1987

Aspects of the biology of VIrginia's sea turtles: 1979-1986

J. A. Keinath
Virginia Institute of Marine Science

J. A. Musick
Virginia Institute of Marine Science

R. A. Byles

Recommended Citation

Keinath, J. A.; Musick, J. A.; and Byles, R. A., Aspects of the biology of VIrginia's sea turtles: 1979-1986 (1987). *Virginia Journal of Science*, 38(4), 331-336.
https://scholarworks.wm.edu/vimsarticles/1872

Virginia Journal of Science
Volume 38, Number 4
Winter 1987

Aspects of the Biology of Virginia's Sea Turtles: 1979–1986

J. A. Keinath

Virginia Institute of Marine Science
School of Marine Science
The College of William and Mary
Gloucester Point, VA 23062

and

J. A. Musick

Virginia Institute of Marine Science
School of Marine Science
The College of William and Mary
Gloucester Point, VA 23062

and

R. A. Byles

U.S. Fish and Wildlife Service
Endangered Species, Box 1306
Albuquerque, NM 87103

ABSTRACT

Research has been carried out on sea turtles in Chesapeake Bay and adjacent waters since 1979. Chesapeake Bay supports populations of juvenile loggerhead, Caretta caretta (Linnaeus) and Kemp's ridley, Lepidochelys kempi (Garmon) sea turtles during summer. Data from our aerial surveys and biotelemetry studies show that turtles migrate northward from south of Cape Hatteras and enter the Bay during spring. We estimate between 2000 and 10,000 loggerheads utilize the Bay during summer, where they forage for abundant invertebrate fauna. Fifty to 200 sea turtles strand dead on shore each year. At least one-third of the deaths are attributable to human activity. In fall, turtles migrate out of the Bay, and travel along the coast to south of Cape Hatteras. Chesapeake Bay is an important developmental habitat for loggerhead and ridley sea turtles.

INTRODUCTION

Four of the seven extant species of sea turtles are found in Virginia's waters (Bellmund et al., 1987). Loggerheads (Caretta caretta) are the most common sea turtle in Chesapeake Bay and adjacent waters, and are found throughout temperate seas in open ocean as well as inland Bays and estuaries (Carr, 1952; Ernst and Barbour, 1972). The second most common sea turtle in Virginia waters is Kemp's ridley (Lepidochelys kempi), which is found throughout the Gulf of Mexico and the temperate western Atlantic Ocean (Carr,1952; Ernst and Barbour, 1972) as well as Chesapeake Bay (Hardy, 1962). Kemp's ridley is in severe danger of extinction throughout its range (Carr, 1977). Leatherback turtles, Dermochelys coriacea (Linnaeus) are primarily pelagic in all oceans (Carr, 1952; Ernst and Barbour, 1972), however, they occasionally enter Chesapeake Bay and travel as far north as Maryland (Hardy,1969). Green turtles, Chelonia mydas (Linnaeus) were historically reported in Chesapeake Bay (Brady, 1925) but are now rarely observed.

Research on the ecology of sea turtles has been conducted at the Virginia Institute of Marine Science (VIMS) since 1979. We employed a variety of techniques to define the distribution and abundance of sea turtles in Virginia, and to describe their basic biology (e.g., behavior and movements) and causes of mortality. The studies were designed to provide information necessary to manage and conserve these species, which are considered threatened or endangered by the Federal Government (CFR, 1987).

MATERIALS AND METHODS

The work reported here involved examination and measurement of live and dead turtles, aerial surveys, and biotelemetry, permiting us to develop an overview of the biology and ecology of sea turtles in Virginia.

Since 1979 we have established a growing volunteer network of cooperating individuals and agencies who examined and reported data on dead, stranded turtles to us. Data reported included location, species identification, and carapace length of dead, stranded turtles to us. When possible, VIMS personnel examined the specimens, took additional morphological measurements (weight, and length and width of the carapace, plastron and head), and autopsied the turtles. Internal examination included determination of sex, cause of death, and analysis of stomach contents.

Live turtles were provided to us by local cooperating fishermen. Morphological measurements were made, and numbered tags were applied to both front flippers for future identification of individuals. Turtles that appeared healthy were released or were used for telemetric studies. Sick turtles were rehabilitated prior to release.

Since 1982, aerial surveys were flown regularly over Chesapeake Bay (Figure 1) to determine distribution and estimate population densities of loggerheads (Bellmund et al., 1987; Byles et al., MS). Surveys were also flown from Cape Henry, Virginia to Cape Hatteras, North Carolina up to 28 km offshore (Figure 2) to determine the timing and size of the migratory population of loggerheads. All surveys were conducted in a DeHavilland Beaver at an altitude of 152 m. Previous studies (Musick et al., 1985) showed that most turtles are seen in a 250 m wide strip on either side of the airplane and we only used data from within those strips. Thus, the total area surveyed equals the linear km flown multiplied by 0.5 km (250 m x 2 observers). This number, divided into the number of turtles observed, yields relative density (ie. density of turtles at the surface).

The surfacing behavior of turtles affects the population density estimates obtained from aerial surveys because only turtles at the surface are observed. A surface adjustment factor, the inverse of the proportion of the time spent at the surface (Keinath, 1986; Standora et al., 1984), is necessary to account for submerged turtles. Therefore, relative density was multiplied by the surface adjustment factor to provide estimated population density, which was extrapolated to estimate population size for the area monitored. These survey and estimation methods were applicable only to loggerheads, because of observational difficulties related to the other species (ridleys and greens are much smaller and cryptically colored turtles and thus were not easily observed from 152 m altitude) and the paucity of habitat and behavioral data for ridleys, greens, and leatherbacks.

Telemetric studies, which provide movement, habitat, and behavioral data, involved the attachment of radio and/or sonic transmitters to the rear of the carapace. Sonic signals, received by a directional hydrophone aboard a boat, were used to maintain contact with individual turtles. Radio signals, which could only be received by directional antennas when the turtle was at the surface, provided information about the surfacing behavior of individuals. Two ridleys and 11 loggerheads were telemetered in Chespeake Bay, and four loggerheads were monitored in offshore waters.

RESULTS AND DISCUSSION

Sea turtles are seasonal visitors to Virginia waters. Although adults can be found offshore, primarily juvenile turtles enter Chesapeake Bay, which provides forage and shelter from sharks, known predators of small sea turtles (Balazs, 1979; Brongersma, 1972). We know, based on information from both the stranding network and aerial surveys (Bellmund et al., 1987, CETAP, 1982a, b; Musick et al., 1985; Shoop et al., 1981), that turtles are present in this area each year from May to November, which coincides with water temperatures in excess of 18 C. Migration to warmer water is necessary to avoid lethal winter temperatures in Virginia. Biotelemetry and aerial data have shown the migratory routes of loggerheads to be nearshore, and to extend at least as far as Cape Hatteras, North Carolina (Byles et al., MS; CETAP, 1982a & b; Shoop et al., 1981), although winter habitats have not been found.

The four species we have documented in Virginia's waters, in order of increasing abundance, are green turtles, leatherbacks, ridleys, and loggerheads (Table 1). Few verifiable green turtle records from Virginia or adjacent waters exist. We have recorded four dead and one live green turtle from Chesapeake Bay and adjacent waters since 1979 (Table 1), all after 1983. These recent occurences may reflect conservation efforts in the southern range.

The leatherback is the third most abundant species in Virginia but should be considered uncommon. We have examined 13 carcasses and two live specimens since 1979 (Table 1) but regularly observe individuals in the vicinity of Chesapeake Bay mouth on aerial surveys. Leatherbacks subsist on jellyfish and other soft bodied creatures (Carr, 1952). Two species of jellyfish, <u>Aurelia aurita</u> (Linnaeus) and <u>Chrysaora quinquecirrha</u> (Desor) are extremely abundant in the Bay and flush to the Bay mouth where leatherbacks may congregate to feed.

Kemp's ridley is the second most abundant turtle we observe in Virginia. We have examined 50 dead and 30 live specimens during the study period (Table 1). Juvenile Kemp's ridleys appear to use the Chesapeake Bay as a major developmental habitat. There are few places along the Atlantic seaboard where such large concentrations of immature ridleys have been reported. Kemp's ridley is the world's most endangered species of sea turtle (Carr, 1977) and in order that the species recover, it is paramount that every protection be afforded Chesapeake Bay juvenile populations and habitats.

Loggerhead turtles are the most abundant sea turtle of coastal United States and likewise in Virginia. Since 1979, we have recorded 853 dead loggerheads and 171 live specimens from Chesapeake Bay and adjacent shores (Table 1). Because of their abundance, our studies focused primarily on loggerheads.

Population estimates have been made for loggerhead turtles within Chesapeake Bay using densities obtained from aerial survey counts (Byles et al., MS) and modified by behavioral data revealed by biotelemetry studies (Byles, MS) (Table 2). We estimate between 2000 and 10,000 juvenile loggerheads inhabit the Bay south of the Potomac River each summer. Since loggerheads do not inhabit water less than 4 m deep (Byles, MS), this

Table 1: Number of dead and live sea turtles recorded by VIMS since 1979. This table includes all turtles examined by VIMS personnel and cooperating stranding network volunteers. Cc = <u>Caretta caretta</u> (loggerheads), Lk = <u>Lepidochelys kempi</u> (ridleys), Dc = <u>Dermochelys coriacea</u> (leatherbacks), Cm = <u>Chelonia mydas</u> (greens).

	SPECIES								
	Cc		Lk		Dc		Cm		Unknown
YEAR	dead	live	dead	live	dead	live	dead	live	all dead
1979	122	2	7	0	1	0	0	0	9
1980	189	7	9	1	3	0	0	0	6
1981	63	4	7	3	0	0	0	0	6
1982	113	15	2	4	2	0	0	0	17
1983	131	28	5	9	2	0	0	0	5
1984	124	50	7	4	3	0	2	0	8
1985	51	31	1	6	2	1	0	0	7
1986	60	34	12	3	0	1	2	1	2
total	853	171	50	30	13	2	4	1	60
total	1024		80		15		5		60

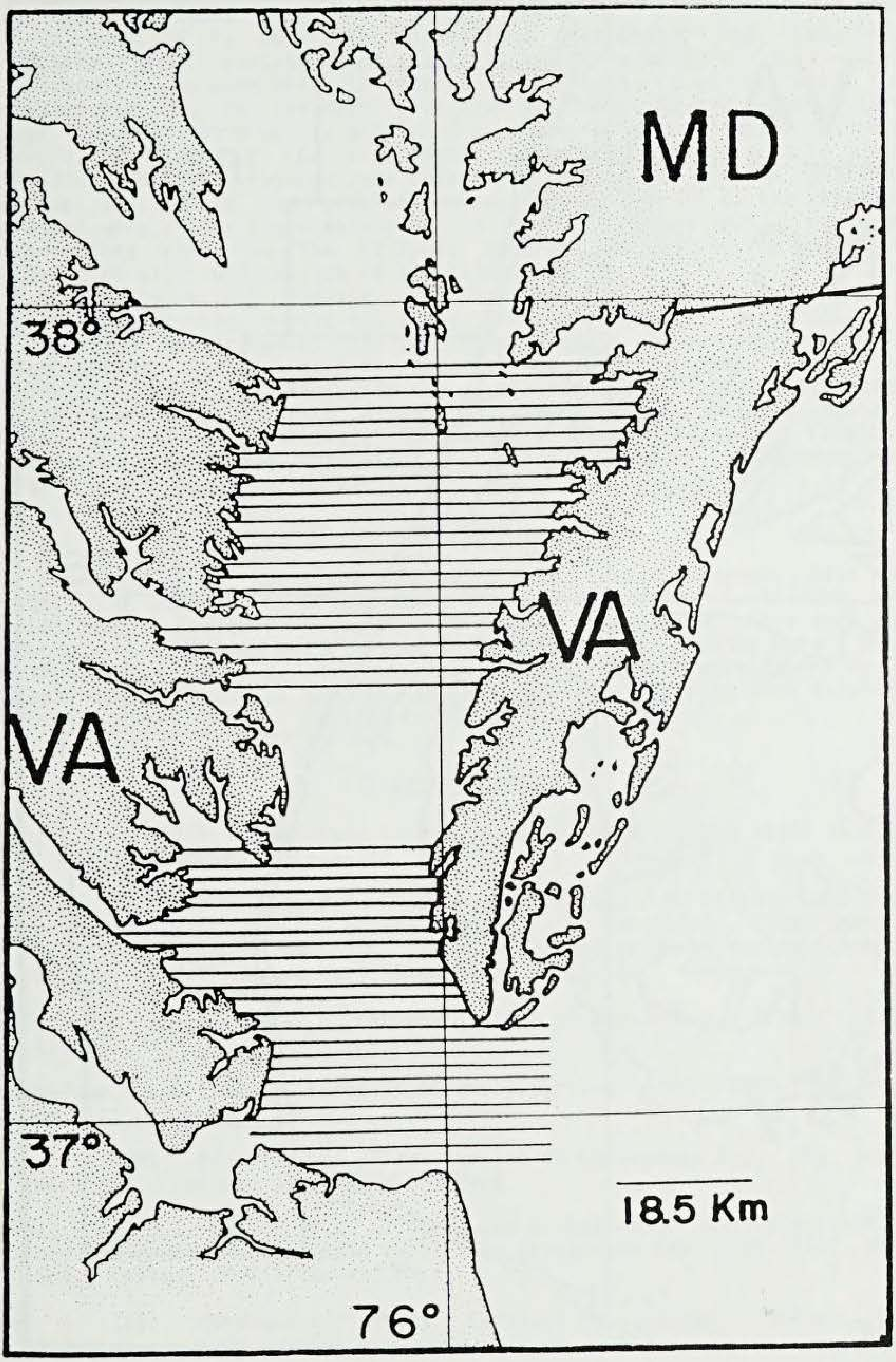
estimate is based on 1383 km^2 of water in the lower Bay that is greater than 4 m deep. Turtle densities in Chesapeake Bay obtained from aerial surveys were multiplied by an adjustment factor of 18.8 to account for submerged turtles. The factor was calculated from radio-equipped loggerheads in the Bay (Byles, MS; Musick et al., 1985). Similar biotelemetry of migrating loggerheads in offshore waters (JAK) revealed they spent more time (17%) at the surface than individuals in estuarine foraging habitats (5%). The difference may be attributable to two factors. Migrating turtles expend more energy than foraging turtles and thus respire more frequently. Also, during migration, these poikilothermic reptiles would benefit from remaining in warmer surface water. The greater surface time of migrating loggerheads necessitates the application of a smaller adjustment factor (5.3) to results of offshore aerial population density estimates.

Offshore aerial surveys between Cape Hatteras, NC, and Cape Henry, VA, during 1985 and 1986 (Figure 2) showed that loggerheads migrated from south of Cape Hatteras into Chesapeake Bight in April and May (Table 2). This immigration time varied by three weeks between the two years. Turtles arrived off the VA coast during late April in 1985, but not until mid May in 1986, and this pattern corresponded with cooler water present later during 1986. Densities of turtles remained relatively constant in offshore waters during summer. In fall 1985 a hurricane in late September cooled the Bay water substantially, which probably initiated sea turtle emigration out of Cheapeake Bay. Turtles moved progressively southward and were south of Cape Hatteras in December. In fall 1986 the emigration from the Bay was less pronounced.

Continued stomach content analyses (JAK) and recent biotelemetric studies (Byles, MS) support the contention of Lutcavage (1981) and Lutcavage and Musick (1985) that ridleys and loggerheads partition available habitat and food resources in the Chesapeake Bay. Loggerheads are found primarily in river mouths and deeper (> 4 m) channels, where they feed on abundant horseshoe crabs, Limulus polyphemus (Linnaeus). Ridleys forage in shallower waters, such as seagrass beds, which are nursery

Table 2. Aerial survey data for 1985 and 1986 combined. Date is split into months, early (E), the first half, and late (L), the last half of each month. F = number of flights, T = number of turtles sighted, A = area covered (km^2), D = adjusted density of turtles (turtles/km^2).

		Mid-Bay				Lower Bay				Offshore			
DATE		F	T	A	D	F	T	A	D	F	T	A	D
April	E	-	-	-	-	-	-	-	-	1	23	63	2.5
	L	-	-	-	-	-	-	-	-	2	128	250	3.5
May	E	-	-	-	-	1	16	66	4.6	4	285	297	6.6
	L	1	5	66	1.4	2	23	98	4.4	4	190	275	4.8
June	E	2	10	121	1.6	1	6	63	1.8	1	5	93	0.4
	L	1	0	60	0	3	56	191	5.5	-	-	-	-
July	E	1	4	65	1.2	1	4	63	1.2	2	54	186	2.0
	L	2	4	105	0.7	3	93	162	10.8	1	8	53	1.0
Aug	E	2	9	126	1.3	2	41	126	6.1	2	34	110	2.1
	L	2	5	123	0.8	2	10	189	1.0	2	44	186	1.6
Sept	E	1	0	60	0	1	12	63	3.6	2	21	88	1.6
	L	1	1	63	0.3	2	16	205	1.5	1	13	140	0.6
Oct	E	1	1	66	0.3	1	8	66	2.3	2	18	80	1.6
	L	-	-	-	-	3	11	194	1.1	3	41	263	1.1
Nov	E	-	-	-	-	-	-	-	-	1	52	181	2.0
	L	-	-	-	-	1	0	63	0	3	41	255	1.1
Dec	E	-	-	-	-	-	-	-	-	2	8	99	0.6



Figures 1.
Chesapeake Bay aerial survey areas. The two sample areas are indicated within the Bay (mid- and lower Bay). Four stratified random east-west lines within one of the areas were flown per flight. Aerial survey data are summarized in Table 2.

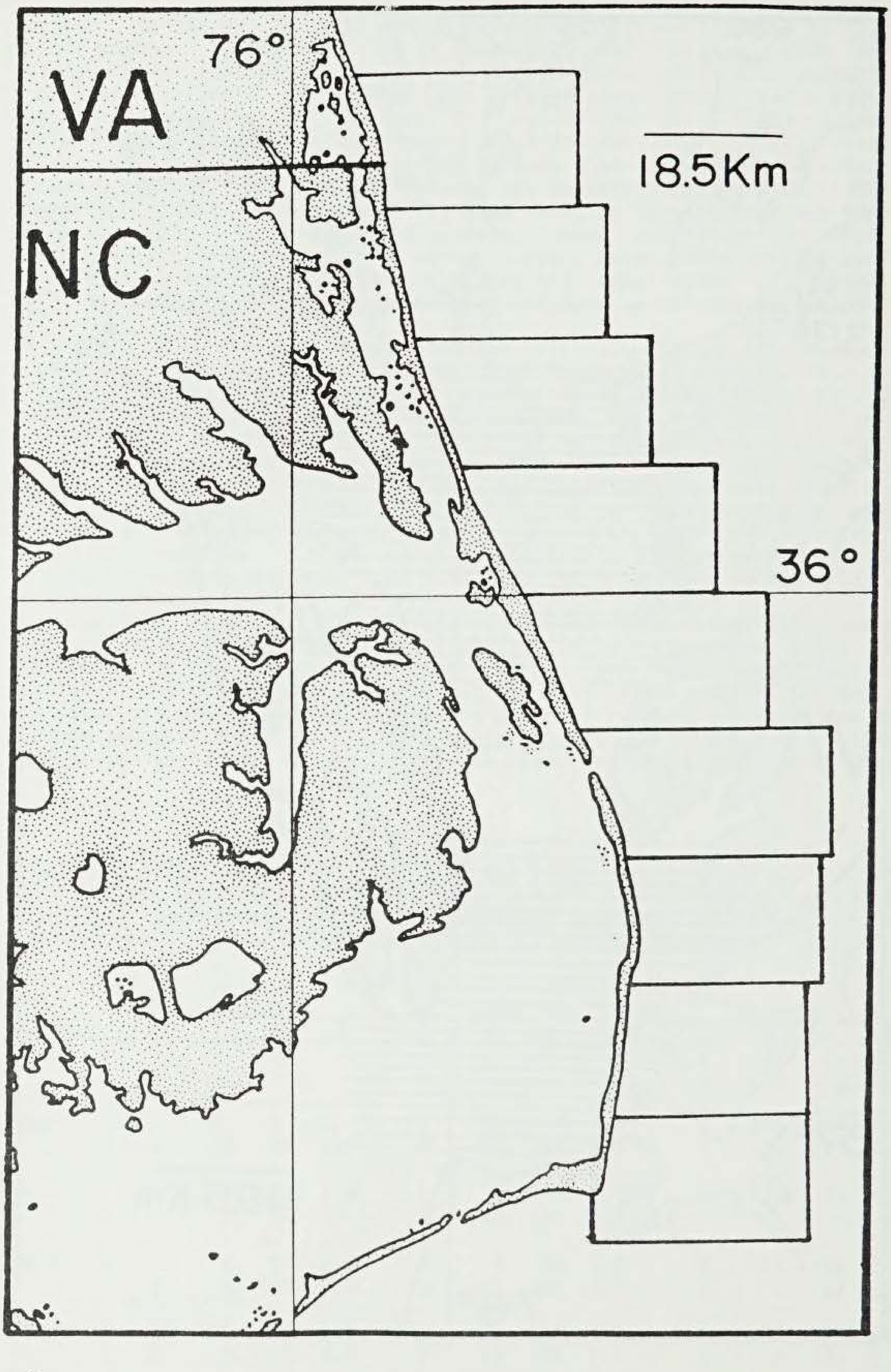


Figure 2.
Continuous offshore aerial survey lines. At least seven lines were sampled per flight, lines sampled were dictated by previous observations. Aerial survey data are summarized in Table 2.

grounds for their predominant prey, blue crabs, Callinectes sapidus Rathbun (Orth and Heck, 1980).

In addition to population densities, movement, and behavior, information about causes of mortality is necessary to effectively manage these species. We were able to determine apparent cause of death in approximately 50% of the dead turtles we examined. Severe decomposition and/or lack of visible wounds precluded a concrete determination in the other cases. All of the explainable deaths were attributable to human activities. Propellor wounds were observed on 10% of the turtles examined and two individuals had gunshot wounds. Forty percent of the examined carcasses were either found entangled in gill or pound nets, or with constrictions marks on the flippers or neck suggesting entanglement (Bellmund et al., 1987; Musick et al., 1985).

Virginia's waters provide important habitat for large numbers of loggerhead sea turtles during the summer. Chesapeake Bay in particular is an important developmental habitat for juvenile loggerhead and Kemp's ridley turtles. Although much has been learned in recent years about sea turtles in Virginia (including species size, sex ratios, stranding statistics and cause of death, diving behavior, migration patterns, age and growth, and blood chemistry), much still needs investigation. Critical information is needed on energetics, cost of migration, mechanisms of migration, and overwintering habitat.

ACKNOWLEDGMENTS

We would like to thank the VIMS sea turtle personnel, past and present; D.E. Barnard, S. Bellmund, J. Brown, W.M. Jones, R.E. Klinger, and M. Lutcavage. Reviewers comments were greatly appreciated. This work was conducted under US Fish and Wildlife Service Endangered Species Permit PRT-680118, issued to J.A. Musick. Parts of the research were funded by US National Marine Fisheries Service, and Non-game Wildlife Fund from Virginia Game Commission. This is VIMS Contribution No. 1413.

LITERATURE CITED

Balazs, G.H. 1979. Loggerhead turtle recovered from a tiger shark at Kure Atoll. 'Elepaio 39: 145-147.

Bellmund, S., J.A. Musick, R.E. Klinger, R.A. Byles, J.A. Keinath, and D.E. Barnard. 1987. Ecology of sea turtles in Virginia. VIMS Special Scientific Report No. 119. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA. 48 pp.

Brady, M.K. 1925. Notes on the herpetology of Hog Island. Copeia 1925: 110-111.

Brongersma, L.D. 1972. European Atlantic turtles. Zool. Verh. (Leiden), Nr. 121. 318 pp.

Byles, R. MS. Biotelemetry of sea turtles in Chesapeake Bay. Va. Inst. Mar. Sci., College of William and Mary.

Byles, R.A., J.A. Musick, R.E. Klinger, and S. Bellmund. MS. Distribution and abundance of loggerhead turtles in Chesapeake Bay. Va. Inst. Mar. Sci., College of William and Mary.

Carr, A. 1952. Handbook of turtles. Comstock Pub. Assoc. Ithaca, NY. 542 pp.

Carr, A. 1977. Crisis for the Atlantic ridley. Mar. Turtle Newsletter 4: 2-3.

CETAP. 1982a. A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. outer continental shelf. Ann. Rep. 1980, U.S. Dept. Interior. Contract AA551-CT8-48. Unpublished report submitted to Bur. Land Manag., Wash. D.C.

CETAP. 1982b. A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. outer continental shelf.

Final Rep., U.S. Dept. Interior. Contract AA551-CT8-48. Unpublished report submitted to Bur. Land Manag., Wash. D.C.

CFR. 1987. Endangered and threatened wildlife and plants. 50 CFR 17.11 and 17.12. U.S. Dept. Interior. 32 pp.

Ernst, C.H. and R.W. Barbour. 1972. Turtles of the United States. Univ. Press Kentucky, Lexington. 347 pp.

Hardy, J.D., Jr. 1962. Comments on the Atlantic ridley turtle Lepidochelys olivacea kempi, in the Chesapeake Bay. Chesapeake Sci. 3: 217-220.

Hardy, J.D. 1969. Records of the leatherback turtle, Dermochelys coriacea coriacea (Linnaeus), from the Chesapeake Bay. Bull. Maryland Herp. Soc. 5: 92-96.

Keinath, J. 1986. A telemetric study of the surface and submersion activities of Dermochelys coriacea and Caretta caretta. MS Thesis. Univ. R.I., Kingston, R.I. 85 pp.

Lutcavage, M. 1981. The status of marine turtles in Chesapeake Bay and Virginia coastal waters. MA Thesis. Va. Inst. Mar. Sci., College of William and Mary, Gloucester Pt., Va. 126 pp.

Lutcavage, M. and Musick, J.A. 1985. Aspects of the biology of sea turtles in Virginia. Copeia 1985: 449-456.

Musick, J.A., R.A. Byles, R.E. Klinger, and S. Bellmund. 1985. Mortality and behavior of sea turtles in the Chesapeake Bay. Unpublished report submitted to N.M.F.S., N.E. Region. Va. Inst. Mar. Sci., College of William and Mary, Gloucester Point, VA. 52 pp. +3 app.

Orth, R.J. and K.L. Heck, Jr. 1980. Structural components of eel-grass (Zostera marina) meadows in the lower Chesapeake Bay. Estuaries 3: 278-288.

Shoop, C., T. Doty, and N. Bray. 1981. Sea turtles in the region between Cape Hatteras and Nova Scotia, in 1979. In: CETAP, A characterization of marine mammals and turtles in the mid and north Atlantic areas of the U.S. outer continental shelf, 1979. Univ. R.I. pp. IX-1 - IX-85. Unpublished report submitted to Bur. Land Manag. Wash. DC.

Standora, E.A., J.R. Spotila, J.A. Keinath, and C.R. Shoop. 1984. Body temperatures, diving cycles, and movement of a subadult leatherback turtle, Dermochelys coriacea. Herpetologica 40: 169-176.