Turtle Tagging and Tracking in Chesapeake Bay and Coastal Waters of Virginia
Annual Progress Report for 2013

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Background & Introduction

In July 2013, the Virginia Aquarium & Marine Science Center (VAQ) and the Naval Facilities Engineering Command for the Atlantic fleet (NAVFAC LANT) initiated a collaborative turtle-tagging project in lower Chesapeake Bay and coastal Virginia waters. The goal of the project is to assess the occurrence, habitat use, and behavior of loggerhead, green, and Kemp's ridley turtles in the Hampton Roads region to better assess the impacts that U.S. Navy activities may have on these protected species. The project includes analysis of historic sea turtle tag data and deployment of satellite and sonic tags on sea turtles captured, incidentally caught, and rehabilitated in Virginia. VAQ gains access to sea turtles in three ways: 1) capture using tangle or dip nets in the vicinity of naval facilities and training areas; 2) incidental capture in Virginia pound nets (fish traps), and 3) rehabilitated turtles from the Virginia Aquarium Stranding Response Program.

An exciting aspect of the project was the leveraging of the U.S. Navy's existing underwater passive acoustic receiver array, initially established to track sturgeon (Hager 2014). This project represents the first use of the Chesapeake Bay acoustic receiver array for sea turtles. This array records the presence of animals using small sonic (i.e., acoustic) tags either inserted surgically into the body (in the case of fishes) or attached externally using epoxy (for sea turtles; **Figure 1**). These tags have a battery life of 250 to >10,000 days, depending on the model and parameters of the tag. The smallest tags weigh less than 10 grams and can be placed on small juvenile green and Kemp's ridley turtles, species that are known to use Chesapeake Bay, but which are usually too small to be outfitted with traditional satellite tags. Along with external tag attachment, we are exploring the efficacy of using these tags internally in turtles as they are used in fishes.

From the underwater acoustic arrays and tags, an objective was to learn more about residency time and migration patterns by being able to tag more turtles at lower cost. Each tag transmits a specific coded signal that is used to identify the individual as it moves from one location to another. As the turtle moves around areas where receiving arrays are present, the arrays detect the pings from the tag and record the information, which is later downloaded by researchers for analysis. For these turtles, the sonic tag also emits a signal that indicates the approximate depth of the turtle when it is in range of the

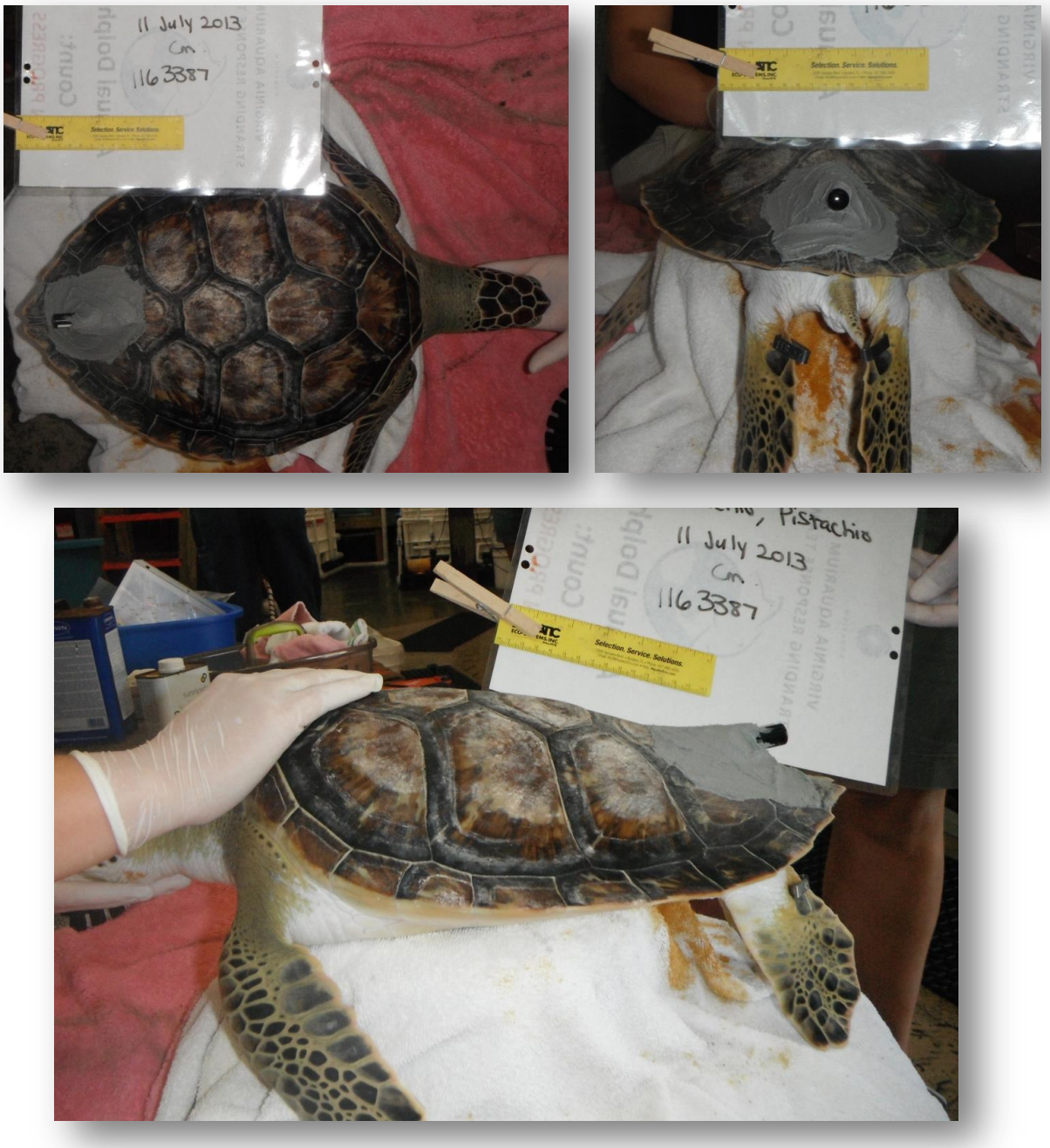


Figure 1: Images of a juvenile green turtle (VAQS20122185) with a sonic tag attached to its carapace, using epoxy

array. These data will help establish a baseline for habitat use and movement patterns by sea turtles in areas where U.S. Navy training and testing activities occur. The collected data may also contribute to habitat use analyses of sea turtles in the region. Some larger turtles were double tagged with sonic and satellite tags. The data-logging satellite-telemetry tags are produced by Wildlife Computers and the Sea Mammal Research Unit and can record behaviors such as dive depth and duration and to track

movements over long ranges. Initially, the satellite tags will help ground truth the performance of the acoustic receiver array and inform the placement of future acoustic receiver elements. The satellite tags will also collect data on yearlong habitat ranges for sea turtles in the Chesapeake Bay.

Methods & Results 2013

In the late summer and fall of 2013, VAQ conducted five capture trips, deploying a 300 to 600-ft tangle net for 3 to 5 hr surrounding a slack tide. The net was deployed in 6 to 10 ft of water on sandy bottoms. During these trips, however, no sea turtles were caught, but a previous trip for another project successfully captured a Kemp's ridley turtle. There are plans to deploy the net again in 2014.

Fourteen turtles (eleven loggerhead, two green, and one Kemp's ridley) were tagged during summer and fall (July through November) 2013 (**Table 1**). Four loggerhead turtles were incidentally captured in

Table 1: Tags deployed during July through November 2013. Several turtles that received U.S. Navy sonic tags also received satellite tags as part of other projects (non-Navy in PTT column). Data from these tags will be shared with the U.S. Navy as part of Year 2 of the project.

				Release Location				Satellite Tag		VEMCO Sonic Tag	
Field Number	**Species**	**Date**	**Source**	**City/County**	**State**	**Latitude**	**Longitude**	**PTT**	**Model**	**VUE Tag ID**	Model
VAQS20122171	Cm	07/11/2013	rehabilitated	Virginia Beach	VA	36.9195	-76.0542	NA	NA	A69-1601-9888	V13-1X
VAQS20122185	Cm	07/11/2013	rehabilitated	Virginia Beach	VA	36.9195	-76.0542	NA	NA	A69-1601-9890	V13-1x
VAQS20122180	Lk	08/27/2013	rehabilitated	Atlantic Ocean	VA	36.8816	-75.9418	NA	NA	A69-1601-11895	V9-2x
VAQS20122163	Cc	08/27/2013	rehabilitated	Atlantic Ocean	VA	36.8816	-75.9418	non-Navy	NA	A69-1601-11901	V13-1x
VAQR2013015	Cc	09/07/2013	pound net	Northampton	VA	37.1278	-75.9492	non-Navy	NA	A69-1601-11908	V16-1x
VAQR2013018	Cc	09/12/2013	pound net	Northampton	VA	37.1660	-75.9881	non-Navy	NA	A69-1601-11907	V16-1x
VAQR2013019	Cc	09/16/2013	pound net	Northampton	VA	37.1660	-75.9881	132362	SMRU 9000x-SRDL	A69-1601-11904	V16-1x
VAQR2013013	Cc	09/19/2013	pound net	Northampton	VA	37.1660	-75.9881	non-Navy	NA	A69-1601-11898	V13-1x
VAQS20132106	Cc	09/28/2013	rehabilitated	Virginia Beach	VA	36.9190	-76.0551	132363	SMRU 9000x-SRDL	A69-1601-11909	V16-1x
NAIB1240CC	Cc	10/20/2013	rehabilitated	Virginia Beach	VA	36.7453	-75.9425	132364	SMRU 9000x-SRDL	A69-1601-11905	V16-1x
VAQS20132126	Cc	10/20/2013	rehabilitated	Virginia Beach	VA	36.7453	-75.9425	non-Navy	NA	A69-1601-11906	V16-1x
VAQS20132102	Cc	10/20/2013	rehabilitated	Virginia Beach	VA	36.7453	-75.9425	132365	WC SPLASH-284A	A69-1601-9084	V16-5x
VAQS20132086	Cc	10/20/2013	rehabilitated	Virginia Beach	VA	36.7453	-75.9425	132366	WC SPLASH-284A	A69-1601-9086	V16-5x
VAQS20132141	Cc	11/22/2013	rehabilitated	Atlantic Ocean	NC	34.2110	-75.8700	132368	WC SPOT-5	A69-1601-11900	V16-5x

Key: Cc = Loggerhead turtle (*Caretta caretta*); Cm = Green turtle (*Chelonia mydas*); ID = identification; Lk = Kemp's ridley turtle (*Lepidochelys kempii*); NA = not applicable; NAIB = National Aquarium in Baltimore; NC = North Carolina; PTT = Platform Transmitting Terminal; SMRU = Sea Mammal Research Unit; SPOT = Smart Position or Temperature Transmitting; VA = Virginia; VAQ = Virginia Aquarium & Marine Science Center.

pound nets; sonic tags were placed on all four, with one turtle also receiving a U.S. Navy-funded satellite tag. In addition, VAQ released (after rehabilitation) seven loggerheads, one Kemp's ridley, and two green turtles with sonic tags. Four of the loggerheads also received U.S. Navy-funded satellite tags. Five loggerheads that received sonic tags received satellite tags as a part of other VAQ projects ('non-Navy' in the PTT column in Table 1). Sika Anchorfix-1™ epoxy was used for all tag attachments. Most of these tags were deployed before the Navy tags were delivered. Data from these tags will be available to NAVFAC in the next year, following completion of current projects. Unfortunately, four of the turtles, one green and three loggerheads, stranded dead after being released with tags (**Table 2**). None of the four stranded turtles retained their sonic tags, and one turtle stranded with the satellite tag, which can be redeployed.

Satellite tags from this and other VAQ projects indicate that, as of 15 January 2014, eight of the 10 turtles are alive and their tags are transmitting normally. Seven of the satellite-tagged turtles had moved out of Virginia and were distributed from North Carolina to Florida (**Table 2; Figure 2**). One satellite tagged turtle traveled to nearshore waters of North Carolina and then moved offshore, into the Gulf

Table 2: Results for tags deployed from July through November 2013. After September, turtles were released south of the acoustic array and thus were not expected to have any detections during 2013. Acoustic array results are through 15 October 2013. The Days column in the Acoustic Array section indicates the number of different days tags were detected and Days in the Satellite Tracking section indicate number of days since release as of 15 January 2014.

			Acoustic Detections			Satellite Tags	
Field Number	**Species**	**Date**	**Detections**	**Receivers**	**Days**	**Days**	**Status**
VAQS20122171	Cm	07/11/2013	0	0	0	NA	stranded dead
VAQS20122185	Cm	07/11/2013	23	3	2	NA	NA
VAQS20122180	Lk	08/27/2013	15	2	2	NA	NA
VAQS20122163	Cc	08/27/2013	383	14	7	146	still transmitting
VAQR2013015	Cc	09/07/2013	0	0	0	129	still transmitting
VAQR2013018	Cc	09/12/2013	5	2	1	7	stranded dead
VAQR2013019	Cc	09/16/2013	0	0	0	2	stranded dead
VAQR2013013	Cc	09/19/2013	7	2	2	35	stranded dead
VAQS20132106	Cc	09/28/2013	55	3	2	109	still transmitting
NAIB1240CC	Cc	10/20/2013	0	0	0	86	still transmitting
VAQS20132126	Cc	10/20/2013	0	0	0	86	still transmitting
VAQS20132102	Cc	10/20/2013	0	0	0	86	still transmitting
VAQS20132086	Cc	10/20/2013	0	0	0	86	still transmitting
VAQS20132141	Cc	11/22/2013	0	0	0	53	still transmitting

Key: Cc = Loggerhead turtle (*Caretta caretta*); Cm = Green turtle (*Chelonia mydas*); NA = not applicable; NAIB = National Aquarium in Baltimore; PTT = Platform Transmitting Terminal; VAQ = Virginia Aquarium & Marine Science Center.

Stream. Satellite tag data can be viewed online at seaturtle.org (http://www.seaturtle.org/tracking/?project_id=917) and the OBIS-SEAMAP NAVFAC collaborative project page (http://seamap.env.duke.edu/partner/NAVY).

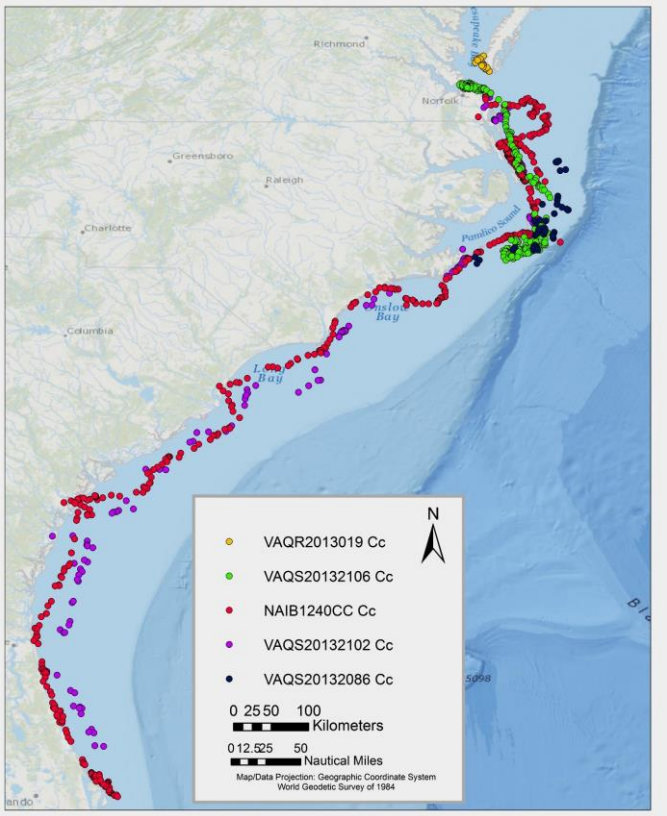


Figure 2: Satellite locations for turtles tagged as part of this project. Tag data were downloaded on 15 January 2014. Turtle 132362 (yellow) stopped transmitting after 2 days and was later found dead. Locations were filtered using the Douglas filter set to parameters suggested by the Turtle Expert Working Group (2009).

In addition to satellite telemetry data, there were 488 detections of six turtles by the acoustic receiver array through 15 October 2013 (see **Table 2**; **Figure 3**). The number of detections from these 6 individuals ranged from five to 383. Detections were recorded by up to 15 different receivers for a single animal. One turtle (PTT 132363 in **Figure 4**) spent 2 days in the vicinity of Thimble Shoals and was detected 55 times. Of the eight turtles that were not detected by the array, five were released in the fall, south of the array, while two stranded shortly after release. Tags placed on the latest (i.e., fall) releases should continue to be active and be detected by the array when the turtles return to the Chesapeake Bay area in the spring.Along with currently deployed tags, VAQF is providing historical telemetry data from turtles tagged from 2007 through 2012 (1 Kemp's ridley, 3 greens, and 15 loggerheads; **Figure 5**). These data will be combined with the data collected by the U.S. Navy-funded tags and may also help to direct placement of future acoustic receivers to enhance sonic detections in the region. The data from these historical tags are current available to all project partners through Movebank.org (https://www.movebank.org/panel_embedded_movebank_webapp).

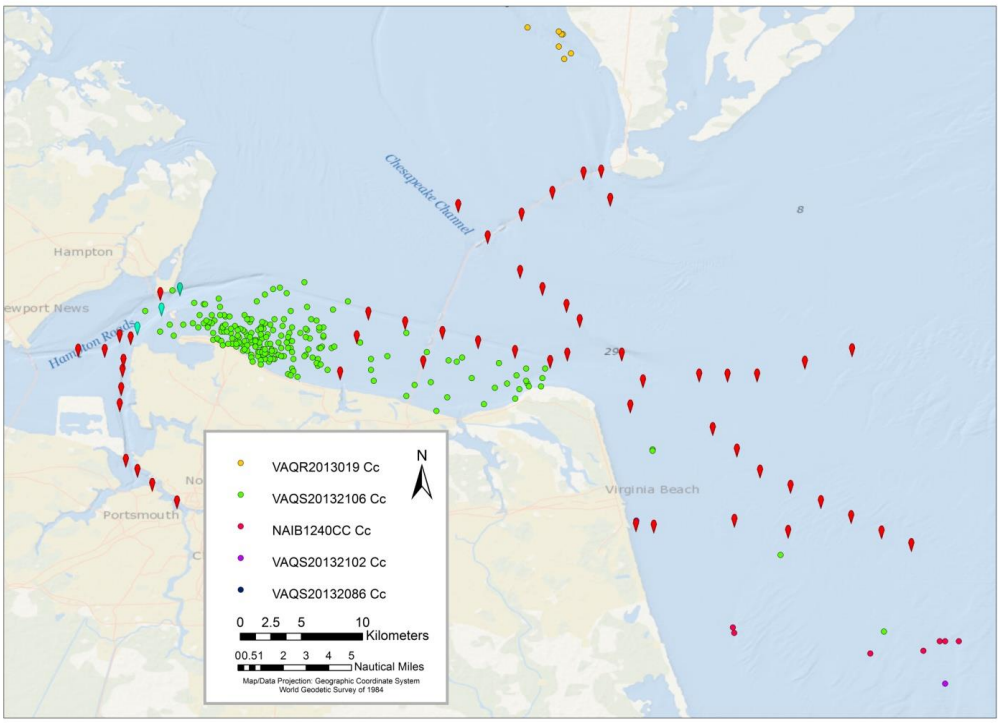


Figure 3: Location of acoustic array receivers (red) in comparison with locations of satellite-tagged turtles (circles). Turtle number VAQS20132106 (green) was detected 55 times by three acoustic receivers over the course of 2 days (light blue). Turtle ID numbers correspond to field number in Tables 1 and 2.

During December 2013, U.S. Navy GIS analysts met with VAQ to determine roles for analysis of the first year of data, recognizing that many of the tags are still actively transmitting. Exploratory data products, including a comparison of satellite telemetry and acoustic tag data from a double-tagged animal and home ranges for historical tags, will be completed in Spring 2014 and reported in next year's Annual Monitoring Report.

Future plans

For the remainder of this study, VAQ has one U.S. Navy-funded Wildlife Computers SPOT-5 tag and six VEMCO sonic tags to deploy in the remainder of the 2014 field season. In-water work for 2014 will commence in May when water temperatures rise to support the migration of turtles into Virginia waters. In May and June, when water temperatures are relatively cool and sea turtles tend to bask on the water's surface, VAQ will attempt to capture animals in ocean waters using dip nets. As waters

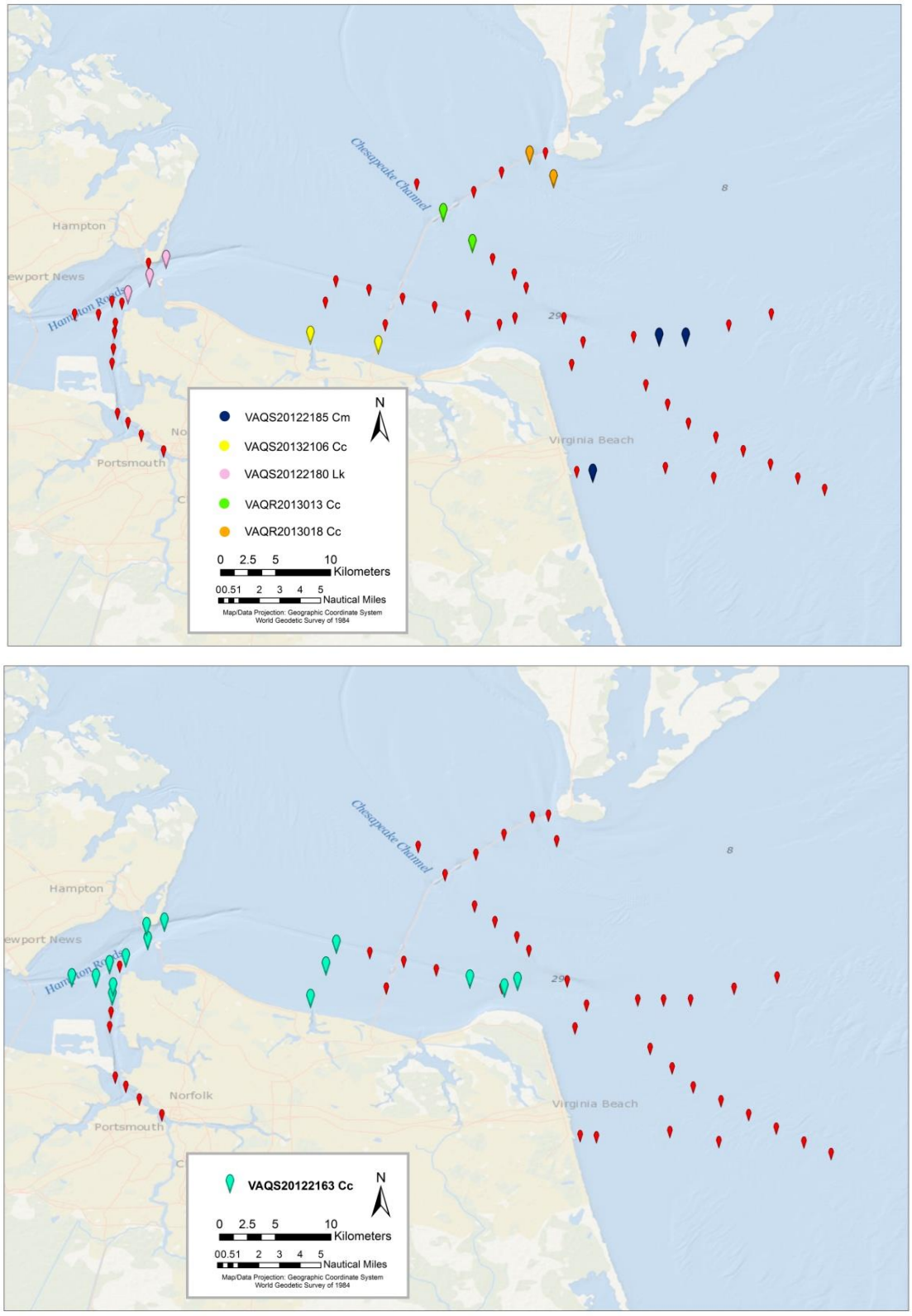
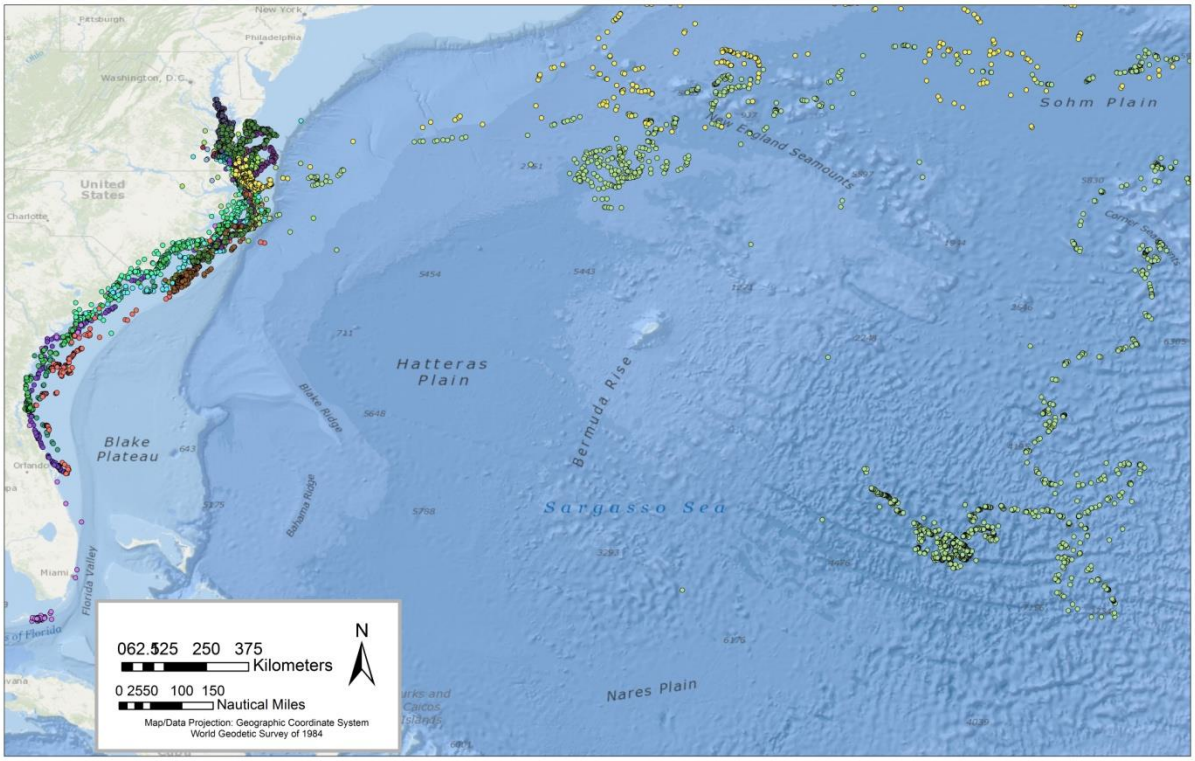


Figure 4: Location of receiver array (red) and receivers that detected turtles from 01 July through 15 October 2013. Top map includes five turtles, none of whom were detected by the same receiver. 'Cc' indicates loggerhead, 'Cm' indicates green and 'Lk' is Kemp's ridley. The bottom map includes one loggerhead turtle that was detected by 14 rec



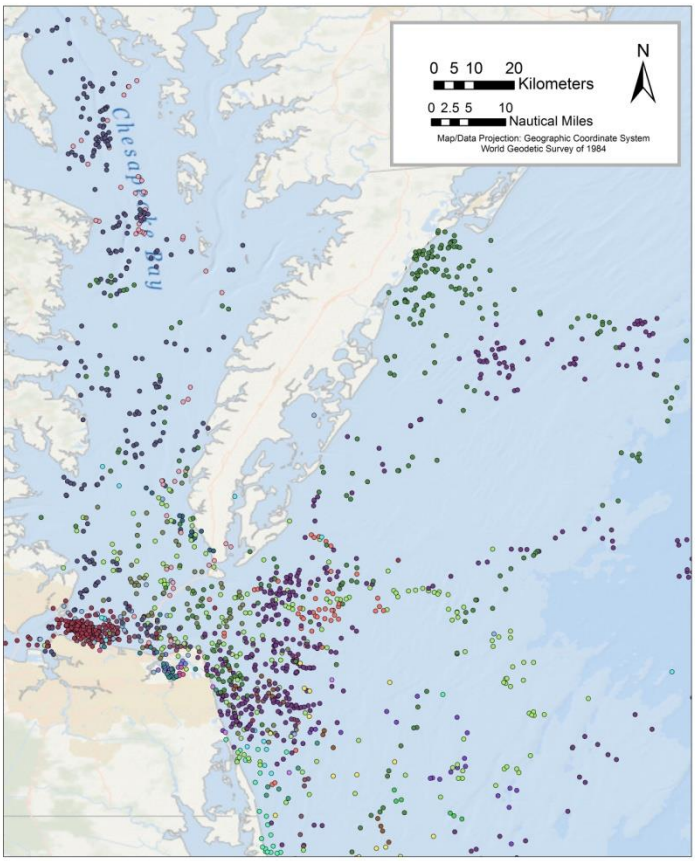


Figure 5: Argos locations of historically tagged turtles by VAQ to be included in the project for habitat use and density modeling. The maps include 19 turtles tagged between 2007 and 2012 as well as the five turtles tagged for the project in 2013. The entire extent of tracks is shown above, and points in Virginia waters are shown at left. Locations were filtered using Douglas filter parameters suggested by the Turtle Expert Working Group (2009).

warm and turtles move into shallow bay waters, we will deploy the tangle net in Chesapeake Bay. Currently VAQ has a total of nine animals in rehabilitation (4 loggerheads, 4 Kemp's ridleys, and 1 green), seven of which are potential candidates to be released with tags in 2014. Also in 2014, we will be measuring the detection ranges of acoustic tags attached externally and implanted internally in sea turtle carcasses. We will place the carcasses at known distances from receivers to develop a detection curve.

Literature Cited

Hager, C. 2014. Telemetry Tracking of Atlantic Sturgeon in the Lower Chesapeake Bay: Annual Progress Report for 2013. Submitted to Naval Facilities Engineering Command (NAVFAC) Atlantic, Norfolk, Virginia, under Contract No. N62470-10-D-3011, Task Order 19, issued to HDR Inc., Norfolk, Virginia. Submitted by Chesapeake Scientific, Williamsburg, Virginia

TEWG (Turtle Expert Working Group). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575. National Marine Fisheries Service, Miami, Florida.