

VaHS PHENOLOGY PROJECT  
II: CONCEPTS AND USES

by (Mr.) Joseph C. Mitchell\*  
Virginia Commonwealth University  
Richmond, VA 23284

In VaHS BULLETIN No. 81, I made a plea to the VaHS membership for support of a new program - phenology in relation to Virginia's amphibians and reptiles.

Since the concept is a relatively recent one, it is important to discuss, once again, the concept of phenology and how it can be useful to the goal we share: increased knowledge of native reptiles and amphibians.

First, some definitions:

**PHENOLOGY:** the study of the timing of recurring biological events, the causes of their timing with regard to living (biotic) and non-living (abiotic) forces, and the phases of the same or different species (Lieth, 1974).

**SEASONALITY:** the occurrence of certain obvious biotic and abiotic events or groups of events within a definite period or periods of the year (Lieth, 1974).

**Autecology:** a branch of ecology dealing with the interrelations between individual organisms or individual kinds of organisms (such as species) and their environment.

Phenology is concerned with the study of seasonality and is an aspect of both autecology and population ecology. Plant and animal life histories are directly or indirectly tied to recurring climatic events, such as rainfall, temperature increase or decrease, and photoperiod (amount of light). Botanists have long kept records of plant phenophases (the timing and duration of life history events). Such events as leaf opening, flowering, fruiting, leaf fall, etc., have been recorded by many. As early as the late 1700's, phenological networks were established to gain insights into these recurring events (Hopp, 1974).

More recently, networks of hundreds of volunteers have been established in various states and countries. In North Carolina, for example, a network centered at the University of North Carolina (Chapel Hill) assembles data for computer analysis supplied by 300+ volunteers (Lieth and Radford, 1971).

Such data are useful in a number of ways. Historically, phenological data were used to construct calendars for agriculture, horticulture and forestry workers. Recently, phenological data have been used for management of natural resources and development of models in theoretical and applied ecology (Lieth and Radford, 1971). Two approaches have been used:

- (1) Phenodynamic analysis. This approach analyzes linkages between species' life history events and various outside stimuli.
- (2) Phenological mapping. This is a geographical approach concerned with presenting a visual model of various phenological events.

Lieth and Radford (1971) presented a map of North Carolina showing the onset of spring based on the flowering dates of dogwood and redbud. Such models aid in our understanding of the timing of various phenomena and allow people in both the pure and applied sciences, from the theoretician to the farmer and naturalist, to predict the appropriate times to expect a particular life history event.

Continued on page two.

VaHS BULLETIN is a newsletter appearing at least four times a year. Its pages are open for articles or comment on topics related to Virginian herpetology. The principal activity is the state survey of reptiles and amphibians. (Request VaHS BULLETIN No. 80).  
ROSTER ISSUE UNDER PREPARATION.

VaHS BULLETIN is sent free of cost to Virginia's university and college biology, zoology, and natural science departments. Science and biology teachers --high school or junior high-- may receive the VaHS BULLETIN (with membership) at \$1.00 a year; please make request on a school letterhead, if possible.

VaHS PHENOLOGY PROJECT II  
Concept and Uses, cont'd:

Amphibians and reptiles offer excellent subjects for phenological observations. They are ectothermic ("cold-blooded") and are more closely tied to the physical environment than endotherms ("warm-blooded" animals). Reptiles and amphibians respond in various ways to temperature, rainfall, and photoperiodicity. Thus their life history events, such as emergence from hibernation, mating, etc. are directly influenced by environmental (abiotic) forces. These forces recur through time and provide and give cues that start, or halt, a particular phenophase or life history event.

An example of the variation of the timing of several phenophases for the painted turtle (*Chrysemys picta*) is presented in the table on page four. Note that most dates are very rough and are indicated only by the month. Also, only one author mentions hatching dates. This indicates that our knowledge is very limited and that we need to write down much more data. In Virginia, for instance, this species may emerge from winter dormancy one to two weeks later in the highlands than on the Coastal Plain. Such differences can lead to an

understanding of how our native species adapt to variations in Virginia's climate.

GOAL:

I suggest that we set as our first goal a set of phenological maps for the species on which we get sufficient data. We can, for instance, map the regional variation of the first calling times of the spring peeper (*Hyla crucifer*). Such a map could be published in the VaHS BULLETIN and could be used to indicate the timing of the herpetological spring throughout the state. We could eventually publish a calendar based on phenological data and, if enough data were available, produce calendars for different regions of Virginia, such as the southeast, central, and mountain regions.

If we want to determine if phenophases follow the classical Coastal Plain, Piedmont, and Mountain physiographic provinces, we can do so by collecting and submitting data. A third, and perhaps most important, use for VA phenological data, is in environmental impact statements and in management and protection of faunal resources especially endangered or threatened species. With these goals in mind, we can start gathering data.

USEFUL DEFINITIONS:

Phenodynamic analysis: the investigation of seasonal events of all members of one defined community or ecosystem. (An example is given in Lieth, 1974.) This approach analyzes the links between species' life history events and various environmental stimuli.

Phenophase: the timing and duration of life history events such as leaf opening, flowering, fruiting, leaf fall, etc.

Synecology: a branch of ecology that deals with the structure, development, and distribution of ecological communities in relation to environment.

Photoperiod: the relative lengths of alternating periods of lightness and darkness as they affect the growth and maturity of an organism (as in the effect upon the flowering of plants and the breeding of animals).

Phenophase definitions:

The following definitions are taken from a manuscript submitted to the HERPETOLOGICAL REVIEW. Suggestions for modification or addition welcomed.

Arrival: emergence of individuals from dormancy.  
Departure: observation of dormant individuals, noted absence of active indi-

PHENOLOGY PROJECT II  
(continued)

Phenophase Definitions:  
(continued from p.2)

viduals or observation of last active individuals.  
Courtship: ritual behavior or observation of mating pairs (for salamanders or reptiles).  
Breeding: characteristic calling of anurans (frogs and toads) and observation of mating pairs.  
Egg-laying: deposition of eggs or construction of a nest by oviparous species.  
Larvae: Appearance of the sub-adult stages of amphibians; e.g., tadpoles.  
Metamorphosis: appearance of transformed individuals of amphibian larvae.  
Hatching: observation of appearance of juveniles of oviparous (egg-laying) reptile species.  
Birth: observation of appearance of juveniles of viviparous species.

Each phenophase has the following attributes:

Onset: first observation;  
Termination: last observation of a phenophase.  
Duration: time from onset to termination.  
Extent: number of individuals in given phenophase.  
Timing: when the onset and termination of a phenophase occurs during the calendar year.

----- JCM

METHODS

As stated in VaHS BULLETIN No. 81, the methodology is simple. A field notebook should be carried whenever one goes into the field or drives any distance. Data for each species encountered should be recorded with the given definitions in mind. In addition, exact locality data, elevation (if possible), weather, and characteristics of associated flora and fauna should be noted. These data can either be transferred to VaHS forms or sent directly to the VaHS Phenology Coordinator in rough form. All data will be stored in species files and used to meet the goals stated above.

Dig out those old notes you took many years ago. Be conscious of writing notes whenever you are out. We may only be able to get pure herpetological data at first. Data on weather, and associated flora and fauna can come when observers start taking such notes. Be aware, also, that all of your notes are valuable, even if you are in the field only during the summer. The ideal is to have data input from as many people and localities in VA as possible. You can help!

COMMENT:

The VaHS Phenology Program is designed to gain a deeper understanding of the biology of Virginia's reptiles and amphibians. Accumulation of data is easy, not time-consuming. It does require the keeping of detailed field-notes. This program can be adapted to individuals or small groups. It provides an activity for those who do not wish to collect and preserve live specimens. It permits contributions of valuable information to the understanding and management of Virginia's herpetofauna. I invite each VaHS member to participate.

(Correspondence welcomed.)

(Mr.) Joseph C. Mitchell\*  
 6611 CARMEL ROAD  
 RICHMOND, VA 23228

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Editor's notes: Mitchell is a long-time VaHS member and the VaHS Phenology Program Coordinator. He is also a biology instructor at VA Commonwealth University, Richmond, VA ...

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TABLE AND BIBLIOGRAPHY

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APPEAR ON THE NEXT PAGE.  
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PHENOLOGY PROJECT II  
(Conclusion)

Literature cited:

1 Cagle, F.R. 1937. Egg-laying habits of the slider (*P. troosti*), the painted turtle (*C. picta*) and musk turtle (*Sternotherus odoratus*). J. Tenn. Acad. Sci., 12:87-95

2 Christiansen, J.L. and E. O. Moll. 1973. Latitudinal reproductive variation within a single subspecies of painted turtle (*Chrysemys picta belli*). Herpetologica 29:152-163.

3 Ernst, C.H. 1971. Population dynamics and activity cycles of *C. picta* in s.e. Pennsylvania. J. Herpetol., 5:151-160

4 Gibbons, J.W. 1968. Reproductive potential, activity, and cycles in painted turtle (*C. picta*). Ecology 49:399-409.

5 Hopp, R.J. 1974. Plant phenology observation networks. pp 25-43. in H. Leith, ed., Phenology and Seasonality Modeling. Springer-Verlag, N.Y.

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7 Leith, H. 1974. Purposes of a phenology book. pp. 3-19, Leith, Phenology and Seasonality Modeling. Springer-Verlag, N.Y.

8 Leith, H. and J.W. Radford. 1971. Phenology, resource management and synagraphic mapping. Bioscience 21:62-70

9 Mitchell, J.C. 1976. VaHS phenology project I: Plea. VaHS BULLETIN, 81:4-6.

10 Moll, E.O. 1973. Latitudinal and intersubspecific variation in reproduction of painted turtle (*Chrysemys picta*). Herpetologica 29: 307-318

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Dates for selective phenophases for the painted turtle, *Chrysemys picta*.  
(See page 2, col. 1.)  
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Locality	Mating	Egg-laying	Hatching	Literature
Michigan	March-May	June-early July	---	(4)
Illinois	---	12 May- 22 July	-----	(10)
Wisconsin	---	late May-early July	---	(2), (10)
Minnesota	---	1 June-28 July	---	(6)
Pennsylvania	29 April-16 June	18 May-16 July	July-Sept.	(3)
Virginia	?	?	?	
Tennessee	May-June	July	---	(1)
Louisiana	---	late May-July	---	(10)
New Mexico	May-July	May-July	---	(2)

BRIEF REPORT ON THE WORK OF THE AMPHIBIANS AND REPTILES PANEL AT VPI&SU

Information on herpetile populations and ecology is skimpy or lacking. The A&R panel at the VPI & SU Symposium on Endangered and Threatened VA Plants and Animals (May 19-20) kept its focus on forms indigenous to Virginia. It completely revised the list appearing in VaHS-B #76 (1974) based on Russ.

The panel deliberations included examination of the VaHS distribution map for each variety on the list of Virginia's 73 amphibians and 68 reptiles (VaHS BULLETIN No. 80).

The panel agreed to list the five marine turtles as "Endangered" in VA and adjacent waters. Of the 141 amphibians & reptiles known to occur in VA, the panel designated 8 as belonging in the "Special Concern" category, and 15 were put in the "Status Undetermined" category. A list of the species in each category will be found on page 6. The panel chairman, a member of the Committee on Geographic Areas of Special Concern, recommended the Mount Rogers-Whitetop and Great Dismal Swamp areas as being of "special concern" because of natural habitat destruction, etc. VaHS will announce the availability of the VPI & SU proceedings as soon as they have been published.

The Panel on Amphibians and Reptiles: (Mr.) Ray E. Ashton, Jr., Director of Education, N.C. State Museum of Natural History, Raleigh, N.C.; (Dr.) C. Kenneth Dodd, U.S. Fish & Wildlife Service, Office of Endangered Species, Washington, D.C.; (Dr.) Robert H. Giles,\*\* Div. of Forestry and Wildlife Resources, VPI & SU; (Dr.) Thomas H. Krakauer,\*\* Dir., Roanoke Valley Science Museum, Roanoke, VA; (Dr.) Richard L. Hoffman,\*\*Dep't of Biology, Radford College, Radford, VA; and (Mr.) Franklin J. Tobey,\* editor, VaHS BULLETIN, of Loudoun County, VA.. Mr. Gary Williamson,\* Ranger, Chesapeake, VA, was the administrative manager on the panel, standing in for Mr. Michael J. Clifford,\* Extension Agent, Amelia, who was unable to attend.

Others participating in the symposium proceedings in alphabetical order were:

(Mr.) William F. Adams, US Army Corps of Engineers, Wilmington, N.C.; (Mr.) Joel D. Artman,\* VA Dep't of Forestry, Charlottesville, VA; (Mr.) Robert Bader, Brookneal, VA; (Ms.) Lynn Collins, Portsmouth, VA; (Dr.) Robert Chipley (The Nature Conservancy, Arlington, VA; (Dr.) John E. Cooper\* N.C. State Museum of Natural History, Raleigh, N.C.; Prof. Frederick B. First,\* Wytheville Community College, Wytheville, VA; (Mr.) Harry L. Gillam,\* Editor, VIRGINIA WILDLIFE, Rich-

mond, VA; (Dr.) Eugene V. Gourley,\*Dep't of Biology, Radford College, VA; (Mr.) Gerard (Rod) Hennessey,\* Coastal Reserve Project, The Nature Conservancy, Massawaddox, VA; (Dr.) Don W. Linzey,\* VPI & SU, Chairman, Conference Steering Committee; (Mrs.) Alicia V. Linzey chaired the panel on Geographic Areas of Special Concern, VPI & SU, Blacksburg, VA; (Mr.) Paul H. Loeffelman, Appalachian Electric Power Co., Environmental Engineering Div., Canton, O. (Mr.) Thomas A. Muir, Box 33, Hillsboro, VA; (Mr.) James E. Nolke, US Fish & Wildlife Service, Baltimore, MD; Prof. Douglas Ogle,\*\* Dep't of Biology, Va. Highlands Comm'ty College, Abingdon, VA; (Mr.) Dale E. Pike, WV Dep't of Natural Resources, Morgantown, WV; (Ms.) Julie Prodyms, Lord Fairfax Community College, Middletown, VA; (Mr.) William H. Redmond, TVA, Norris, Tenn.; (Ms.) Madeleine E. Roggenbuck,\* Blacksburg, VA; (Mr.) Donald W. Schwab, biologist, US Fish & Wildlife Service, Suffolk, VA; (Mr.) A. Floyd Scott, KY Nature Preserves Commission, Frankfort, KY; Prof. Robt C. Simpson,\*\* Lord Fairfax Community College, Middletown, VA; (Mr.) Peter L. VIA, Mill Mountain Zoo, Roanoke, VA; (Mr.) Donald L. West, VA Dep't of Highways, Environmental Div., Richmond, VA; and Prof. Shirley K. Whitt\*\* Dept of Biology, Lynchburg, College, Lynchburg, VA...

BULLETINS TO BE BACK ON THE TRACK BY FALL 1978

Apologies to members who anxiously awaited receipt of the VaHS BULLETIN this spring and early summer!

The VPI&SU (VA. Tech.) symposium on endangered and threatened species of plants and animals took a lot more of the editor's time than anticipated. A report on the May event appears on this page.

Sorry for the delayed mailings of # 85 and 86. If you haven't received either one please let the editor know, soonest.

Frank J. Tobey, Jr.,  
VaHS BULLETIN  
P.O. Box #1376  
Leesburg, VA 22075

Amphibians and Reptiles Panel

STATUS

<u>"ENDANGERED"</u>	Standard common name <sup>2/</sup>	Proposed name change <sup>3/</sup>
<u>Caretta caretta</u>	loggerhead	none
<u>Chelonia mydas</u>	green turtle	none
<u>Dermodochelys coriacea</u>	leatherback	none
<u>Eretmodochelys imbricata</u>	hawksbill	none
<u>Lepidochelys kempi</u>	ridley	none
<u>"SPECIAL CONCERN"</u>		
<u>Desmognathus wrighti</u>	pigmy salamander	none
<u>Leurognathus marmoratus</u> <sup>1/</sup>	shovel-nosed salamander	shovelnose salamander
<u>Plethodon n. hubrichti</u>	Peaks of Otter salamander	Thunder Ridge salamander
<u>Plethodon n. shenandoah</u>	Shenandoah salamander	<u>Plethodon shenandoah</u>
<u>Plethodon w. ventromaculatum</u>	spot-bellied salamander	spotbelly salamander
<u>Plethodon punctatus</u>	Cow Knob salamander	white-spotted salamander
<u>Clemmys muhlenbergi</u>	bog turtle	none
<u>Crotalus h. atricaudatus</u> <sup>1/</sup>	canebrake rattlesnake	(subspecies invalidated)
<u>"STATUS UNDETERMINED"</u>		
<u>Cryptobranchus a. alleghaniensis</u>	hellbender	Eastern hellbender
<u>Necturus m. maculosus</u>	mudpuppy	none
<u>Necturus punctatus</u>	dwarf waterdog	none
<u>Siren lacertina</u>	greater siren	none
<u>Ambystoma t. tigrinum</u>	eastern tiger salamander	none
<u>Aneides aeneus</u>	green salamander	none
<u>Rana virgatipes</u>	carpenter frog	none
<u>Sternotherus minor peltifer</u>	stripe-necked musk turtle	stripeneck musk turtle
<u>Graptemys geographica</u>	map turtle	none
<u>Graptemys pseudogeographica ouachitensis</u>	Ouachita map turtle	none
<u>Trionyx s. spiniferus</u>	Eastern spiny softshell	none
<u>Anolis c. carolinensis</u>	green anole	none
<u>Natrix r. rigida</u>	eastern glossy watersnake	glossy crayfish snake ( <u>Regina r. rigida</u> )
<u>Pituophis m. melanoleucus</u>	northern pine snake	none
<u>Tantilla coronata</u>	southeastern crowned snake	none

Footnotes:

1/ Refers to southeastern population of the timber rattlesnake (Crotalus h. horridus).  
Pisani et al (1972)  
A re-evaluation of the subspecies of Crotalus horridus, Trans., Kan. Acad. of Science 75(3), pp. 255-263.

2/ Conant, R. (1975) "A Field Guide to Reptiles and Amphibians of Eastern and Central North America" Houghton Mifflin Co., Boston, Mass.  
  
(VaHS Bulletin No. 80 is a "Virginia Index" to the Conant Field Guide; Free index on request to VaHS.)

3/ Collins et al (1978)  
"Standard Common and Current Scientific Names for North American Amphibians and Reptiles" SSAR Miscellaneous Publication Herpetological Circular Number 7.

FLORIDA'S FROG CALLS ARE ON LP DISC; KEY TO AMPHIBIANS & REPTILES ON SALE!

A new phonograph record is available on Florida's frogs. The disc was made by the Florida State Museum Associates as an educational project to acquaint the public with the variety of amphibian sounds heard in Florida.

This disc presents recordings of all the commonly-heard frogs and toads of Florida narrated by Linda Berker. (LP disc \$4./+)

Also available from the Florida State Museum is a key to the reptiles and amphibians of Florida by (Mr.) Ray E. Ashton, Jr., with illustrations by Joyce Murray. The manual has been designed to make identification "simple, accurate, and fun." The guide treats all of the local species including-- information on the range, habitat, and abundance of each form. (\$2. a copy.)

The disc and manual are available from:

FSM Collectors' Shop, Florida State Museum, Univ. of Florida, GAINESVILLE, FL 32611

+ Add .50 to cost for mail orders for postage, etc.

SEE ESHL MEETING NOTICE IN COLUMN THREE THIS PAGE.

NOTE FROM THE GALAPAGOS I.

Post card: 3 July '78

Have eleven students out here this year. Have made lots of improvements in our station, but we need a source of fresh water. Also, we would like to have a summer to work our Tropidonotus complex. It really needs re-working!

Hope to see you at the fall meeting of ESHL! (See column 3, this page!)

Best, (Dr.) Lester E. Harris, Jr. 4635 MARATHON PLACE RIVERSIDE, CA 92505

Los Angeles TIMES item:

"Scientists from Mexico and the United States have a plan to help save the endangered ridley which lays its eggs along the sandy Gulf Coast of Texas. More than 1,200 turtle eggs will be hatched under the supervision of scientists and the young turtles transported to a marine laboratory near Galveston. The turtles will remain in protective custody until they are large enough to escape their natural predators."

LOS ANGELES TIMES 30 July 1978

\* VaHS member \*\* VaHS Director

"SOMETHING FOR EVERYONE" VaHS-WHS-ESHL MEETING AT SMITHSONIAN INSTITUTION

The fall meeting of VaHS will be held simultaneously with the regular fall meeting of the Eastern Seaboard Herpetological League (ESHL). VaHS will co-host the meeting with the Washington (D.C.) Her-

Saturday, October 28, 1978 Baird Auditorium, Natural History Building, Wash, DC petological Society (WHS).

General interest programs are being lined up for a noon to six p.m. session. Dr. George R. Zug\*\* (VaHS) Curator of Vertebrate Zoology, will welcome the ESHL group, followed by Mal Skaroff, (PHS) ESHL Coordinator. Robert Tuck, ESHL's Founder, is coming back from Iran to talk on herpetology in the field; Prof. Robert Simpson, Lord Fairfax Community College, Middletown, VA, will tell about wood turtle studies in northern VA which took these turtles off the endangered list. (See pp5-6.)

Other illustrated talks will cover reptiles and amphibians of tropical or semitropical areas. This meeting will afford an excellent opportunity to meet others interested in herpetology and to visit famed collections in the Smithsonian's Natural History Museum and the great National Zoological Park on Connecticut Ave, N.W. Washington, D.C.

DOOR PRIZES AT ESHL MEETING PRESENTED BY THE SSAR.

The Society for Study of Amphibians and Reptiles (SSAR), one of three national herpetological societies, has given ESHL a set of the color plates from the reprint of Holbrook's "North American Herpetology." These will be used as door prizes at the fall ESHL meeting in Washington, DC.

Malvin I. Skaroff

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"EASTERN SEABOARD HERPETOLOGICAL LEAGUE page"

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Florida's Frog Calls on LP Disc, on sale;  
Florida's Amphibs & Reptiles, key on sale.  
Post card from Dr. L. E. Harris, Jr. (Galapagos)  
L.A. TIMES item on saving endangered ridley turtle

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ESHL MEETING at the Smithsonian Institution's  
National Museum of Natural History,  
Baird Auditorium, 28 October 1978  
Saturday afternoon noontime to six.

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PLEASE: CHECK YOUR ADDRESS LABEL, IF IT IS INCORRECT PLEASE LET VaHS KNOW PROMPTLY!

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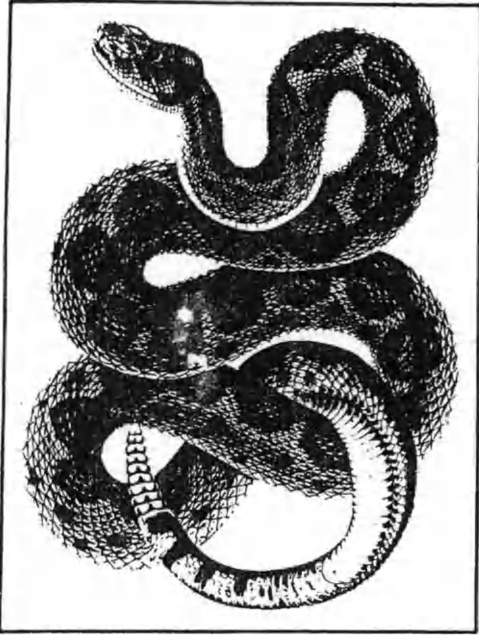
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YOU ARE INVITED TO THE #87  
VaHS-WHS-ESHL MEETING!  
SMITHSONIAN, WASH, DC,  
NATURAL HISTORY BLDG.  
28 OCTOBER 1978: 12 to 6 p.m.  
Saturday afternoon.  
(See tentative program p.7)

\*CLIFFORD, Mr. Michael J.  
Extension Agent, Box 311  
AMELIA, VA 23002 (AMIA)



# SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES



Howard K. Gloyd's

## **Rattlesnakes** **Genera *Sistrurus*** **and *Crotalus***

WITH A NEW INTRODUCTION BY HOBART M. SMITH AND HERBERT S. HARRIS, JR.

*About 320 pages including 31 plates of photographs; Index; 7 x 10 inches; Clothbound*

GLOYD'S monograph, "The Rattlesnakes, Genera *Sistrurus* and *Crotalus*, a Study in Zoogeography and Evolution," has been a standard reference since it was published in 1940 by The Chicago Academy of Sciences. Now long out-of-print, it is one of the most sought after of herpetological books because of its continuing utility. It includes an historical narrative about rattlesnakes, a taxonomic key, and detailed accounts of the 45 species and subspecies of rattlesnakes then recognized. These accounts contain for each form an extensive nomenclatural synonymy, a detailed description including scutellation and coloration, a section on distribution with map and list of specific localities, and a discussion of variation. There are 22 tables of data on geographic variation, 32 figures and maps in the text, and 31 plates containing, in part, 47 photographs of living rattlesnakes, plus an index.

The reprint also includes a new introductory essay by Hobart M. Smith and Herbert S. Harris, Jr., containing a biography of Howard K. Gloyd, a recounting of the production of his book, and an extensive table showing the current status of scientific names utilized in Gloyd's book.

### **Prices and Ordering**

SSAR members, if ordered *before November 1*

\$15 clothbound

Institutions; Non-members; All orders received *after November 1*

\$20 clothbound

Orders may be placed now; the book will be issued in December 1978. To take advantage of special pre-publication rates, SSAR members must send their orders *before November 1*. All orders should be sent to Dr. Douglas H. Taylor, Department of Zoology, Miami University, Oxford, Ohio 45056, USA. Please make checks payable to "SSAR"; receipt sent on request only. Prices include postage, world-wide.

A pricelist of other Society publications can be obtained from Dr. Taylor.