Virginia Herpetological Society

NEWSLETTER

Volume 6, Number 2 August 1996

Timber Rattlesnakes and Pleistocene Climates

Submitted by W.H. Martin, Biologist, Rt. 3, Box 804, Harpers Ferry, WV 25425

During the past 2 million years huge glaciers have advanced and retreated somewhere between 4 and 21 times. Ice sheets in excess of 1 mile thick covered what is now the northwestern United States. The last glacial advance (the Wisconsinan) is believed to have lasted about 100,000 years; prior to it, a warm interglacial (the Sangamonian) lasted about 10,000 years. We are now 11,000 years into what is probably another interglacial, the Holocene. A good summary is provided by Peilou (1991). Available evidence from palynological (pollen) sources and from geology indicate that temperatures in the mid-Atlantic region during the Wisconsinan glacial advance may have averaged about 16 °F lower than those of today (Barry, 1982). Periglacial geologic features formed under conditions of permafrost with mean annual temperatures below freezing provide evidence of a very cold climate in the central Appalachians (Pewe, 1982). Palynological evidence indicates prevailing vegetation was dominated by conifers such as spruce and jack pine (Delcourt and Delcourt, 1981). Recent fossil evidence indicates that the reptile and amphibian assemblage in the unglaciated Appalachians was fairly similar to the herpetofauna of today, but Holman (1995) notes a few southern and western additions.

How do we reconcile this seeming disharmonious assemblage of plants and animals? An older view, the *stripe hypothesis* with whole communities of plants and animals moving north and south together has been replaced by a newer scenario, the *plaid hypothesis* which suggests that each species responds in its own way (Holman, 1995). Barry (1982) suggested that most of the temperature change occurred in winter. Watts (1980) suggested a similar phenomenon in the South Carolina Coastal Plain. Lundelius et al. (1983) advanced the *pleistocene climatic equability hypothesis*, suggesting that winters were warmer and summers cooler than today in the southern and central United States. For the Appalachians, however, this hypothesis is completely inconsistent with the evidence. In fact, we are now coming out of an equable climate phase. An idea that reptiles and amphibians made physiological and behavioral adaptations to cold climate has also been advanced (Fay, 1988). Reptiles are capable of making certain adaptations to colder climates such as aggregating in large gestating and hibernating groups in the few suitable sites. That they are able to adapt to radical vegetation changes is evidenced by the survival of many species in areas converted to agriculture. However, if physiological

adaptations to increased cold had been made, we should still see these adaptations in population persisting in the boreal zones of high elevations and northerly areas.

In 1973, when I began a long-term field study on the timber rattlesnake, a primary objective was to determine the extremes of measurable life history traits that influence the distribution of this Appalachian rattlesnake. Through mark-recapture sampling I was able to work out much of the species life history. To determine the factors that limit the range of any species it is useful to study the species at the fringes of its range. In the case of reptiles, in those areas where the climatic limits are approached, one should expect to see a lowering of the population sizes due primarily to constraints on reproduction. My primary study area is located in the northern section of the Blue Ridge Mountains from Virginia's Shenandoah National Park north to southern Pennsylvania. In the Blue Ridge, elevations of my study sites range from 900-3300 feet and active seasons (the time span from spring emergence to fall ingress) from 4.9-5.9 months with the bulk of them clustering around 5.4 months. Rattlesnakes reproduction in the Blue Ridge is characterized by a late age of maturity and long intervals between births (Martin, 1993). Females typically birth for the first time at 8 years of age and at 3 year intervals with some old large females birthing at two year intervals. However, a season of below-average temperatures and above average cloud cover results in putting off reproduction for most of the population. A year of low reproduction is usually followed by a year of high reproduction. Timing of birthing also is affected by weather (Martin, 1992). During a typical year, births begin at the lower warmer sites in mid- to late August and finish at the higher elevations in mid- to late September. A majority of the young and their emaciated mothers have a chance to forage before hibernation. Birthing can be advanced by up to three weeks by heat and drought or delayed by 3 weeks when cool cloudy conditions prevail. When birthing is delayed, the last snakes are giving birth at denning time in October. Yet I saw no evidence that they were unable to bring the young to term in the Blue Ridge. In northwestern New York, where there is a short active season (4.6 months, 68-70°F July mean) Brown (1991) similarly reported no reproductive failures.

In 1989, I began studies on a population located in the Allegheny Mountains in northeastern West Virginia where the elevation is 3500 feet and the active season is 4.6 months with a mean July temperature of about 65°F. Here birthing typically occurs in mid- to late September immediately prior to hibernation with no opportunity for the females to forage and replace their depleted fat stores. A preliminary analysis indicates that females usually birth initially at an age of 10 years and to date, 4 year reproductive intervals only, have been recorded. The total population is high but dominated by juveniles of the 1986-1988 and 1991 cohorts. In contrast with most Blue Ridge populations, where adult breeders make up about 40% of the total, adults of this Allegheny population make up only about 30%. In the autumn of 1989 and again in 1992, I got some clues to the reasons for the demographic differences. With above-average cloud cover and below-average temperatures during those two years, I observed that the pregnant females were forced into hibernation before birthing. Neither those individual females nor their expected cohorts of young have been seen subsequently. From the year 1985 through 1988 and again in 1991, temperatures were above average and rainfall was below average. Rattlesnakes of the high Allegheny's thrived and reproduction was high, thus the high proportion of juveniles in the sample was high.

In 1995, I began work at a site with several dens located in close proximity to one another at elevations of 4100-4500 feet on North Fork Mountain in West Virginia. Here the active season is 4.2-4.3 months and mean July temperatures are about 63-64°F. That this site is truly near the climatic limits of the timber rattlesnakes is indicated by a small population dominated by old males with few juveniles from only a few aged cohorts. In spite of its remote location and abundant exposed shattered rock for denning and gestating, the snakes appear to be simply unable to build up even a moderate population. The harsh climate and resultant infrequent breeding along with a probable high rate of reproductive failures produces a demographically-stressed population.

Several fossil sites in the central Appalachians (Bath and Highland Counties, Virginia; Pendleton County, West Virginia; and Bedford County, Pennsylvania) have *C. horridus* fossils that have been variously aged from 11,000-30,000 years BP during the Wisconsinan glacial advance (Holman, 1995). In addition to timber rattlesnakes some of these sites had pine snakes (*Pituophis melanoglecus*), corn snake (*Elaphe guttata*), eastern and mole kings (*Lampropeltus getula, L. calligaster*) and other species, which are today associated with more southerly or westerly range.

Based on what I now have recorded about the climatic requirements and limits of the timber rattlesnake, there is only one Pleistocene climate hypothesis that seems consistent with all the evidence: *The Pleistocene climatic inequability hypothesis*, which supports a climate consisting of cold winters and mild summers. The moisture regime was near the humid-arid boundary with perhaps half the precipitation of today. Summer temperatures in the unglaciated Appalachians averaged no more than 6°F lower

than those of today. Precipitation was much lower than today because of permanent massive high pressure over the glacier. Although the frost-free season may have only been about 3 months, the clear air and abundant sun for thermoregulation allowed an active season in excess of 4 months for most reptiles. This climate probably has no modern analogue.

In general, it is the combination of active season length, solar insolation (affected by canopy and cloud cover) and summer temperatures that are the more critical limiting effects on reptile distribution, rather than winter temperatures (outside of the permafrost zone of course). Canopy openness rather than species composition of the canopy can be an important consideration for reptiles and amphibians. Low temperature requirements are similar for most temperate zone reptiles (some turtles excepted) and the effect of winter temperatures is to limit reptiles to places where they can get below the frost line. In the mild climates that currently prevail in the more southerly parts of the United States, various ephemeral situations (e.g., root systems of dead and living trees and burrows of small mammals) are used as winter refuges. In the colder climates, hibernation is limited to deep semi-permanent sites such as deep rock fissures, talus slides, springs and limestone caverns or sinkholes.

In general, plant distribution is affected by moisture and winter temperatures more importantly than summer temperatures. A reason for the dominance of conifers during glacial advances is that most of the deciduous trees that now dominate the Appalachians are less cold-hardy and were simply killed off by the winters. Conifers were able to occupy those areas free from competition. Although I will leave the details up to the paleobotanists, the vegetation of the central Appalachian region (38-39 degrees north latitude) may have been as follows: The areas above about 4000 feet would have been permafrost with tundra vegetation. At elevations below about 3000 feet, the moist coves and riparian corridors were dominated by fairly dense stands of conifers whereas the ridges had open-canopied conifers with very sparse scrubby or grassy vegetation on the southerly slopes. The valleys, located largely in rain shadows, would have been grasslands with their large herds of associated megafauna (bison, elk wolf, etc.).

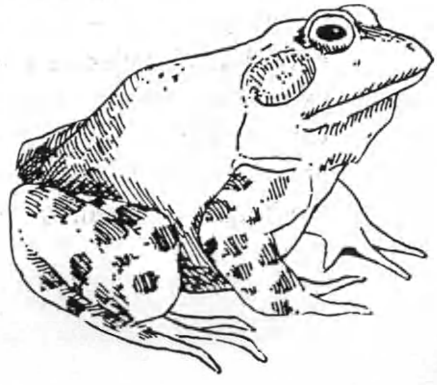
Fairly mild summers with abundant sunshine allowed the reptiles and amphibians to persist in places where they could find suitable hibernacula. The reptiles and amphibians were concentrated along the streams, south slopes of ridges, and in the vicinity of limestone caverns. These sites, especially the latter, provided the major refugia for many species. The location of suitable overwintering sites was probably the major factor in local distribution of reptiles. Most ectotherms were probably limited to areas below 3000 feet.

Because of vastly different moisture and thermal requirements, each species of flora and fauna reacted differently and for the most part independently of each other. This is especially so for the reptiles and amphibians which, for the most part being predators, are not necessarily dependent on the particular plant communities with which they are associated today.

Postscript - The northern portion of the 35 mile long North Fork Mountain is in the Monongahela National Forest and the southern portion (the part over 4000 feet and south of US 33) is mostly privately owned but until recently remained pristine and roadless. This is one of the most scenic areas in the Eastern United States, and contains several disjunct "sky lands" with rare assemblages of boreal plants. The entire mountain should have been protected as a showcase wilderness and ecological laboratory. The Nature Conservancy owns a portion of North Fork Mountain, but tragically a developer has bought large portions of it and has already built vacation homes on the highest part. The balance is slated for similar development.

Acknowledgments - I thank W.S. Brown for critically reviewing this paper.

(*Literature Cited on Page 10*)



Teaming with Wildlife Advances

Reprinted and slightly modified from the Wildlife Society Newsletter, Aug. 1996.

Two important Teaming with Wildlife meetings were held in June. A Congressional oversight hearing before the Fisheries, Wildlife & Oceans Subcommittee of House Resources and a briefing of the Congressional Sportmen's Caucus, focused positive attention on the initiative. Supportive testimony at the oversight hearing from conservation, industry and government sportsmen were well presented. Unexpectedly, Rep. Shaddegg (R-AZ), a "no new taxes" freshman provided an enthusiastic statement of support.

The Congressional Sportmen's Caucus briefing was well attended with over 100 members and staffers. It provided an excellent forum to address sportmen's concerns about the initiative. Three messages came across loud and clear in both meeting:

1) *Bipartisan sponsorship is needed* - Securing Republican and Democratic sponsors is extremely important. Interest is Teaming with Wildlife is evident, but most members of Congress are waiting to see leadership action before they make a commitment to cosponsors the bill.

2) *All stakeholders must understand the workings of the initiative* - Because Teaming with Wildlife relies on a manufacturer's excise tax, industry, governors, Congressional delegates, conservationists and sportmen must understand the workings of the federal aid funding process.

3) *The coalition must expand and strengthen* - Representatives from ski, recreational vehicle and sporting goods industries and anti-tax groups are finally beginning to organize. By strengthening a supportive coalition, informed citizens, industry and Congress can be persuaded to support a nominal fee to conserve wildlife.

The Teaming with Wildlife national steering committee is taking action to address each of these needs. Members of the VHS and the entire Teaming with Wildlife coalition must continue to recruit conservation organizations and gain endorsement from members of Congress, governors and industry. The Teaming with Wildlife coalition now includes over 1,000 organizations. For more information and a list of companies, please contact the International Association of Fish and Wildlife Agencies, 444 N. Capital St. NW, Suite 544, Washington DC 20001 or call (202) 624-7890.

ESA ALERT

Submitted from the Endangered Species Coalition .

The U.S. Fish and Wildlife Service narrowed the list of potential endangered species candidates from 4,000 to 182. Only top-tier candidates for which the FWS had sufficient information to support listings remain on the candidates list. According to FWS spokesperson Meg Durham, "This was a scientific scrubbing of the candidate list that was long overdue." But some biologists say that the move will adversely effect efforts to protect plants and animals by sending a "we don't care about the other species" signal to federal land managers. The Biodiversity Legal Foundation is challenging the FWS decision in federal court.

HERP HAPPENINGS

Massanutten Mt. Survey - On May 5, 1996, members of the VHS, braving rainstorms and blood-thirsty gnats, conducted an extensive herp survey on the Massanutten Mt.range. Areas surveyed included streams, wetlands, shale barrens, springs, and ponds.. A total of 10 reptile and 16 amphibian species were collected. New county records were found for the Northern spring salamander (*Gyrinophilus porphyriticus*) and fence lizard (*Sceloporus undulatus*). A detailed species list will be presented in the next issue of Catesbeiana.

Spring Meeting - The spring meeting for the VHS was held at the Smithsonian Conservation and Research Center in Front Royal, Virginia on May 3rd. Topics included society T-shirts, the fall meeting, a herp workshop for teachers, the snake poster, and a state repository for data presented in a Catesbeiana. The fall meeting will be held October 26th at Maymount Park in Richmond. See the next issue of Catesbeiana for additional details.

Snapping Turtle Study - Because of the poor market demand, no snapping turtles were collected by Hazelwood Brothers Seafood Company this year. During the previous year, the Virginia of Game and Inland Fisheries was able to collect data from approximately 11,000 turtles. Joe Mitchell is currently analyzing this data and a report is expected by the end of the year.

Bog Turtle Study - Since the beginning of the study, 118 bog turtles have been found from 6 sites in Floyd Co. Of these, 81 were previously marked and 37 were new captures. The movements of 23 turtles are being monitored with the use of radio transmitters attached to their carapace. One bog turtle moved 530 m between wetlands connected by a stream, while another turtle was found crossing a road 2.7 km from its original location. Work will continue on this project through Spring 1997.

SSAR Meeting - VHS members Joe Mitchell and Shawn Carter attended the annual Society for the Study of Amphibians and Reptiles meeting in Kansas. In addition, Shawn presented his findings on the bog turtle study.

Peaks of Otter Salamander - VHS President, Paul Sattler, is continuing work on the Peaks of Otter Salamander (*Plethodon hubrichti*). A manuscript describing the results the first two years of investigating the effects of timbering on *P. hubrichti* populations was submitted for review. A second study looking at possible movements out of timbered area was begun by marking out of the study site.

Nature Center Coalition - Through the efforts of the Coalition for a Nature Center in Central Virginia, VHS members Lora DeVan, Mike Hayslett (Sec./Tres.), and Jim Scranton are busy attempting to establish a nature center in the Lynchburg area. In support of the groups routine programs featuring Virginia's herps, the Blue Ridge Herpetological Society recently donated a 8 ft reptile display/housing unit for the nature center. The coalition is accepting a land gift of 85 acres in Bedford County. Currently, the coalition is based out of Lynchburg. For more information on these efforts, contact Mike Hayslett at (804) 845-4505.

VAEE Award - Congratulations to teacher Patricia E. Grunow of York High School for receiving the Virginia Association of Environmental Educators Distinguished Service Award. Ms. Grunow organized the Students Against Violating the Earth (S.A.V.E.) club that helped to educate the local community about preservation and conservation. Students are presently developing a thirty-minute educational video that documents the seasonal cycles of 3 unique vernal ponds in the Grafton Plains Complex, which is home to barking treefrog (*Hyla gratiosa*), Mabee salamander (*Ambystoma mabeei*), and two-toed amphiuma (*Amphiuma means*).

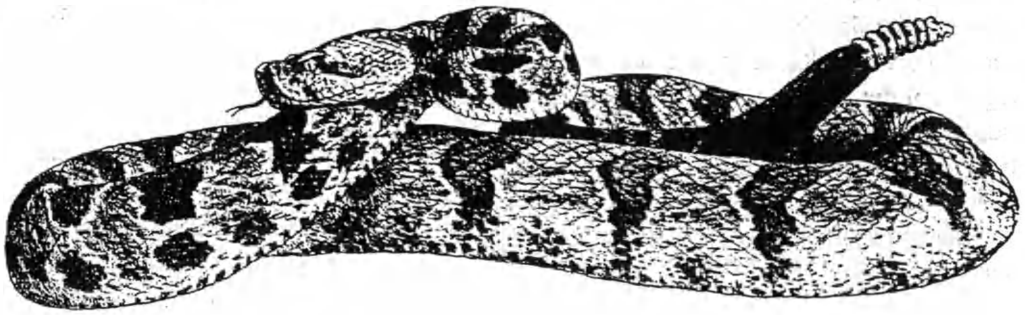
THE VHS WANTS YOU

to give a presentation at our fall meeting. The society currently is accepting presentations for the fall meeting to be held at Maymount Park, Richmond on October 26th. Topics should be relevent to Virginia's herps. Titles should be submitted by September 29th. For additional information contact Paul Sattler at; Liberty University, Biology Department, Box 20,000, Lynchburg, Va 24506-8001 or call (804) 582-2209.

Timber Rattlesnake

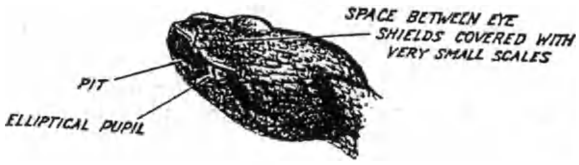
(Crotalus horridus horridus)

Legal status in U.S.: Unprotected
Legal status in Virginia: Unprotected



Description

The timber rattlesnake is a rough-scaled heavy bodied venomous snake with a broad, distinct head. It is marked with about 20 to 25 wavy crossbands or chevrons of black on a ground color that are highly variable and can be tan, yellow, gray, brown, or black. The tail is usually black and the rattle is tan. Young tend to by grayer than most adults. Timber rattlesnakes belong to the group called pit vipers. These snakes, which include copperheads and cottonmouths, have a deep facial pit on each side of the head situated below and midway between the eye and the nostril.



The most distinct characteristic of this species is, of course, their rattle. The rattle is a loose attachment of horny segments that strike against one another to produce a buzzing sound when the tail is vibrated rapidly. An additional segment is added with each shed. Because the rate of shedding depends on temperature, growth, and time elapsed, a rough estimate of age can be obtained for young snakes that still have the button or that have a distinct taper to the rattle. For snakes with uniform-sized rattle segments one can only note they are old adults probably exceeding 14 years of age. In captivity rattlesnakes are known to exceed 30 years of age.

Adults are usually from 30 to 50 inches in total length exclusive of the rattle. Males average 10 to 15% longer than females. Young snakes typically require 2 years to double their lengths and 4-5 years to triple them at which time they are approaching maturity.

Habitat

In Virginia, the timber rattlesnake primarily occurs in the mountainous parts of the state where it habitat needs, heavily wooded country with exposed broken rock, are best met. Timber rattlesnakes overwinter in deep-crevices located in rocky areas from October until April or May. Because of the remoteness of these areas, large aggregations of rattlers still occur at some places. The summer range generally occupies an area within 1-2 miles of the den site. Adult males usually travel further than females and juveniles.

Food

Timber rattlesnakes predominantly feed on warm-blooded prey such as rodents and birds. Their method of capturing prey is to wait motionless until the prey comes within striking distance. Once the prey has been bitten, the snake waits for the venom to take affect. The rattlesnake's venom is a hemotoxin and contains powerful enzymes that breaks down tissue, which not only kills but also predigests the prey. The snake then uses heat sensing pits located just below the each eye to locate its meal. Rattlesnakes, like all snakes, are able to dislocate their jaw and swallow meals whole. These meals can sometimes be one third their body weight or larger.

Distribution

The timber rattlesnake ranges from Kansas and Texas, north to Wisconsin and New England, and south to Florida. In Virginia, timber rattlesnakes occur in the Blue Ridge Mountains, mountainous regions of the western part of the state, and isolated ridges in the western Piedmont. A subspecies of timber rattlesnake, the canebrake rattlesnake (*Crotalus horridus atricaudatus*), is a state-endangered species and occurs in some parts of southeastern Virginia.

Breeding Biology

A few fast-growing females breed at 4 and 5 years of age, but for most individuals, both males and females, first mating occurs at around 7 years of age with the young born approximately one year later. The interval between birth is usually 3 years for an individual female. The mating season is late July to mid-September. Gestation and birthing usually take place at rocky well-exposed sites. Gestating females feed little if any but usually attempt to secure food after birthing as do the newborn after scattering. Birthing typically occurs from mid-August to late September. Litter size averages about 8 and the young stay at the birth place with the mother for 1-2 weeks until after postnatal molt. Newborns are about 11 inches long and acquire the first permanent rattle, the button, 1-2 weeks after birth with the initial skin shedding.

Current Status and Threats

Living in the rocky outcrops of mountians, and requiring large tracts of undeveloped habitat, the timber rattlesnake is truely a symbol of Virginia's wilderness. The bulk of the timber rattlesnake's habitat in Virginia is fairly secure because it is located on public lands. The portion located on private lands however, is under threats from encroaching housing developments and vacation homes.

Natural predators of rattlesnakes include red-tailed hawks, kingsnakes, and blackrat snakes. However, humans pose the greatest threat to their survival. Snake-hunting, which is selective against gestating females, occur in scattered areas around the state. The extent is poorly known but some colonies are known to have been severely depleted.

The risk of dieing from a rattlesnake bite is less than being killed by lightening strikes, bee stings or horses. Since 1948, five deaths have been attributed to bites by rattlesnakes. Most snakebites have occured when somebody attempts to handle or kill the snake; therefore, one should not disturb rattlesnakes if found.

To learn more about rattlesnakes and other Virginia reptiles we suggest the following material:

Conant, R., and J.T. Collins. 1991. The Peterson Field Guide Series - A Field Guide to Reptiles and Amphibians of Eastern and Central North American. 3rd edition. Houghton Mifflin Company, Boston. 450 pp.

Linzey, D.W., and M.J. Clifford. 1987. Snakes of Virginia. 2nd printing. University Press of Virginia, Charlottesville. 159 pp.

Mitchell, J.C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, D.C. 325 pp.

Editors Note:

This is a draft copy of what will eventually be a fact sheet for the timber rattlesnake in Virginia. We wish to thank W.H. Martin for his development of the early draft, and Ned Smith for his art work contribution. Any suggestions and corrections on this draft should be sent to the editor.

Literature Review

The purpose of this column is to inform members of recent herpetological research pertinent to Virginia or of special interest to the Society's membership. Papers or notes from professional journals, new books, "gray literature" reports, and popular magazine articles are acceptable for inclusion. Members are encouraged to send recently published items of interest to the editor. Submissions will be accepted subject to the approval of the editor.

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Parker, W.S. 1996. Age and survivorship of the slider (Trachemys scripta) and the mud turtle (Kinosternon subrubrum) in a Mississippi farm pond. Journal of Herpetology 30(2): 275-278.

Pechmann, J.H.K. 1995. Use of large field enclosures to study the terrestrial ecology of pond breeding amphibians. Herpetologica 51(4): 434-450.

Plummer, M.V., and N.E. Mills. 1996. Observations on trailing and mating behaviors in hognose snakes (Heterodon platirhinos). Journal of Herpetology 30(1): 80-82.

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Virginia's Natural History Weekend Retreat

September 20-22, 1996

Co-sponsored by

The Wintergreen Nature Foundation
The Virginia Museum of Natural History

Virginia's Natural History is a fascinating story. From the broad eastern Coastal Plain to the rippled ridge and valley on the western boundary with West Virginia, the state possesses interesting land forms as well as interesting life forms. Virginia's plant and animal populations show many links with past geologic climate changes, but we seldom have the mysteries of the past. A rare opportunity exists to study these and other facets of natural history this September. Whether parent, teacher, or naturalist, come prepared for quality instruction from Virginia's finest field scientists.

For more information, call The Wintergreen Nature Foundation, Rosalind Rowe (804) 325-8172, or Eva Lowe (804) 325-8169.

Coming Soon to a Fall VHS Meeting Near You

*** Society T-Shirts ***

- 100% Cotton
- Society Logo on Front
- Spotted Salamander Design on Back

$13 VHS Members
$15 Nonmembers

BOOKS

Reptiles of Virginia
By Joseph C. Mitchell

Beginning with Captain John Smith's observations of the region's reptilian fauna , this book offers the first complete catalog of the reptiles of Virginia, from the sea turtles of the Atlantic Coast to the snakes, turtles, and lizards of the Piedmont and Blue Ridge Mountains.

Including full-color illustrations of numerous habitats and thirty-two of the species, distribution maps for each species, and easy-to-use keys for quick identification (with a separate key for young snakes), The Reptiles of Virginia is a practical resource and an essential overview of this faunal group and its habitats.

The book is based on data derived from examination of some 10,000 Virginia specimens, yielding a wealth of new information on the ecology, life histories, and biogeography of reptiles in the state. Each of the 62 individual species accounts provides local common names, the historical context for scientific names, present habitat affinities, and information about geographic variation in color, pattern, and morphology, as well as reproduction, predators, and prey. The book also explores the human impact on Virginia's natural habitats and species' distribution patterns, presenting a historical perspective on the conservation of these animals.

About the Authors

Joseph C. Mitchell is an adjunct professor of environmental and conservation biology at the University of Richmond and is a research associate of the Virginia Museum of Natural History. John M. Anderson, a curatorial assistant at the Virginia Museum of Natural History, participated in a herpetological survey of Assateague Island funded by the National Park Service.

Amphibians and Reptiles of Assateague and Chincoteague Islands
By Joseph C. Mitchell and John M. Anderson

Assatague and Chincoteague islands are among the best-known barrier islands off the Atlantic coast of North America. Millions of people visit them every year for recreation. Most visitors are well acquainted with the famous Assateague ponies, but few know that these islands are home to unique assemblages of plants and animals.

This book provides information on some of the islands most secretive inhabitant, the amphibians and reptiles. Most of the frogs, salamanders, turtles, lizards, and snakes have occupied these islands since they were formed thousands of years ago. The reptiles and amphibians have learned to live in a harsh environment characterized by hot and dry sand, scarcity of freshwater, and periodic overwash by saltwater. Each of the seven species of amphibians and eighteen species of reptiles can be readily identified using the keys, color photographs, and descriptions in this book. Many interesting aspects of their biology are summarized in highly readable form.

Within these pages we discover why the islands are inhabited by far fewer species than are known to occupy the Delmarva mainland. We also learn about measures proposed to insure their longterm conservation, and how to observe these animals in their natural habitats. This book is the only source available that provides a window into the biology and ecology of two fascinating groups of animals on these barrier islands.

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