead	U	ND
VAQS20202088	6/26/2020	green	Poquoson	37.109666	-76.32211	dead	M	28.8
VAQS20202090	6/26/2020	loggerhead	Newport News	37.010222	-76.460185	live	U	51*
VAQS20202091	6/26/2020	loggerhead	Virginia Beach	37.067633	-76.044183	dead	U	ND
VAQS20202093	6/26/2020	unidentified	Norfolk	36.962578	-76.258947	live	U	ND
VAQS20202092	6/27/2020	loggerhead	York	37.220212	-76.465618	live	U	ND
VAQS20202094	6/29/2020	Kemp's ridley	Virginia Beach	36.9108	-76.1025	dead	U	28.5*
VAQS20202095	6/30/2020	loggerhead	Northampton	37.362744	-75.991309	dead	U	ND
VAQS20202096	7/13/2020	loggerhead	Northampton	37.09906	-75.9411	dead	U	114*
VAQS20202097	7/2/2020	loggerhead	Northampton	37.291087	-76.015059	dead	U	ND
VAQS20202098	7/3/2020	loggerhead	Virginia Beach	36.694178	-75.922557	live	U	53.9
VAQS20202100	7/3/2020	loggerhead	Northampton	37.333165	-76.012185	dead	U	ND
VAQS20202099	7/4/2020	Kemp's ridley	Norfolk	36.9627	-76.258648	live	U	25.1
VAQS20202101	7/5/2020	loggerhead	Virginia Beach	36.934117	-76.084083	dead	U	ND
VAQS20202102	7/6/2020	Kemp's ridley	Hampton	37.06228	-76.28119	dead	U	51.5*
VAQS20202103	7/6/2020	loggerhead	Accomack	37.944167	-75.363611	dead	U	ND
VAQS20202104	7/8/2020	loggerhead	Hampton	37.073333	-76.278333	dead	U	ND
VAQS20202105	7/8/2020	loggerhead	Accomack	37.852347	-75.394128	dead	U	ND
VAQS20202106	7/8/2020	loggerhead	Virginia Beach	36.928335	-76.007132	dead	U	ND
VAQS20202107	7/8/2020	Kemp's ridley	Virginia Beach	36.843802	-75.969847	live	U	29.1
VAQS20202108	7/13/2020	loggerhead	Norfolk	36.9519	-76.2457	dead	M	94.8*
VAQS20202109	7/10/2020	Kemp's ridley	Mathews	37.44121	-76.25529	dead	F	55.3
VAQS20202110	7/10/2020	loggerhead	Northumberland	38.005624	-76.470432	dead	U	ND
VAQS20202111	7/17/2020	loggerhead	Virginia Beach	36.818597	-75.966721	dead	U	ND
VAQS20202112	7/19/2020	loggerhead	Norfolk	36.906821	-76.308382	dead	U	71*
VAQS20202113	7/22/2020	loggerhead	Virginia Beach	36.917563	-76.057385	dead	M	101.8
VAQS20202114	7/27/2020	green	Northampton	37.1647	-75.9839	dead	U	ND
VAQS20202115	7/27/2020	unidentified	Newport News	36.967607	-76.409086	live	U	ND
VAQS20202116	7/27/2020	loggerhead	Virginia Beach	36.934967	-76.011617	dead	U	ND
VAQS20202117	7/28/2020	loggerhead	Northampton	37.157884	-75.977739	dead	U	ND
VAQS20202118	8/1/2020	loggerhead	Virginia Beach	37.0458	-76.0624	live	F	72.1
VAQS20202119	8/4/2020	loggerhead	Virginia Beach	36.837534	-75.970636	dead	U	91*
VAQS20202120	8/9/2020	Kemp's ridley	Virginia Beach	36.843728	-75.9699	live	U	27

Field	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20202121	8/10/2020	loggerhead	Accomack	37.864274	-75.364313	dead	U	ND
VAQS20202135	8/10/2020	unidentified	Newport News	36.974796	-76.402657	dead	U	ND
VAQS20202122	8/11/2020	loggerhead	Hampton	37.0855	-76.2723	dead	F	103
VAQS20202123	8/13/2020	loggerhead	Northampton	37.227694	-75.800165	dead	U	ND
VAQS20202124	8/13/2020	loggerhead	Virginia Beach	36.8234	-75.968	dead	U	91.3
VAQS20202125	8/13/2020	Kemp's ridley	Hampton	37.01846	-76.29659	dead	U	43*
VAQS20202126	8/14/2020	loggerhead	Virginia Beach	36.826744	-75.967756	dead	F	66.7*
VAQS20202127	8/14/2020	loggerhead	Virginia Beach	36.843673	-75.970497	live	U	ND
VAQS20202128	8/15/2020	loggerhead	Virginia Beach	36.561338	-75.870297	dead	F	91*
VAQS20202129	8/17/2020	loggerhead	Virginia Beach	36.845	-75.97111	dead	U	75.5*
VAQS20202130	8/18/2020	loggerhead	Northampton	37.251667	-76.031733	dead	U	76*
VAQS20202131	8/19/2020	loggerhead	Virginia Beach	36.5919	-75.877	dead	U	60*
VAQS20202132	8/19/2020	loggerhead	Accomack	37.673457	-75.591827	dead	U	ND
VAQS20202133	8/20/2020	Kemp's ridley	Virginia Beach	36.917459	-75.992983	dead	U	ND
VAQS20202134	8/20/2020	unidentified	Newport News	36.974714	-76.402943	dead	U	ND
VAQS20202136	8/20/2020	loggerhead	Norfolk	36.9323	-76.1955	dead	M	60*
VAQS20202137	8/21/2020	loggerhead	Virginia Beach	36.692661	-75.922045	dead	U	ND
VAQS20202138	8/22/2020	loggerhead	Virginia Beach	36.713758	-75.930431	dead	M	97
VAQS20202139	8/23/2020	loggerhead	Hampton	37.0203	-76.3084	dead	F	62.5
VAQS20202140	8/25/2020	loggerhead	Northampton	37.158333	-75.978056	dead	F	64.8*
VAQS20202141	8/26/2020	loggerhead	Northampton	37.1575	-75.9775	dead	M	63.5*
VAQS20202142	8/30/2020	loggerhead	Virginia Beach	36.70454	-75.926346	dead	U	ND
VAQS20202143	9/3/2020	loggerhead	Accomack	37.770537	-75.538684	dead	U	ND
VAQS20202144	9/4/2020	loggerhead	Northampton	37.11307	-75.968473	dead	M	ND
VAQS20202145	9/5/2020	loggerhead	Virginia Beach	36.829613	-75.969155	dead	U	63*
VAQS20202146	9/12/2020	loggerhead	Norfolk	36.9537	-76.2481	dead	U	96.5
VAQS20202147	9/13/2020	loggerhead	Virginia Beach	36.664983	-75.907883	dead	F	87.5
VAQS20202148	9/18/2020	loggerhead	Hampton	37.08226	-76.274469	dead	U	ND
VAQS20202149	9/20/2020	loggerhead	Virginia Beach	36.89667	-75.98631	dead	F	72*
VAQS20202150	9/20/2020	green	Northampton	37.172651	-75.987853	dead	U	ND
VAQS20202151	9/21/2020	leatherback	Norfolk	36.9306	-76.1874	live	F	138
VAQS20202152	9/22/2020	loggerhead	Norfolk	36.96666	-76.27158	dead	F	62.7
VAQS20202153	9/22/2020	Kemp's ridley	Isle of Wight	36.9927	-76.54519	dead	U	40.5
VAQS20202154	9/25/2020	green	Northampton	37.20239	-76.011361	dead	U	30.1

Field	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20202155	9/26/2020	Kemp's ridley	Newport News	36.962397	-76.411375	dead	U	ND
VAQS20202156	9/27/2020	loggerhead	Virginia Beach	36.930436	-76.045725	dead	U	ND
VAQS20202157	9/27/2020	Kemp's ridley	Virginia Beach	36.754137	-75.94627	dead	U	52.1
VAQS20202158	9/27/2020	loggerhead	Virginia Beach	36.98425	-75.2182	live	U	ND
VAQS20202159	10/1/2020	green	Northampton	37.15795	-75.977917	dead	U	ND
VAQS20202160	10/3/2020	Kemp's ridley	Norfolk	36.952041	-76.246097	dead	F	60*
VAQS20202161	10/3/2020	loggerhead	Virginia Beach	36.92074	-75.99509	dead	U	79.6*
VAQS20202162	10/3/2020	Kemp's ridley	Norfolk	36.94231	-76.22956	dead	M	53.1
VAQS20202163	10/4/2020	Kemp's ridley	Norfolk	36.93011	-76.18487	dead	F	37.5
VAQS20202164	10/5/2020	loggerhead	Norfolk	36.9353	-76.2082	dead	M	69.2*
VAQS20202165	10/5/2020	loggerhead	Northumberland	37.935433	-76.318602	dead	U	ND
VAQS20202166	10/7/2020	loggerhead	Hampton	37.01483	-76.34131	dead	M	55.8
VAQS20202167	10/8/2020	loggerhead	Northampton	37.167933	-75.987679	dead	U	ND
VAQS20202168	10/9/2020	loggerhead	Hampton	36.981583	-76.297667	dead	U	ND
VAQS20202169	10/9/2020	loggerhead	Virginia Beach	36.656484	-75.903192	dead	U	ND
VAQS20202170	10/11/2020	loggerhead	Newport News	37.0555	-76.5147	dead	M	44.2
VAQS20162027	10/13/2020	Kemp's ridley	Virginia Beach	36.927266	-76.046387	dead	U	60*
VAQS20202172	10/13/2020	loggerhead	Virginia Beach	36.927271	-76.046619	dead	U	ND
VAQS20202173	10/14/2020	loggerhead	Norfolk	36.9298	-76.1819	dead	U	78*
VAQS20202174	10/14/2020	loggerhead	Virginia Beach	36.908805	-76.096734	dead	U	74*
VAQS20202175	10/14/2020	loggerhead	Virginia Beach	36.909216	-76.097898	dead	U	65*
VAQS20202176	10/14/2020	loggerhead	Norfolk	36.9689	-76.2909	dead	U	77.5
VAQS20202171	10/15/2020	loggerhead	Newport News	36.968376	-76.40922	dead	U	ND
VAQS20202177	10/18/2020	loggerhead	Virginia Beach	36.767628	-75.951506	live	U	69.6
VAQS20202178	10/19/2020	loggerhead	Northampton	37.139483	-75.972701	dead	U	ND
VAQS20202179	10/20/2020	Kemp's ridley	Virginia Beach	36.556869	-75.868963	dead	U	ND
VAQS20202180	10/25/2020	Kemp's ridley	Virginia Beach	36.757885	-75.94721	dead	F	40
VAQS20202181	10/25/2020	loggerhead	Virginia Beach	36.86346	-75.9772	dead	U	74.3*
VAQS20202182	10/25/2020	loggerhead	Virginia Beach	36.926807	-76.00454	dead	M	61*
VAQS20202183	10/26/2020	green	Virginia Beach	36.91325	-76.1115	dead	F	30.4
VAQS20202184	10/26/2020	Kemp's ridley	Norfolk	36.95391	-76.24836	dead	U	47*
VAQS20202185	10/26/2020	Kemp's ridley	Norfolk	36.93645	-76.21237	dead	M	35.2
VAQS20202186	10/27/2020	loggerhead	Northumberland	37.71075	-76.219417	dead	F	ND
VAQS20202187	10/28/2020	green	Suffolk	36.86725	-76.503528	dead	U	ND

Field	Date	Species	City/County	Latitude	Longitude	Condition	Sex	Length
VAQS20202188	11/1/2020	loggerhead	Mathews	37.328065	-76.30527	dead	U	ND
VAQS20202189	11/1/2020	Kemp's ridley	Virginia Beach	36.932228	-76.026716	dead	U	ND
VAQS20202190	11/3/2020	loggerhead	Northampton	37.167321	-75.987986	dead	U	ND
VAQS20202191	11/6/2020	Kemp's ridley	Norfolk	36.93554	-76.20983	dead	F	27.9
VAQS20202192	11/7/2020	loggerhead	York	37.208833	-76.278167	dead	U	ND
VAQS20202193	11/8/2020	Kemp's ridley	Virginia Beach	36.8778	-75.9815	dead	F	26.3
VAQS20202194	11/8/2020	Kemp's ridley	Virginia Beach	36.799633	-75.961867	dead	M	27.8
VAQS20202195	11/10/2020	Kemp's ridley	Virginia Beach	36.66992	-75.91083	dead	M	29.7
VAQS20202196	11/13/2020	loggerhead	Norfolk	36.94438	-76.23331	dead	F	65.1
VAQS20202197	11/13/2020	loggerhead	Virginia Beach	36.81935	-75.96713	dead	F	57*
VAQS20202198	11/15/2020	Kemp's ridley	Norfolk	36.95534	-76.25105	dead	F	25.4
VAQS20202199	11/19/2020	loggerhead	Northampton	37.501582	-75.957953	live	U	57.6
VAQS20202200	11/21/2020	loggerhead	Northampton	37.346321	-76.000776	dead	U	ND
VAQS20202202	11/22/2020	loggerhead	Hampton	37.104786	-76.288363	dead	U	ND
VAQS20202201	11/24/2020	loggerhead	Northampton	37.171301	-75.840267	dead	U	ND
VAQS20202203	11/26/2020	loggerhead	Northampton	37.325482	-76.016296	dead	U	ND
VAQS20202204	11/28/2020	Kemp's ridley	Accomack	37.639522	-75.620247	live	F	31
VAQS20202205	11/28/2020	loggerhead	Northampton	37.344373	-76.002139	dead	F	72.8
VAQS20202206	12/2/2020	loggerhead	Northampton	37.4194	-75.98392	live	M	74.6
VAQS20202207	12/3/2020	loggerhead	Northampton	37.4842	-75.9621	live	M	81.5
VAQS20202208	12/8/2020	green	Accomack	37.933618	-75.352417	dead	M	28.9
VAQS20202209	12/10/2020	green	Accomack	37.875712	-75.354325	dead	U	30.6
VAQS20202210	12/12/2020	green	Virginia Beach	36.914875	-76.065941	dead	F	30.6
VAQS20202211	12/12/2020	green	Accomack	37.8675	-75.36804	dead	U	33.02
VAQS20202212	12/12/2020	green	Accomack	37.8675	-75.363804	dead	U	35.31
VAQS20202213	12/18/2020	green	Virginia Beach	36.91657	-76.122976	dead	M	30
VAQS20202214	12/26/2020	loggerhead	Virginia Beach	36.7211	-75.93312	dead	M	68
VAQS20202215	12/29/2020	loggerhead	Northampton	37.366756	-75.988748	dead	F	64.9

Table 4: Live stranded sea turtles recorded by VAQS in 2020, n=34. Notes: Sea turtles that stranded in 2019 with a disposition in 2020 are also listed, n=5. Organizations in disposition column: NA = National Aquarium; USCG = United States Coast Guard.

Field Number	Strand Date	Species	State	Disposition	Release Location	Disposition Date
VAQS20192043	5/22/2019	Kemp's ridley	VA	transferred to aquarium		06/09/20
VAQS20192111	7/4/2019	loggerhead	VA	released by VAQS	Sandbridge, VB, VA	10/26/2020
VAQS20192228	11/9/2019	green	VA	released by NA	New Smyrna Beach, FL	02/05/2020
VAQS20192254	12/18/2019	Kemp's ridley	VA	released by USCG	Offshore VA	05/29/2020
VAQS20192256	12/19/2019	green	VA	released by USCG	Offshore VA	05/29/2020
VAQS20202002	1/5/2020	Kemp's ridley	VA	died, necropsied		01/06/2020
VAQS20202005	1/11/2020	green	VA	died, necropsied		01/12/2020
VAQS20202015	5/15/2020	unidentified	VA	released by fisher		
VAQS20202016	5/16/2020	Kemp's ridley	VA	released by fisher		
VAQS20202020	5/24/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	05/26/2020
VAQS20202026	5/29/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	06/05/2020
VAQS20202028	5/31/2020	unidentified	VA	released by fisher		
VAQS20202035	6/2/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	06/04/2020
VAQS20202034	6/2/2020	loggerhead	VA	released by VAQS	57th St, VB Oceanfront	06/03/2020
VAQS20202043	6/7/2020	Kemp's ridley	VA	not recovered		
VAQS20202041	6/7/2020	loggerhead	VA	released by fisher		
VAQS20202047	6/8/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	10/01/2020
VAQS20202057	6/13/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	10/14/2020
VAQS20202061	6/15/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	06/17/2020
VAQS20202066	6/18/2020	loggerhead	VA	died, necropsied		06/18/2020
VAQS20202071	6/19/2020	Kemp's ridley	VA	released by VAQS	47 St, VB Oceanfront	10/12/2020
VAQS20202073	6/20/2020	leatherback	VA	not recovered		
VAQS20202093	6/26/2020	unidentified	VA	released by fisher		
VAQS20202090	6/26/2020	loggerhead	VA	released by VAQS	47th St, VB Oceanfront	10/12/2020

Field Number	Strand Date	Species	State	Disposition	Release Location	Disposition Date
VAQS20202092	6/27/2020	loggerhead	VA	released by fisher		
VAQS20202098	7/3/2020	loggerhead	VA	released by VAQS	47th St, VB Oceanfront	07/28/2020
VAQS20202099	7/4/2020	Kemp's ridley	VA	released by VAQS	Croatan Beach, VB, VA	07/05/2020
VAQS20202107	7/8/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	07/10/2020
VAQS20202115	7/27/2020	unidentified	VA	released by fisher		
VAQS20202118	8/1/2020	loggerhead	VA	died, necropsied		08/15/2020
VAQS20202120	8/9/2020	Kemp's ridley	VA	released by VAQS	47th St, VB Oceanfront	09/22/2020
VAQS20202127	8/14/2020	loggerhead	VA	released by fisher		
VAQS20202151	9/21/2020	leatherback	VA	euthanized, necropsied		
VAQS20202158	9/27/2020	loggerhead	VA	not recovered		
VAQS20202177	10/18/2020	loggerhead	VA	current patient		
VAQS20202199	11/19/2020	loggerhead	VA	current patient		
VAQS20202204	11/28/2020	Kemp's ridley	VA	died, necropsied		12/11/2020
VAQS20202206	12/2/2020	loggerhead	VA	died, necropsied		12/05/2020
VAQS20202207	12/3/2020	loggerhead	VA	died, necropsied		12/05/2020

Figures

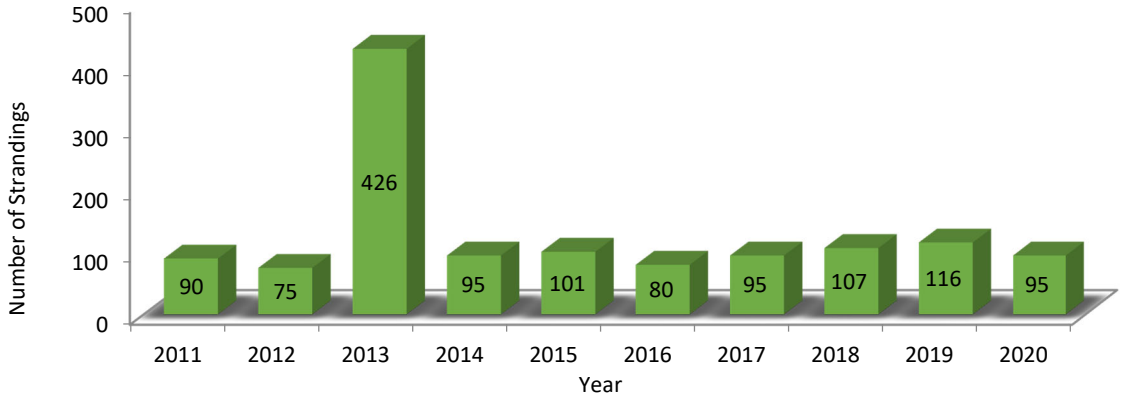


Figure 1- Yearly frequency of marine mammal strandings in Virginia, 2011-2020.

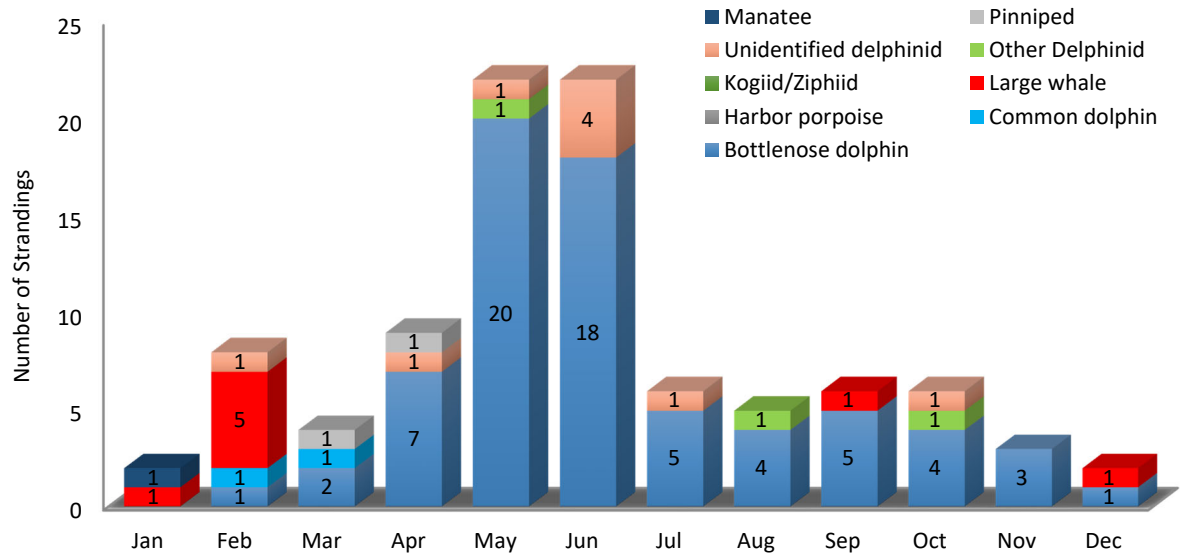


Figure 2- Monthly frequency of marine mammal strandings by species group in Virginia during 2020.

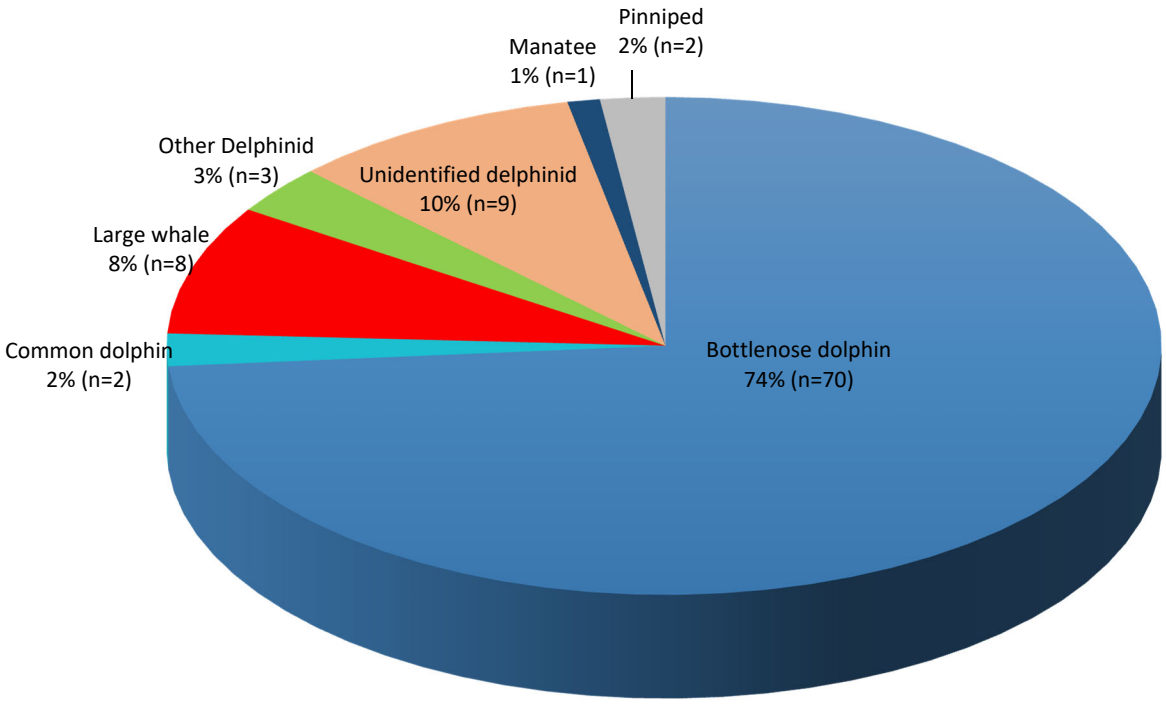


Figure 3- Marine mammal stranding groups in Virginia during 2020.

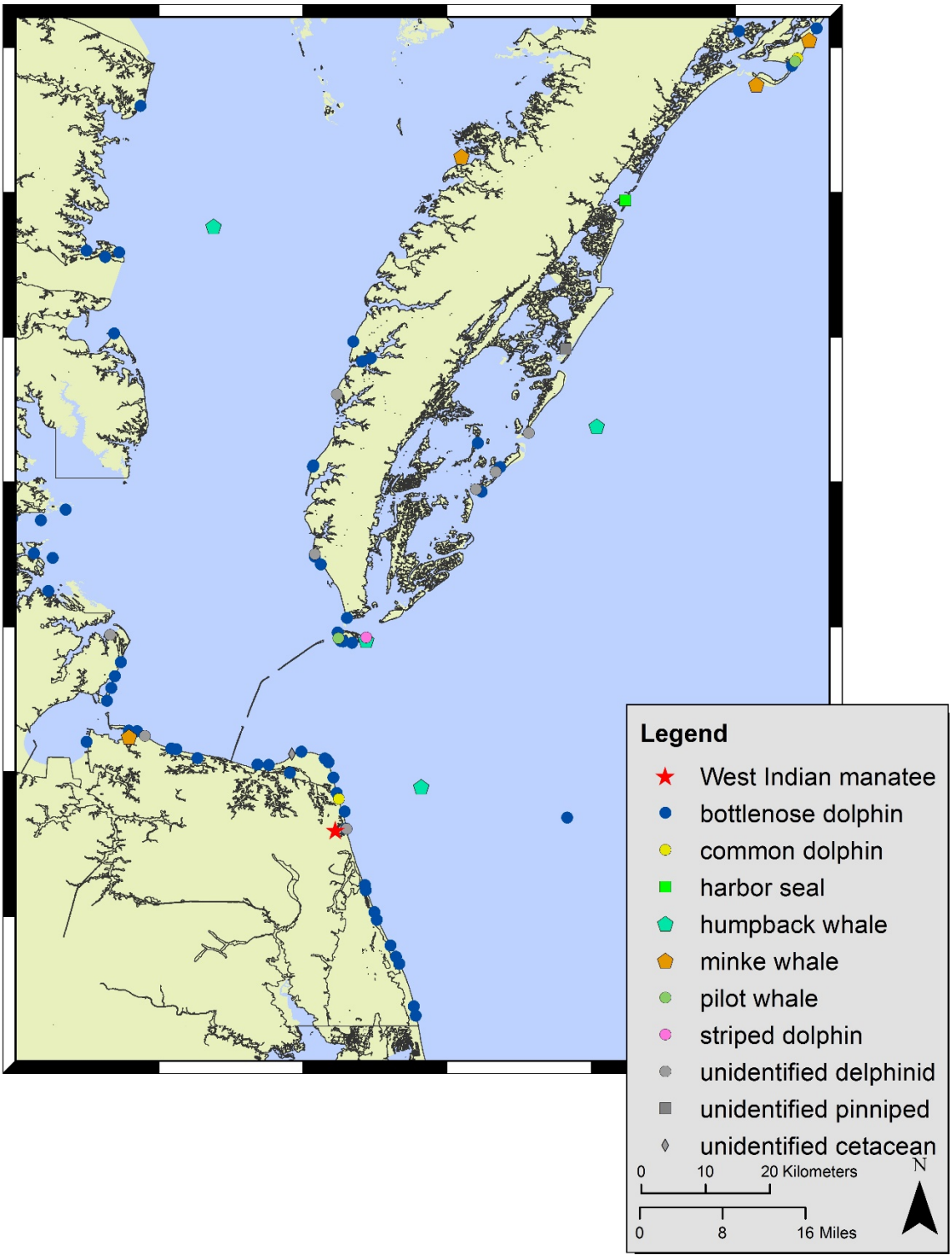


Figure 4- Locations of Virginia marine mammal strandings in 2020.

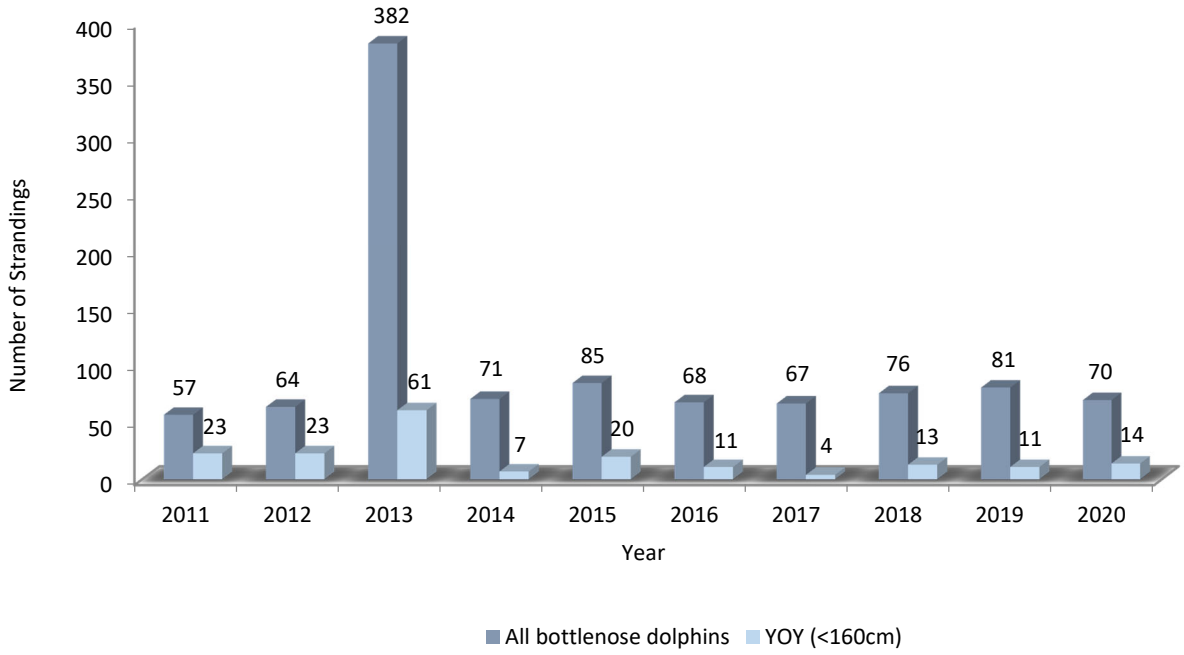


Figure 5- Yearly stranding frequency of bottlenose dolphin in Virginia, 2011-2020 (YOY = young of the year).

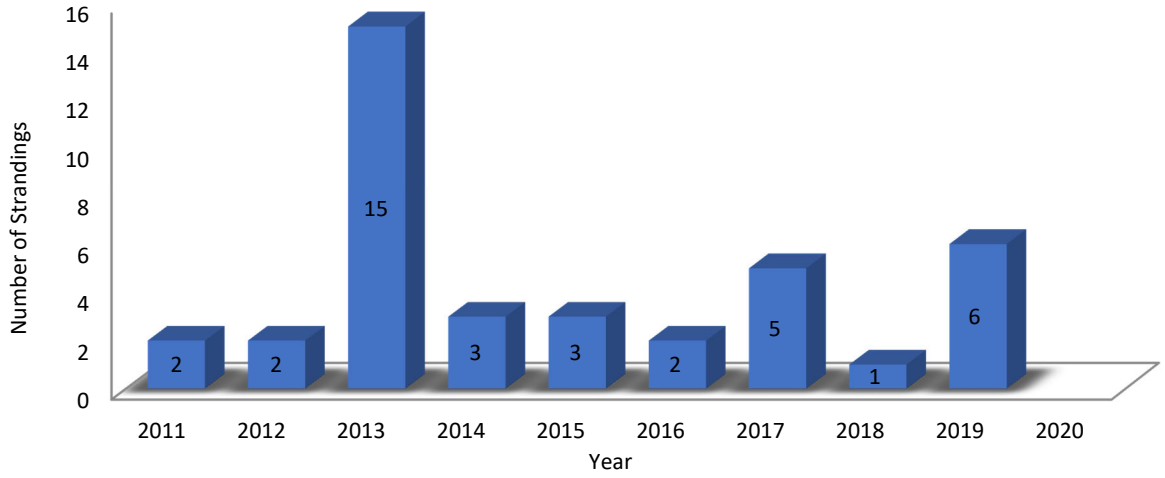


Figure 6- Yearly stranding frequency of harbor porpoise in Virginia, 2011-2020.

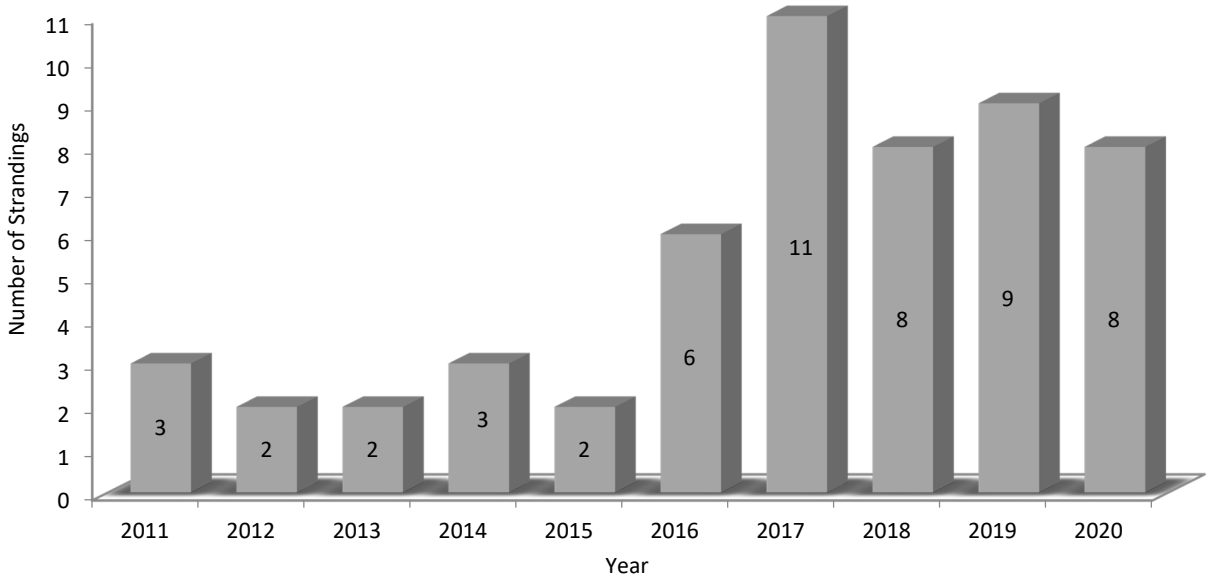


Figure 7- Yearly stranding frequency of large whales in Virginia, 2011-2020.

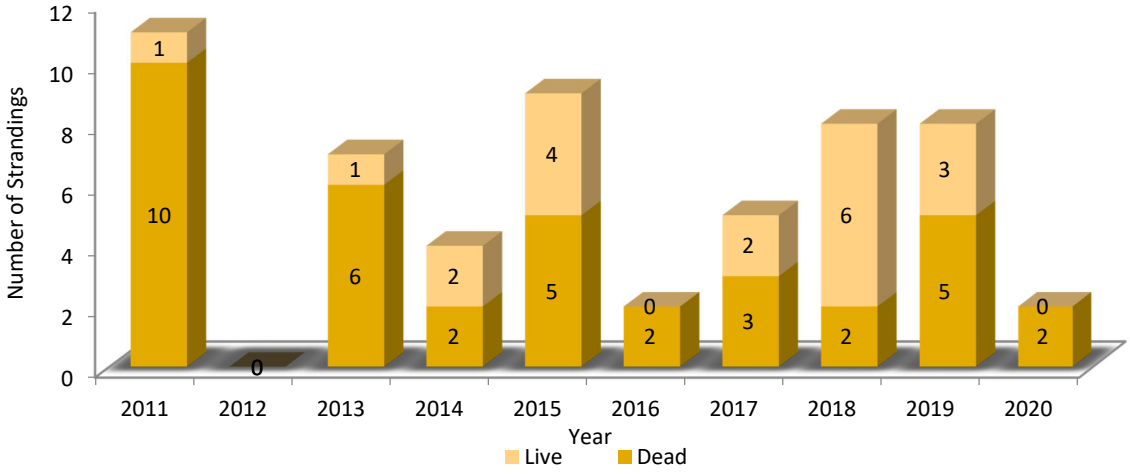


Figure 8- Yearly stranding frequency of pinnipeds in Virginia, 2011-2020.

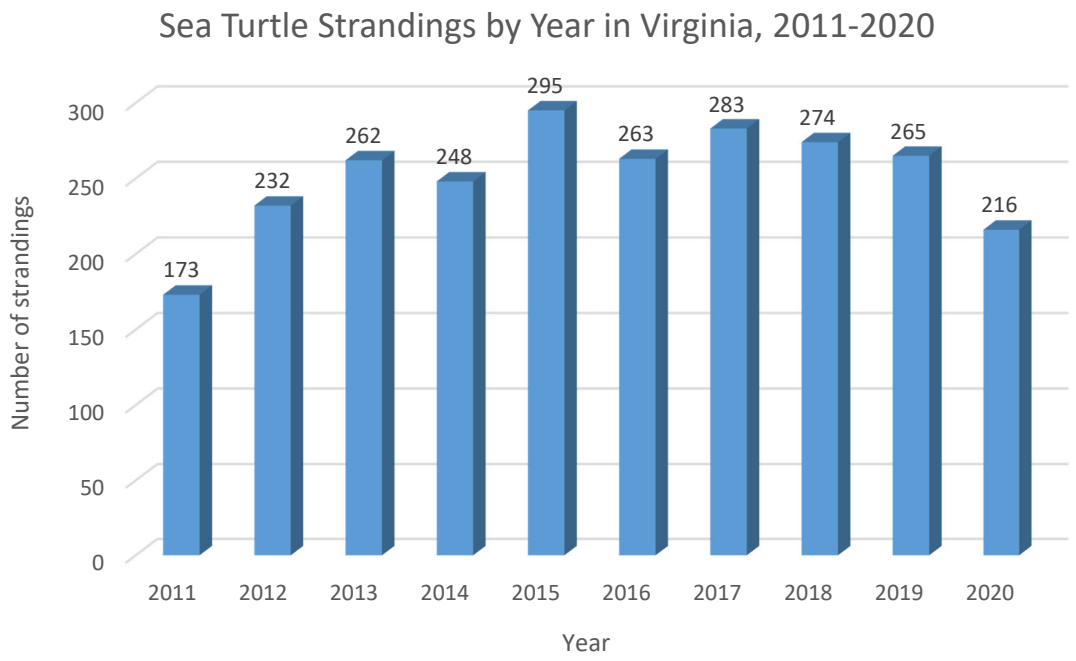


Figure 9- Yearly frequency of sea turtle strandings in Virginia, 2011-2020.

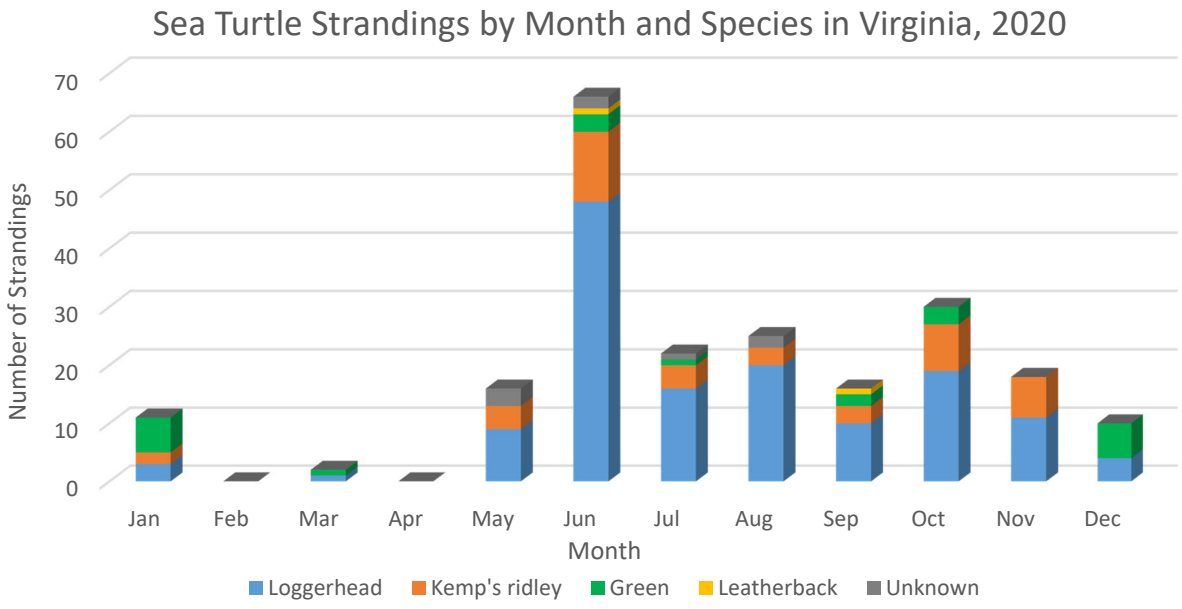


Figure 10- Monthly frequency of sea turtle strandings by species in Virginia during 2020.

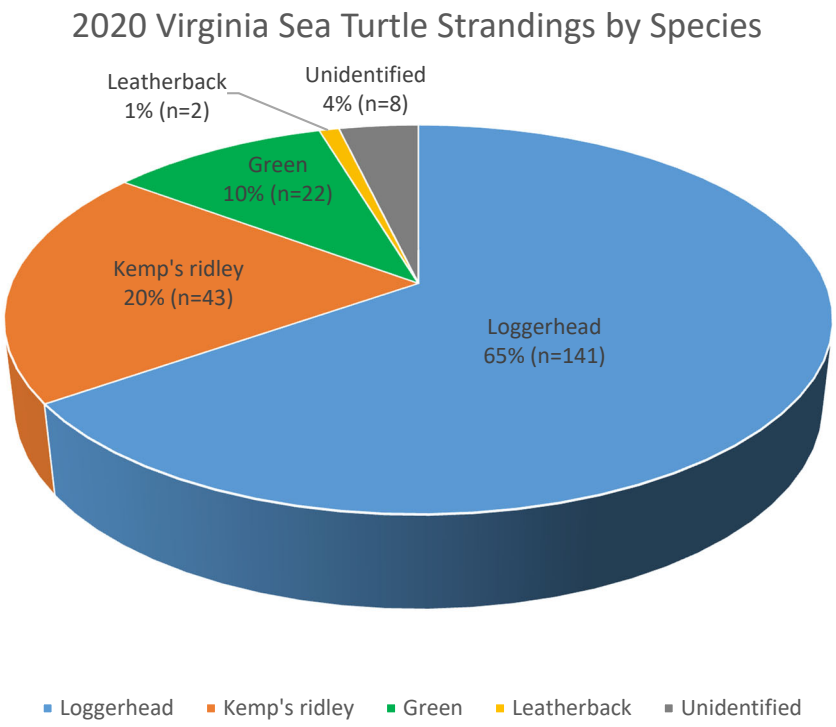


Figure 11- Frequency of sea turtle species among Virginia strandings in 2020.

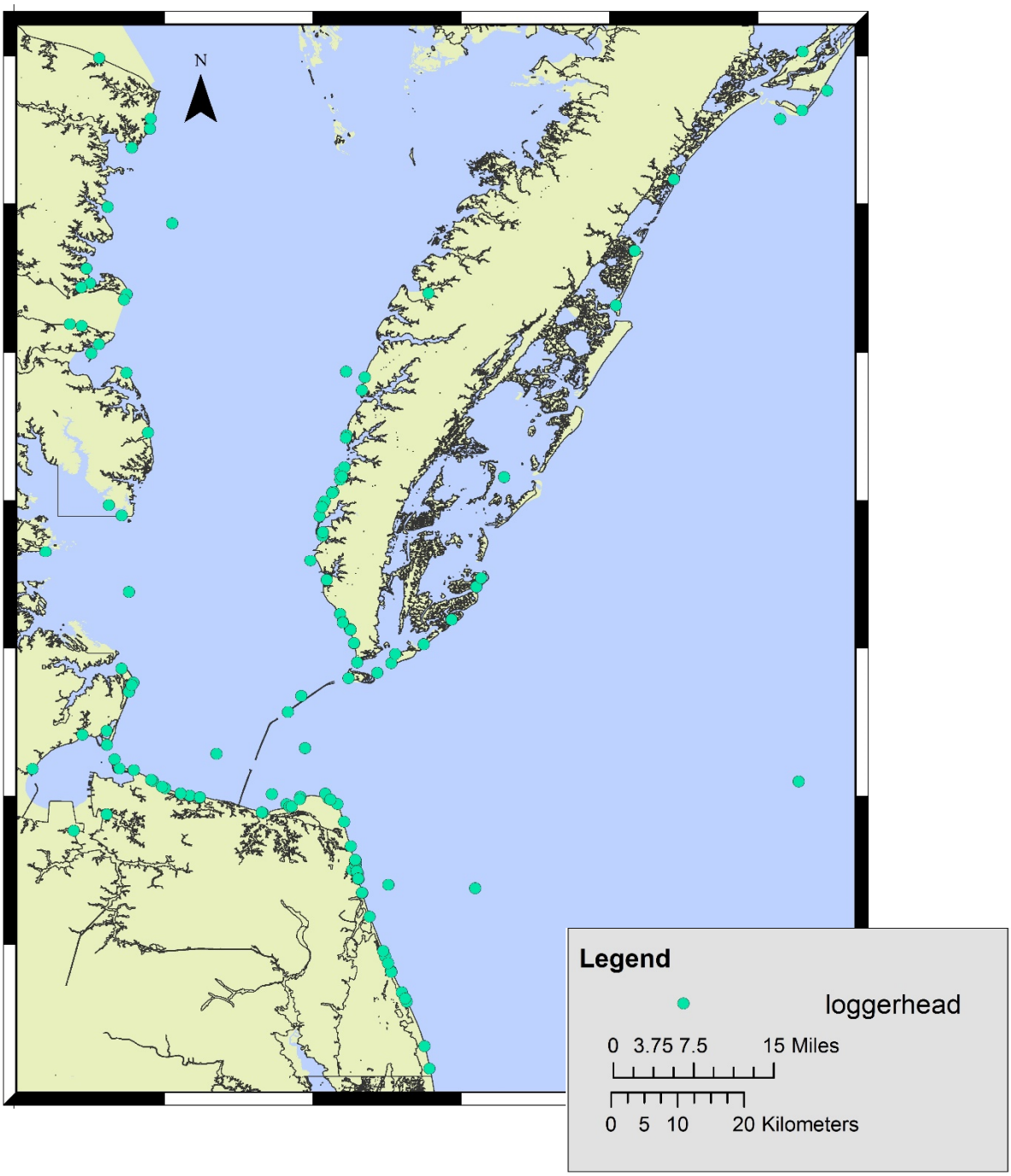


Figure 12- Locations of loggerhead sea turtle strandings in Virginia in 2020.

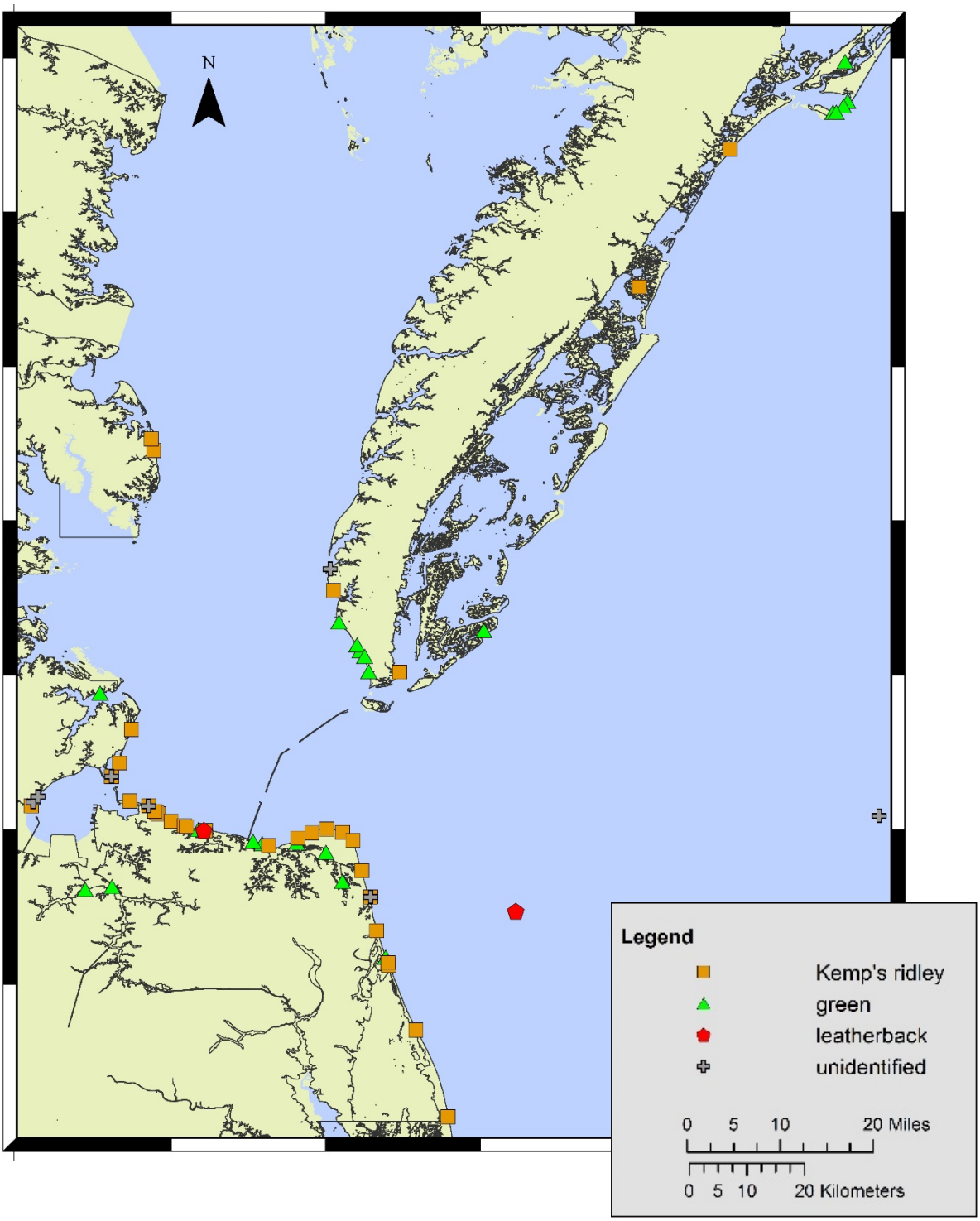


Figure 13- Locations of Virginia sea turtle strandings in 2020, excluding loggerheads.

Appendix I: Professional and Education Activities

Educational Activities	Date	Attendance	Location
VAQS Science Talk Series: Stranding Response	6/2/20	46	Virtual

Outreach Opportunities	Date	Attendance	Location
Winter Wildlife Festival	1/25/20	400	Princess Anne Rec Center, Virginia Beach, VA

Public Presentations	Date	Attendance	Location
SERSTM Poster Presentation (Are Weather Balloons an Underrepresented Source of Sea Turtle Mortality and Marine Debris?)	2/5/20	~100-300	Corpus Christi, TX
Univ. Hawaii Class lecture (Topics in Natural Resources and Environmental Management): Marine Mammal Stranding Response & Necropsy	8/4/20	12	Virtual
Virginia Aquarium's Conservation Mission, Presentation to Rotary Club of Norfolk	11/17/20	48	Virtual

Conferences and Meetings	Date	Attendance	Location
AZA Sea Turtle SAFE Program Annual Meeting	2/2/20-2/3/20	1 VAQF, 15 total	Corpus Christi, TX
Southeast Regional Sea Turtle Meeting	2/3/20-2/6/20	4 VAQS, ~400 total	Corpus Christi, TX

Staff Training	Date	Attendance	Location
CREW Training	1/21/20-1/22/20	2	VAQ, Virginia Beach, VA
Pain Management in Zoological Companion Animals	3/4/20	N/A	Virtual
FEMA Decision-Making & Problem Solving	4/1/20	1	Virtual
Volunteers & Change Management	4/16/20	1	Virtual
Recreational Off-Highway Vehicle Course	4/15/20	9	Virtual
Zoonotic Disease and Biosecurity	4/15/20	7	Virtual
Anesthesia and Common Co-Morbidities	4/24/20	N/A	Virtual
Staff beach response training	4/27/20	2	Back Bay, Virginia Beach, VA
24 Hour HAZWOPER Refresher	4/30/20	1	Virtual
Unusual Congenital Heart Defects	5/7/20	N/A	Virtual
Hands-on UTV access and operation training - Team A	5/19/20	4	Virginia Beach, VA
Sea Turtle PIT Tagging Database Webinar	5/20/20	50	Virtual

Staff Training (continued)	Date	Attendance	Location
Hands-on UTV access and operation training - Team B	5/21/20	4	Virginia Beach, VA
Reproductive Diseases in Reptiles	7/8/20	N/A	Virtual
Sea Turtle Disentanglement Training	8/3/20	12	Virtual
InfoSec Awareness Training	8/5/20	9	Virtual
UMiami Hematology Webinar - Comparative Hematology: An Introduction	8/12/20	50	Virtual
24 Hour HAZWOPER	9/26/20	1	Virtual
FWC Online Manatee Necropsy Training	9/29/20	1	Virtual
COVID-19 Training	10/2/20	9	Virtual
Research Presententation - Point of no return: determining the depth at which sea turtle carcasses experience constant submergence	10/8/20	30	Virtual
Reptile Wildlife Euthanasia Techniques	10/29/20	N/A	Virtual
Wound Bed Preparation	10/30/20	N/A	Virtual
Research Presentation - Fluking on a breath-hold: vascular adaptations in whales	11/30/20	100	Virtual
UMiami Hematology Webinar - Acute Phase Response: Highlights of Protein Electrophoresis	12/9/20	50	Virtual
Fluid Therapy in Critical Care	12/15/20	N/A	Virtual
Advances in Suturing Technique and Surgical Knots	12/15/20	N/A	Virtual

Stranding Response Team & Cooperator Meetings & Trainings	Date	Attendance	Location
Winter Intern Orientation	1/8/20	2	MACC, Virginia Beach, VA
DMACC Transition Volunteer Meeting	2/10/20	46	VAQ, Virginia Beach, VA
Pier Partner Response Training with VA Beach Animal Control	4/27/20	2	Virtual
Pier Partner Response Training with Norfolk Animal Control	4/29/20	6	Virtual
ST Nesting Training for Public Works - Beach Ops	5/5/20	10	Public Works, Virginia Beach, VA
Pier Partner Response Training with Hampton Animal Control	5/6/20	10	Virtual
Fishes Team B Hands on Gator Training	6/17/20	2	Virginia Beach, VA
Fishes Team A Hands on Gator Training	6/17/20	5	Virginia Beach, VA
Team B Intern/Fellow Orientation	7/1/20	3	MACC, Virginia Beach, VA
Team A Intern/Fellow Orientation	7/5/20	2	MACC, Virginia Beach, VA
ST Nesting Training for Summer Interns/Fellows	7/15/20	4	Virtual

Other	Date	Attendance	Location
Prescott proposal reviews	1/1/20	N/A	Virtual
Prescott scientific review committee	1/1/20	N/A	Virtual
Prescott proposal reviews - mail-in	1/1/20	N/A	Virtual
UNCW graduate student committee meetings (2 students)(3 meetings)	1/1/20-2/29/20	6	Virtual
Manatee species assessment consultation	1/3/20	15	Virtual
Grey Seal Pup Health Assessment Captures	1/13/20-1/16/20	15	Monomoy NWR, MA
Sarasota dolphin mortality consultation	2/1/20	15	Virtual
VA Sea Turtle Nesting Meeting	2/12/20	8	Back Bay, Virginia Beach, VA
Gray whale UME Case Review	2/15/20 & 2/20/20	23 Vi	rtual
Navy Harbor Seal Satellite Tagging Captures	2/23/20-3/3/20	18	Kiptopeke, VA
WGMMUME Northern GOMEX dolphin UME closure consultation	3/1/20-4/15/20	12	Virtual
ODU Master's Defense Presentation	3/2/20	25	Virginia Beach, VA
WGMMUME annual meeting	3/23/20-3/25/20	45	Virtual
NOAA dolphin human interaction consultation	4/3/20	4	Virtual
NOAA SWFC & TMMC pathology findings database coordination	4/27/20 5	5	Virtual
CBF offshore drilling webinar presenter	5/5/20	65	virtual
MMHSRP 5 year programmatic review NOAA interview	5/15/20 1	1	Virtual
USFWS sea turtle permit process updates and stakeholder comment webinar	5/26/20	45	Virtual
UME working group webinar (Hawaii monk seals and toxoplasmosis)	6/4/20	12	Virtual
International marine mammal anatomy & physiology consortium roundtable	6/12/20	10	Virtual
Lead NARW necropsy NTL	6/27/20-6/28/20	35	Sandy Hook, NJ
Freezerworks Meeting	7/30/20	4	Virtual
Entangled (NAWR) Screening and Q&A	10/15/20	100	Virtual
NARW serious injury case review	10/30/20	7	Virtual
NOAA consultation: Criteria for inclusion of NARW morbidity cases in UME numbers	11/4/20 & 11/24/20	16 Vi	rtual
UNCW Master's Defense Presentation	11/9/20	5	Virtual
Duke/NOAA/BOEM whale virtual aquaculture entanglement model consultation	11/17/20	6	Virtual

Book Chapters, Scientific Papers and Presentations (VAQ staff in bold)

Publications

- **Epple A, Daniel J, Barco S,** Rotstein D, **Costidis A**. 2020. Novel findings linked to peracute underwater entrapment in bottlenose dolphins (*Tursiops truncatus*). Frontiers in Marine Science, doi: 10.3389/fmars.2020.00503
- Contributor: Official 2019 NARW mortality event incident report, Eastern Canada (**A. Costidis**)
- Ewing RY, Rotstein D, McLellan W, **Costidis A**, Lovewell G, Schaefer AM, Romero CH, Bossart GD. 2020. Macroscopic and histopathologic findings from a mass stranding of rough-toothed dolphins (*Steno bredanensis*) in 2005 on Marathon Key, Florida, USA. Frontiers in Veterinary Science, doi: 10.3389/fvets.2020.00572

Presentations (as Primary Presenter)

- **Daniel, J., A. Costidis, S. Barco.** Are weather balloons an underrepresented source of sea turtle mortality and marine debris? Poster Presentation at Southeast Regional Sea Turtle Meeting. Feb. 3-6, 2020. Corpus Christi, TX.
- **Costidis, A.** Marine Mammal Circulatory Anatomy. International Marine Mammal Anatomy & Physiology Consortium. Feb. 2, 2020. Virtual. (Invited Speaker)

Presentations (as Coauthor)

- Sharp S, **Costidis A**, Durham K, McLellan W, Moore M, Platt T, Rotstein D, Smith A, Fauquier D, Rowles T. 2020. North Atlantic Right Whale Mortalities in the United States, 2019 through September 2020. North Atlantic Right Whale Consortium. Feb. 28, 2020. Virtual.
- Fauquier D, Moore M, McLellan W, **Costidis A**, et al., 2020. 2017-2020 North Atlantic Right Whale Unusual Mortality Event. North Atlantic Right Whale Consortium. Feb. 28, 2020. Virtual.
- Sharp S, **Costidis A**, Moore M, McLellan W: Criteria for inclusion of NARW morbidity cases in UME numbers. Oct-Dec 2020.

Scientific Review Work

- **Costidis A**: Frontiers in Veterinary Medicine (Retrospective study of traumatic intra-interspecific interactions in stranded cetaceans, Canary Islands); January 2020
- **Costidis A**: Endangered Species Research (Quantifying sublethal Florida manatee-watercraft interactions by examining scars on manatee carcasses); May 2020
- **Costidis A**: Journal of Morphology (Microanatomical, immunohistochemical and morphometric characterization of the terminal portions of the lung in cetaceans); June 2020
- **Costidis A**: Frontiers in Marine Science (Gray whale Health and Disease: Review and future directions); August 2020
- **Costidis A**: NOAA 5year Programmatic Environmental Impact Statement (review PRIOR to public comment phase); August 2020.

Appendix II: Highlights of the Year – Marine Mammals

In 2020, Virginia experienced numerous notable marine mammal strandings. The first involved a Florida manatee that was initially observed on December 5, 2019 in Lake Wesley, Virginia Beach. VAQS staff responded to observe and document the animal, but logistical challenges related to the body of water and resource limitations precluded immediate intervention. During consultation with USFWS regarding response options, sightings of the animal ceased. Unfortunately, scar patterns matched this animal to a deceased manatee reported on January 10, 2020 (Figure 14). A postmortem examination showed gross evidence of emaciation, anorexia, and constipation which, combined with the cold ambient water temperature, make cold stress syndrome the probable cause of death.

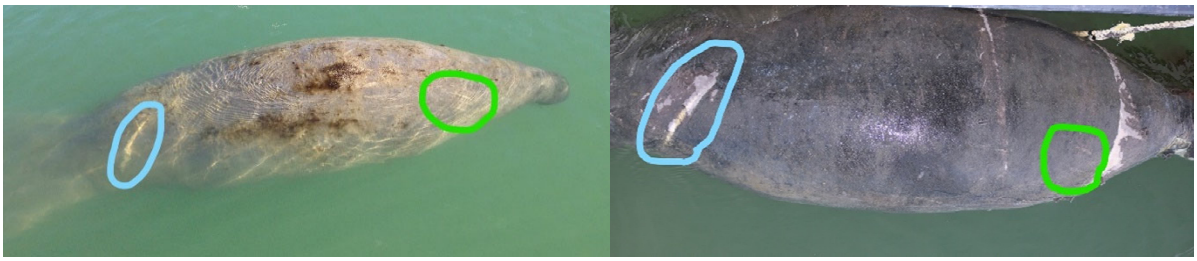


Figure 14- Caller photo of manatee reported alive and swimming on December 6, 2019 (left) matched distinctive scar pattern on deceased manatee reported to VAQS on January 10, 2020 (right).

The second notable marine mammal stranding of 2020 was a deceased female minke whale that was entangled in a gillnet in the Chesapeake Bay on February 3, 2020. The monofilament net was encircling the head, left pectoral flipper (tightly), right pectoral flipper, left and right lateral body, dorsal fin, dorsal body, peduncle, and flukes (Figure 15). This entanglement created substantial abrasions and lacerations on the leading margins and apices of the involved anatomy (Figure 15). This animal also had evidence of infectious cardiopulmonary pathology similar to those documented in other minke whales involved in the current UME, however the extent and severity of the gillnet entanglement indicates that the fisheries interaction was the likely cause of death.

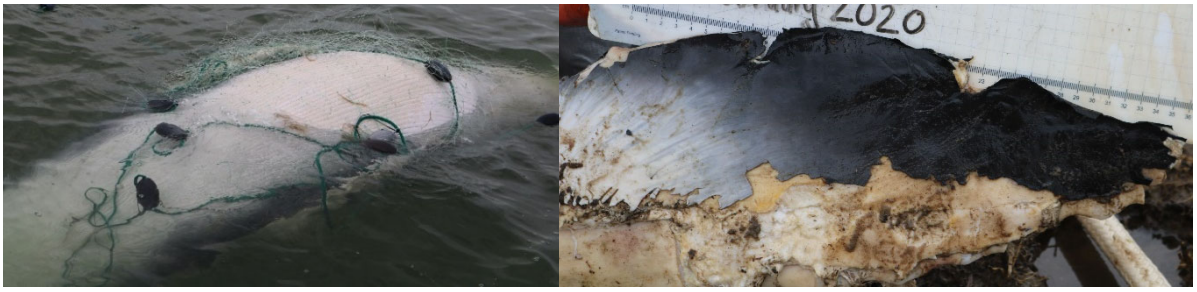


Figure 15- Minke whale entangled in monofilament net (left). Substantial abrasions and lacerations associated with monofilament entanglement present on left pectoral flipper (right).

The third notable stranding of 2020 involved a neonate short-finned pilot whale that was reported as alive and in the surf at Chincoteague National Wildlife Refuge on August 31, 2020. Within minutes of the initial report, the park employee reported that the animal no longer had any signs of life. The carcass was retrieved the following day and a necropsy was performed on September 2, 2020. The necropsy revealed a mostly empty gastrointestinal tract and evidence of significant antemortem shark predation (Figure 16). In addition, the presence of lesions on the mandible, tongue, and peduncle (Figure 17), as well as tonsillitis suggested a chronic infection. Given the age class of this animal, the cause of strand was a confluence of factors including infection, malnutrition, and antemortem shark predation.

Figure 16- Neonate pilot whale with evidence of antemortem shark predation.

Figure 17- Ulcerative lesions on mandible (left) and peduncle (right).

Appendix III: Highlights of the Year – Sea Turtles

Several of the 2020 live stranded sea turtle cases were very challenging, including cases involving traumatic hook ingestions and blunt trauma, which often leads to prolonged rehabilitation times. One loggerhead turtle, which stranded after ingesting a hook on July 4, 2019, presented with traumatic carapace wounds consistent with a propeller interaction (Figure 18). This animal was in rehabilitation for over 15 months, until it was released on October 26, 2020 (Figure 18). This animal's recovery included several CT scans and an MRI, which allowed us to assess the degree of damage to the spinal cord and monitor the animal's progress, as well as strengthen our partnerships with local veterinary and human hospitals.

Figure 18- Rehabilitation patient at admit (left) and release (right) after recovering from a recreational fishery interaction and vessel strike.

An additional hooked turtle with evidence of a healing traumatic injury was admitted to rehabilitation in 2020. This loggerhead turtle was hooked by a recreational fisher on June 26, 2020 at James River Bridge fishing pier. This animal had a partially-healed shearing wound to the caudal carapace, a heavy burden of epibiota coating the carapace and mild anemia. The animal responded well to antibiotics, pain medication and therapeutic debridement of the wound. After several weeks of antibiotics and wound care, the animal's blood values normalized and the wound continued to heal nicely (Figure 19). The animal was cleared for release by the VAQS Veterinarian and was released on October 12, 2020.

Figure 19- Healing blunt trauma wound of rehabilitation patient in 2020.

One of our most challenging rehab cases involved a loggerhead sea turtle that was found on a drag head on an active dredge. The animal stranded on September 1, 2020 in critical condition with three open fractures of the carapace (Figure 20) and a shearing injury to the caudal tip of the carapace. A CT scan revealed the presence of coelomitis resulting from the carapace fractures, renal and mesenteric intravascular gas accumulation, a fractured right acromion with associated ligamental damage, and fractures of the 2nd and 3rd thoracic vertebrae. The animal continued to receive intensive care, including pain medication, antibiotics, and wound care. There was some improvement over time and the animal was eventually able to swim in shallow water with the wounds bandaged, but the animal had worsening anemia. The turtle was taken for an MRI on October 4, 2020. As a result of the MRI findings, which included a lung lesion on the right lung, and his worsening blood values, the animal was euthanized on October 7, 2020. Blood culture results, submitted just prior to euthanasia, showed septicemia, with three different organisms present. Necropsy findings included a laceration of the pectoral muscle with an associated hematoma ventral to the acromion fracture, a granuloma in the cranial right lung and a substantial hematoma at the medial aspect of the largest carapace fracture.

Figure 20- Carapace trauma to live dredge take sea turtle.

One final case of note was a live leatherback reported traveling on the beach in circles in September 2020. A live, non-nesting leatherback on the beach is an extremely rare occurrence in Virginia. A team of VAQS staff responded to the animal, performed a field veterinary exam and applied flipper and PIT tags, as well as a paint stick to the carapace. The animal soon returned to the water but continued to stay close to shore and was seen sideways and even upside down in the water until after dark. The next morning, the animal was back on shore and continuing to travel in circles. Due to this abnormal behavior and the failure of the animal to swim back out to sea after over 24 hours of monitoring, the animal was euthanized on scene. A necropsy was performed later that day and involved extensive sample collection and dissemination efforts for outside research. Necropsy findings included traumatic lesions consistent with stranding trauma, as well as a retrocoelomic hemorrhage, meningeal

congestion, and intestinal diverticulitis. This very rare case provided VAQS staff and partner organizations with valuable experience and research samples.

Figure 21- Live stranded leatherback sea turtle

Appendix IV: Stranding Network Datasheets

A. Marine Mammal Level A data sheet

MARINE MAMMAL STRANDING REPORT - LEVEL A DATA

FIELD #: _____ **NMFS REGIONAL #:** _____ (NMFS USE) **NATIONAL DATABASE#:** _____ (NMFS USE)

COMMON NAME: _____ **GENUS:** _____ **SPECIES:** _____

EXAMINER Name: _____ Affiliation: _____

Address: _____ Phone: _____

Stranding Agreement or Authority: _____

LOCATION OF INITIAL OBSERVATION

State: _____ County: _____

City: _____

Body of Water: _____

Locality Details: _____

_____

Lat (DD): _____ . _____ N

Long (DD): _____ . _____ W

☐ Actual ☐ Estimated

How Determined: (check ONE)

☐ GPS ☐ Map ☐ Internet/Software

OCURRENCE DETAILS ☐ Restrand GE# _____ (NMFS Use)

Group Event: ☐ YES ☐ NO

If Yes, Type: ☐ Cow/Calf Pair ☐ Mass Stranding # Animals: _____ ☐ Actual ☐ Estimated

Findings of Human Interaction: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)

If Yes, Choose one or more: ☐ 1. Boat Collision ☐ 2. Shot ☐ 3. Fishery Interaction

☐ 4. Other Human Interaction: _____

How Determined (Check one or more): ☐ External Exam ☐ Internal Exam ☐ Necropsy

☐ Other: _____

Gear Collected? ☐ YES ☐ NO Gear Disposition: _____

Other Findings Upon Level A: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)

If Yes, Choose one or more: ☐ 1. Illness ☐ 2. Injury ☐ 3. Pregnant ☐ 4.Other: _____

How Determined (Check one or more): ☐ External Exam ☐ Internal Exam ☐ Necropsy

☐ Other: _____

INITIAL OBSERVATION

Date: Year: _____ Month: _____ Day: _____

First Observed: ☐ Beach or Land ☐ Floating ☐ Swimming

CONDITION AT INITIAL OBSERVATION (Check ONE)

☐ 1. Alive ☐ 4. Advanced Decomposition

☐ 2. Fresh dead ☐ 5. Mummified/Skeletal

☐ 3. Moderate decomposition ☐ 6. Condition Unknown

LEVEL A EXAMINATION ☐ Not Able to Examine

Date: Year: _____ Month: _____ Day: _____

CONDITION AT EXAMINATION (Check ONE)

☐ 1. Alive ☐ 4. Advanced Decomposition

☐ 2. Fresh dead ☐ 5. Mummified/Skeletal

☐ 3. Moderate decomposition ☐ 6. Unknown

INITIAL LIVE ANIMAL DISPOSITION (Check one or more)

☐ 1. Left at Site ☐ 6. Euthanized at Site

☐ 2. Immediate Release at Site ☐ 7. Transferred to Rehabilitation:

☐ 3. Relocated Date: Year:_____ Month:_____Day:___ Facility:_____

☐ 4. Disentangled ☐ 8. Died during Transport

☐ 5. Died at Site ☐ 9. Euthanized during Transport

☐ 10. Other:_____

CONDITION/DETERMINATION (Check one or more)

☐ 1. Sick 7. Location Hazardous

☐ 2. Injured ☐ a. To animal

☐ 3. Out of Habitat ☐ b. To public

☐ 4. Deemed Releasable ☐ 8. Unknown/CBD

☐ 5. Abandoned/Orphaned ☐ 9.Other_____

☐ 6. Inaccessible _____

MORPHOLOGICAL DATA

SEX (Check ONE)

☐ 1. Male

☐ 2. Female

☐ 3. Unknown

AGE CLASS (Check ONE)

☐ 1. Adult ☐ 4. Pup/Calf

☐ 2. Subadult ☐ 5. Unknown

☐ 3. Yearling

☐ Whole Carcass ☐ Partial Carcass

Straight length:_____ ☐ cm ☐ in ☐ actual ☐ estimated

Weight:_____ ☐ kg ☐ lb ☐ actual ☐ estimated

PHOTOS/VIDEOS TAKEN: ☐ YES ☐ NO

Photo/Video Disposition: _____

_____

TAG DATA Tags Were:

Present at Time of Stranding (Pre-existing): ☐ YES ☐ NO

Applied during Stranding Response: ☐ YES ☐ NO

ID#	Color	Type	Placement* (Circle ONE)	Applied	Present
			D DF L LF LR RF RR	☐	☐
			D DF L LF LR RF RR	☐	☐
			D DF L LF LR RF RR	☐	☐

* D= Dorsal; DF= Dorsal Fin; L= Lateral Body
LF= Left Front; LR= Left Rear; RF= Right Front; RR= Right Rear

CARCASS STATUS (Check one or more)

☐ 1. Left at Site ☐ 4. Towed: Lat_____Long_____ ☐ 7. Landfill

☐ 2. Buried ☐ 5. Sunk: Lat_____Long_____ ☐ 8. Unknown

☐ 3. Rendered ☐ 6. Frozen for Later Examination ☐ 9. Other_____

SPECIMEN DISPOSITION (Check one or more)

☐ 1. Scientific collection ☐ 2. Educational collection

☐ 3. Other:_____

Comments: _____

_____

NECROPSIED ☐ NO ☐ YES ☐ Limited ☐ Complete

☐ Carcass Fresh ☐ Carcass Frozen/Thawed

NECROPSIED BY: _____

Date: Year: _____ **Month:** _____ **Day:** _____

NOAA Form 89-864; OMB No.0648-0178; Expires 01/31/2014

PLEASE USE THE BACK SIDE OF THIS FORM FOR ADDITIONAL REMARKS

B. Sea Turtle Stranding and Salvage Network (STSSN) data sheet

SEA TURTLE STRANDING AND SALVAGE NETWORK – STRANDING REPORT

OBSERVER'S NAME / ADDRESS / PHONE:
First _____ M.I.____ Last _____
Affiliation: Virginia Aquarium Stranding Response Program
Address: 717 General Booth Blvd, Virginia Beach, VA 23451
vaqstranding@gmail.com
Area code/Phone number: 757-385-7575

STRANDING DATE:
Year 20☐☐ Month ☐☐ Day☐☐
Turtle number by day ☐☐

-State coordinator must be notified within 24 hrs; this was done by ☐phone (757)385-7575 ☐email ☐fax (757)437-4933

SPECIES: (check one)
- ☐ CC = Loggerhead
- ☐ CM = Green
- ☐ DC = Leatherback
- ☐ EI = Hawksbill
- ☐ LK = Kemp's Ridley
- ☐ LO = Olive Ridley
- ☐ UN = Unidentified

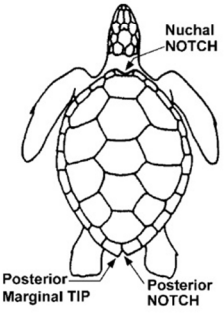
Check Unidentified if not positive. Do Not Guess.

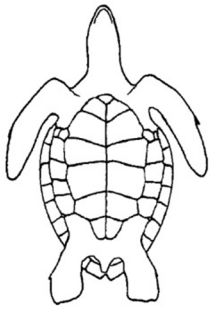
Carcass necropsied? ☐Yes☐No
Necropsied By_____
Necropsy Date _____
Photos taken? ☐Yes ☐No
Species verified by state coordinator?
☐ Yes ☐ No Initial _____

SEX:
- ☐ Undetermined
- ☐ Female ☐ Male

Does tail extend beyond carapace?
- ☐ Yes; how far?_____ cm / in
- ☐ No

How was sex determined?
- ☐ Necropsy
- ☐ Tail length (adult only)





STRANDING LOCATION: ☐Offshore (Atlantic or Gulf beach) ☐Inshore (bay, river, sound, inlet, etc)
State _____ County_____
Descriptive location (be specific)_____
_____
_____
Latitude _____ Longitude _____

CONDITION: (check one)
- ☐ 0 = Alive
- ☐ 1 = Fresh dead
- ☐ 2 = Moderately decomposed
- ☐ 3 = Severely decomposed
- ☐ 4 = Dried carcass
- ☐ 5 = Skeleton, bones only

TAGS: ***Contact state coordinator before disposing of any tagged animal!!***
Checked for flipper tags? ☐ Yes ☐ No
Check all 4 flippers. If found, record tag number(s) / tag location / return address
_____
_____
_____
PIT tag scan? ☐ Yes ☐ No
If found, record number / tag location
_____
_____
Coded wire tag scan? ☐ Yes ☐ No
If positive response, record location (flipper)
_____
Checked for living tag? ☐Yes ☐ No
If found, record location (scute number & side)
_____

FINAL DISPOSITION: (check)
- ☐1 = Left on beach where found; painted? ☐Yes* ☐No(5)
- ☐2 = Buried: ☐ on beach / ☐ off beach; carcass painted before buried? ☐ Yes* ☐ No
- ☐3 = Salvaged: ☐ all / ☐ part(s), what/why? _____
  _____
  _____
- ☐4 = Pulled up on beach/dune; painted? ☐Yes* ☐No
- ☐6 = Alive, released
- ☐7 = Alive, taken to rehab. facility, where? _____
  _____
- ☐8 = Left floating, not recovered; painted? ☐Yes* ☐No
- ☐9 = Disposition unknown, explain _____
  _____

***If painted, what color?** _____

CARAPACE MEASUREMENTS: (*see drawing*)

Using calipers	**Circle unit**
Straight length (NOTCH-TIP)	_____ cm / in
Minimum length (NOTCH-NOTCH)	_____ cm / in
Straight width (Widest Point)	_____ cm / in
Using non-metal measuring tape	**Circle unit**
Curved length (NOTCH–TIP)	_____ cm / in
Minimum length (NOTCH-NOTCH)	_____ cm / in
Curved width (Widest Point)	_____ cm / in
	Circle unit
Weight ☐ actual / ☐ est.	_____ kg / lb

Mark wounds / abnormalities on diagrams at left and describe below (note tar or oil, gear or debris entanglement, propeller damage, epibiota, papillomas, emaciation, etc.). **Please note if no wounds / abnormalities are found.**
_____
_____
_____
_____
_____
_____

Appendix V: Virginia Species Lists

A. Marine mammal species in stranding records from Virginia, U.S.A. (Virginia Aquarium Marine Mammal Stranding Database, Potter 1991).

Common Name	Scientific Name	ESA Status
Order: Sirenia		
Family: Trichechidea		
West Indian manatee	*Trichechus manatus latirostris*	Threatened
Order: Cetacea		
Suborder: Mysticeti		
Family: Balaenidae		
North Atlantic Right whale	*Eubalaena glacialis*	Endangered
Family: Balaenopteridae		
Fin whale	*Balaenoptera physalus*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Bryde's whale	*Balaenoptera brydei*	Endangered
Humpback whale	*Megaptera novaeangliae*	Not Listed
Minke whale	*Balaenoptera acutorostrata*	Not Listed
Suborder: Odontoceti		
Family: Physteridae		
Sperm whale	*Physeter macrocephalus*	Endangered
Pygmy sperm whale	*Kogia breviceps*	Uncertain
Dwarf sperm whale	*Kogia sima*	Uncertain
Family: Ziphiidae		
Cuvier's beaked whale	*Ziphius cavirostris*	Uncertain
Gervais' beaked whale	*Mesoplodon europaeus*	Uncertain
True's beaked whale	*Mesoplodon mirus*	Uncertain
Sowerby's beaked whale	*Mesoplodon bidens*	Uncertain
Blainville's beaked whale	*Mesoplodon densirostris*	Uncertain
Family: Delphinidae		
Long-finned pilot whale	*Globicephala melas*	Not Listed
Short-finned pilot whale	*Globicephala macrorynchus*	Not Listed
Risso's dolphin	*Grampus griseus*	Not Listed
Bottlenose dolphin	*Tursiops truncatus*	Not Listed
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Not Listed
Pygmy killer whale	*Feresa attenuata*	Not Listed
Melon-headed whale	*Peponocephala electra*	Not Listed
Rough-toothed dolphin	*Steno bredanensis*	Uncertain
Common dolphin	*Delphinus delphis*	Not Listed
Striped dolphin	*Stenella coerubeoalba*	Not Listed
Pantropical spotted dolphin	*Stenella attenuata*	Not Listed
Atlantic spotted dolphin	*Stenella frontalis*	Not Listed
Family: Phocoenidae		
Harbor porpoise	*Phocoena phocoena*	Not Listed

Common Name	Scientific Name	ESA Status
Order: Carnivora		
Suborder: Pinnipedia		
Family: Phocidae		
Harbor seal	*Phoca vitulina*	Not Listed
Gray seal	*Halichoerus grypus*	Not Listed
Hooded seal	*Crystophora cristata*	Not Listed
Harp seal	*Pagophilus groenlandica*	Not Listed

B. Sea turtle species in stranding records from Virginia, U.S.A. (Virginia Aquarium Sea Turtle Stranding Database).

Common Name	Scientific Name	ESA Status
Class: Reptilia		
Order: Testudines		
Family: Dermochelyidea		
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Family: Cheloniidae		
Green sea turtle	*Chelonia mydas*	Threatened
Loggerhead sea turtle	*Caretta caretta*	Threatened
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered