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 MATING AND EGG-LAYING IN
 THE SPRING PEEPER
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by (Mr.) Chris Pague*
 BLACKSBURG, VA.

In late winter and early spring of 1975, calling, mating, and egg-laying spring peepers were collected from several localities in MONTGOMERY County, Virginia.

Observation of treefrog amplexus and oviposition were made under various conditions in the laboratory as well as in the field. In the laboratory, frogs were placed in five gallon aquaria containing tap water (40° to 60°F). Also in the water were natural substrate and vegetation. Observations of egg-laying frogs were made with the eye and with a Super-8 movie camera equipped with zoom lens. Lighting was provided by two photo lamps placed behind the camera and observer. Field observations, though not as detailed, agreed with the laboratory results.

The spring peeper (Hyla crucifer) is one of the most familiar treefrogs even to those people who do not study herpetology. The upward slurred whistling call is one of the early signs of spring and surely one of the most familiar. In the thoughts

of many, the mating and egg-laying of frogs is boring if not altogether passive. With treefrogs, this is not the case.

Many of the treefrogs, chorus frogs, and cricket frogs, lay their eggs singly or in small bunches. [Few species in North America, lay the total complement of eggs in one place (as in Bufo and Rana); though the laying of "small masses" (as used by Wright and Wright, 1949) is not uncommon.] Necessarily following this is the process of multiple fertilizations. For instance, a spring peeper deposits from 250 to 1,000 eggs in a season. Each egg is laid individually. This means that sperm must be emitted by the male and received by the female (or egg) 250 to 1,000 times. (I am not here considering the possibility of sperm storage as there is no evidence to support it in H. crucifer).

How does this take place in Hyla crucifer? The males precede the females to the breeding sites.

The females become ready to mate (ovulate) at individually varying times during the breeding season. This allows a relatively few females to enter the breeding area (containing many males) during any given night, hence giving each female a high probability of meeting a potential mate.

As the female enters the breeding area, any males noticing her movements orient toward her. She is attracted to an individual male. When she has approached to within a few inches of the singing male, he will leap or crawl onto her back. He places his fists just behind and above where her forelegs join her body. His back legs are free of the female. This position is called amplexus and the special type is known as supra-axillary amplexus.

After attaining this position and holding it for a few minutes or a few hours, there is a sudden movement to a suitable location for laying eggs; i.e., oviposition. The female does all of the swimming; the male riding along passively. Each

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MATING AND EGG-LAYING IN THE SPRING PEEPER, continued from page one.

time the female lays an egg, she must swim to a suitable location. (Note: Occasionally two eggs are laid in the same spot; rarely more.) A suitable location (to the female) appears to be any protruding object beneath the surface of the water which she can firmly grasp with her forelegs. If something is so wide that she cannot grasp it, she will usually move to another spot.

After she has found a suitable location, she strongly arches the back, upturning the cloaca to the belly of the male. An instant after the female begins this, the male raises his cloaca. Then, the male thrusts down and forward in a copulatory thrust (term used by Gosner and Rossman, 1959). It is highly probable that the sperm is emitted at this stage. The female straightens out bringing her cloaca forward between the hind legs where the egg is placed on an object to which it adheres. All this time, the male is holding on to the female by the forelegs, while hanging free in the water. This rather complicated behavior pattern is repeated 250 to 1,000 times over a few hours. The release mechanism for Hyla crucifer has not yet been described.

The late Dr. G. K. Noble and Mrs. Noble made some apparently original observations on this phase of reproduction in Hyla crucifer in 1923 while observing the Pine Barrens treefrog (Hyla andersoni).

Noble and Noble described the fertilizing and egg-laying process by dividing it into four steps:

- 1) The female cloaca upturned, and egg or its capsule (rarely two) appears in mouth of cloaca.
- 2) Cloaca of female usually touches posterior ventral surface of male's body in upward movement.
- 3) Emission of spermatozoa apparently takes place as cloaca touches or passes near the ventral surface of the male.
- 4) Back straightened and cloaca of female brought forward beneath body where the egg (or eggs) is shot out against some object to which it adheres.

It is obvious, in comparing the two sets of observations, that there are major discrepancies:

A) Noble and Noble (1923) mention nothing of a copulatory thrust and claimed that sperm is emitted when the female's upturning cloaca passes the male's cloaca.

Analysis by film shows this to be a very unlikely time of sperm emission as the male is usually upturning his vent at the time the female is upturning hers. A more likely time would be during the copulatory thrust where the two cloacas make contact.

B) Noble and Noble describe the egg as being "shot out" against an object. Again, film analysis and field observations show this to be a bad term to describe the event. The egg is placed against an object to which it adheres. At the time of egg expulsion, the female cloaca is within 1 mm of the object on which the egg is to be laid.

On the basis of the above observations, it can be seen that the spring peeper (H. crucifer) does not have a passive mating but one that is active. There is a very stereotyped sequence of events that must be followed. Is this a possible species-specific series of events which might serve as an isolating mechanism? It is difficult to say as there have been so few recorded and detailed observations on oviposition in most amphibians. Jameson (1957) has seriously questioned the

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MATING AND EGG-LAYING IN SPRING PEEPER, continued from page two.

value of life history data in determining phylogenetic relationships. Duellman (1967) claimed that courtship and mating cannot be considered as primary ethological isolating mechanisms.

Undoubtedly, much remains to be discovered in the life histories of even the most common species of North American frogs and toads. The "odd-ball species" are always of special interest and many have been relatively thoroughly studied. With the naked eye, cameras, and other tools, we can record and accurately analyze the behavioral traits of many herpetiles. Until we know more about the lives of many species, we should not try to make systematic use of the life history data that is currently in circulation. However, further investigation may provide information of great taxonomic significance.

Acknowledgement: Without the constant encouragement and advice of Dr. R. D. Ross and Dr. T. A. Jenssen, none of this study would have been done.

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Literature cited:

1) Duellman, W.E., 1967. Courtship isolating mechanisms in Costa Rican hylid frogs. HERPETOLOGICA 23(3):169-183.

2) Gosner and Rossman, 1959. Observations on the reproductive cycle of the swamp chorus frog, Pseudacris nigrita. COPEIA 3: 263-266

3) Jameson, D.L., 1957. Life history and phylogeny in the salientians. J. Systematic Zoology, 6(2): 75-78.

4) Noble, G.K., and R.C. Noble, 1923. The Anderson Tree Frog, Hyla andersoni Baird, Observations on its habits and life history. ZOOLOGICA, 11 (18): 413-455.

5) Wright, A.H., and A.A. Wright, 1949. Handbook of frogs and toads, 3d ed. Comstock Publishing Co., Ithaca, N.Y.

"TURTLES OF VIRGINIA" IN
JUNE'S VIRGINIA WILDLIFE

The June 1976 edition of VIRGINIA WILDLIFE magazine carries an article on "Turtles of Virginia." The author is Joseph C. Mitchell, long-time VaHS member from Richmond, VA, currently in graduate school at Tempe, Arizona.

From: AUDUBON NATURALIST
NEWS, Washington, D.C.

Mrs. Constance P. WARNER*

"When Constance P. Warner retired from nursing in the field of human eye care, she extended her interest in eyes to the eye adaptations of wild animals. For 15 years, Mrs. Warner worked as a volunteer photographer at the National Zoological Park and built up a collection of some 40,000 slides of 2,500 different subjects. She has travelled throughout the U.S. and the world to photograph animals not available locally, and she has received a citation as an honorary collaborator with the Smithsonian Institution. Mrs. Warner is recognized as the foremost photographer in her field, and her eye photo collection -- as well as her collection of animal photographs and of the adaptations of feet, skin, beaks, tongues, etc., -- have been published worldwide." (Mrs. Warner is a member of VaHS of long-standing. She attended several of the VaHS meetings at the National Zoo in the early 1960's and, at one of these, showed the attendees a number of her excellent photos of reptiles and amphibians.)

AUDUBON NATURALIST NEWS
8940 Jones Mill Road
Washington, D.C. 20015

RELATIVE ABUNDANCE AND
SEASONAL ACTIVITY OF
SNAKES IN AMELIA COUNTY

by Michael J. Clifford*
County Extension
Agent, Amelia, VA.

Amelia County, VA., includes among its inhabitants at least 18 species of snakes. Several other species may occur within the area but have not been recorded, at least in recent history.⁺ Data and opinions on relative abundance and seasonal activity of the observed species will be discussed in this article.

AMELIA County is located in Virginia's central Piedmont, totally above the fall line. The topography is gently rolling, with altitudes ranging from 200 to 500 feet. Soils vary from clay to sandy loam. Nearly 75% of the county is forested with various hardwoods and pines.

Corn, soybeans, small grains, and tobacco, are the common agricultural crops. The major stream systems include the Appomattox River, Deep Creek, and Flat Creek. The latter, and many smaller creeks contain many large beaver swamps that provide excellent amphibian and reptilian habitats.

+ U.S. National Museum of Natural History records show the Mud S. was once present.

The information in the accompanying table (p. 5) was accumulated from early 1972 through October 1975 with the exception of one scarlet snake caught in July 1971. Many of the snakes were brought to the County Extension Office both dead and alive, by county residents. Some are DOR⁺⁺ records. A large number were seen or captured by the author in the field. Several were removed from homes after calls by frightened residents. All snakes included in the data were actually seen and identified by the author.

This data gives some indication of the relative abundance of the species in AMELIA County. However, variables such as species size, habitat, proximity to people, daily periods of activity, secretiveness, and other factors cloud the picture. It would probably be more accurate to compare species of similar habits and size when drawing conclusions about relative abundance.

The black rat snake (Elaphe obsoleta obsoleta) is, by far, the most commonly seen snake in the county. Nearly 15% of those recorded were taken from inside houses. An additional 30% were found on home grounds. Of the adult eastern hognosed snakes (Heterodon platyrhinos platyrhinos) about 25% were black phase. The single ring-

++ D.O.R. = Dead on road.

neck snake (Diadophis punctatus) from AMELIA, and three others from adjacent NOTTOWAY County, show traits of both the northern and southern subspecies. For information on the eastern milk snake X scarlet king snake intergrade, see VaHS B.#70.

Graph and table on page 5.

Assuming that the number of specimens reported is a function of seasonal activity, the graph shown leads to interesting but not unexpected conclusions. The snakes emerge from hibernation in early spring (March and April) and then reach a yearly peak of activity during May. They are actively breeding and feeding during this warm, but not oppressively hot, month.

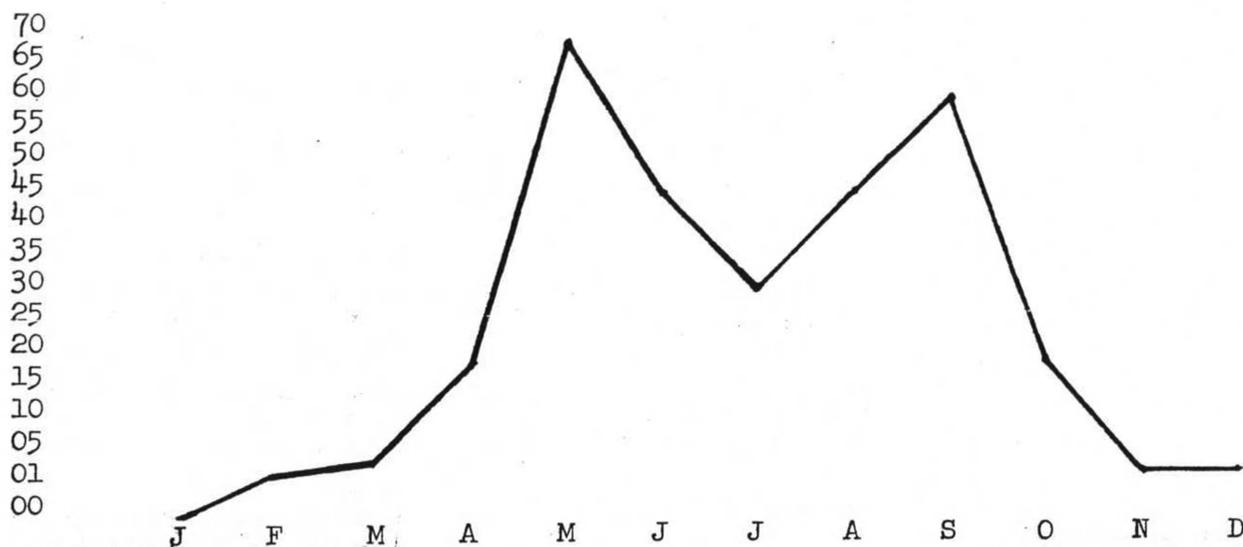
Judging from reports, the activity of snakes slows considerably during the heat of summer as the snakes become more dormant or nocturnal. A second peak occurs during September as the weather cools and as the young of the year become evident. Activity then drops sharply as the snakes enter hibernation.

The relative abundance and seasonal activity of AMELIA County snakes may be fairly typical of snakes in much of the Virginia Piedmont. It would be interesting to make comparisons with data from the coastal plain and the highlands,

(Continued on page six.)



SEASONAL ACTIVITY GRAPH



MONTHLY SUMMARY OF SNAKES RECORDED FROM
AMELIA COUNTY, 1972, '73, '74, '75 (to Nov.)

<u>SPECIES</u>	<u>MONTH</u>										<u>TOTAL</u>
	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	
Black Rat S.	0	1	30	19	10	12	27	5	1	0	105
Black Racer	0	4	10	4	2	3	4	2	0	0	29
E. Hognose S.	0	2	5	6	3	2	4	2	0	0	24
E. Worm Snake	1	0	4	2	1	12	0	1	0	0	21
E. Garter S.	0	3	3	3	3	3	4	0	0	1	20
N. Copperhead	0	0	3	0	2	5	5	2	0	0	17
N. Watersnake	1	4	3	3	2	1	1	1	0	0	16
Mole Snake	0	0	2	3	2	0	3	0	0	0	10
Rough Green S.	0	0	2	1	0	2	3	0	0	0	8
E. Kingsnake	0	1	1	0	0	2	1	1	0	0	6
N. Brown S.	0	0	0	0	1	0	3	1	0	0	5
Smooth Earth S.	0	2	0	0	1	0	0	1	0	0	4
Red-bellied S.	0	1	1	0	1	1	0	0	0	0	4
Corn Snake	0	0	2	0	0	0	2	0	0	0	4
Ribbon Snake	0	0	0	2	0	0	0	0	0	0	2
Ringneck Snake	0	0	0	0	0	0	1	0	0	0	1
E. Milk X Scarlet King	0	0	0	0	0	0	1	0	0	0	1
Scarlet Snake (1971)	0	0	0	0	1	0	0	0	0	0	1
TOTALS	<u>2</u>	<u>18</u>	<u>66</u>	<u>43</u>	<u>29</u>	<u>43</u>	<u>59</u>	<u>16</u>	<u>1</u>	<u>1</u>	

Continued from page four.

as well as with other sections of the Piedmont. Over longer periods of time, local population fluctuations of species might be observed which possibly could be correlated with changes in the weather or other environmental factors. Such studies could be done by many VaHS members with relatively little effort if records are kept with any reasonable accuracy.

(Mr.) Michael J. Clifford*
Extension Agent
Box #229, Amelia, VA
23002

VaHS FACTS - a background statement on what VaHS is (and is not) will appear in the near future. This wrap-up on the society is scheduled to go to the 20 VaHS Directors and following the receipt and disposition of their comments will be seen by the members in a VaHS BULLETIN.

Thereafter, the item will be kept up-to-date and in stock for use in response to inquiries on the goals, purpose, and nature of the Virginia Herpetological Society (VaHS).

The roster of members is in preparation and we are planning to issue it in Bulletin form during the coming months.

SUCCESSFUL MEETING HELD
AT AMELIA FAMILY CAMPSITE

Twenty-five VaHS members attended the spring meeting at the Amelia Family Campground near Amelia, VA., on 24 April 1976.

Geographical distribution was as follows: Amelia 8; Bedford 1; Blacksburg 2; Burkeville 1; Crewe 1; Farmville 2; Leesburg 1; Mechanicsville 1; Portsmouth 1; Richmond 7; and Roanoke 1.

Introduction was given by Mike Clifford, Extension Agent, Amelia County; F. Tobey followed with some general information on VaHS which will be used at a later date in the VaHS BULLETIN; Mike Clifford told about the number and variety of Amelia reptiles (see pp. 4 to 6 of this VaHS BULLETIN.) William P. Jones, Amelia, covered close-up photography of reptiles and stressed the advantages of using professional film and techniques. The gathering took a short break after which Robert Gagnon showed slides of herpetological institutes in Iran and Thailand.

Barry Fox, in absentia, provided a talk on photographing reptiles and amphibians with some good advice: "do's and don'ts"; John Payne gave a round-up on his survey of FLOYD County's Buffalo Mountain which he is undertaking

with another student at VPI & SU, Blacksburg, VA. There may be more on this in a future VaHS BULLETIN.

Costello Craig provided a survey of Virginia herpetofauna including shots of typical environments. The session was enjoyed by all who attended. The VaHS wishes to extend its sincere thanks to the John B. Hutchinson family for use of the campground recreation room for talks and exhibits. This is a pleasant place to stop or spend overnight while in the Amelia area.

Exhibits were seen in the meeting room before and after the talks. These were prepared by Michael Clifford, Amelia; Mr. Cos Craig, Bedford; Brian Craig, Roanoke; Ed Goetz of Richmond; Bill Jones, Amelia; John Payne, VPI & SU, Blacksburg, VA., and F.J. Tobey, Leesburg, VA, brought the exhibit presented at the 12th State Science Teachers' Conference at Fredericksburg in October 1974.

Be **CERTAIN** that the VaHS Secretary has your latest address! And be sure you keep your support of VaHS current by occasional contributions to the VaHS Treasury.

THANKS!

REPORT FROM THE VIRGINIA DIVISION OF PARKS

The Virginia State Parks recently received the accompanying report from a 1975 collecting permittee (Mr.) Chris Pague*.

The following specimens were collected in the State Park indicated:

-SEASHORE STATE PARK-

- Plethodon g. glutinosus Slimy salamander
Acris gryllus Southern cricket frog
Hyla c. crucifer Northern spring peeper
Rana catesbeiana Bullfrog
Rana clamitans melanota Green frog
Rana utricularia Southern leopard frog
Eumeces laticeps Broad-headed skink
Coluber c. constrictor Black racer

-CLATOR LAKE STATE PARK-

- Sceloporus undulatus hyacinthinus Northern fence lizard
Terrepene c. carolina Eastern box turtle

-GRAYSON HIGHLANDS ST.PK-

- Plethodon c. cinereus Red-backed salamander
Plethodon jordani Appalachian woodland salamander

Editor's Note: Mr. Chris A. Pague* is currently a graduate student (biology) at VPI&SU, Blacksburg, VA. All specimens noted above are in the VPI&SU collection. We are grateful to the Division of Parks and Commissioner Ben H. Bolen for supplying this data.

TADPOLES, OR LACK OF THEM MAY TILT THE BALANCE IN A FRESH-WATER POND

The balance of nature in fresh water ponds can teeter on a tadpole. In a study published in 1971, one observer suggested that man had introduced factors into the environment that caused a "50 per cent decline in the frog population of the United States during the past 10 years."

Dr. Diane B. Seale, Penn State research biologist, cites those findings as evidence of a near-crisis. "Unfortunately, we are just beginning to understand the important role these animals play in the aquatic community. I hope we'll know the whole story before it's too late," Dr. Seale said.

Dr. Seale and an associate -- Elizabeth Rodgers, now a TVA biologist -- found that polliwogs play a key role in keeping ponds alive, clean, and young.

Working below the pond's surface like miniature filtration systems, the tadpoles suck up scum formed by algae, bacteria, and pond debris. While some of it passes through the polliwog's gut almost unchanged, most gets trapped in the wastes and a smaller quantity nourishes the tadpoles and leaves the pond when they do--as frogs, Dr. Seale explains.

In some ponds without the tadpoles to tip the scale the scum could take over. The pond would soon lose oxygen needed for other animals and age rapidly.

The tadpoles' capacity to process algae seems very large, Dr. Seale notes. She found that almost all of the algae in a 10-acre pond passed through its tadpole population about once a day. Whether the trip through the gut is the major thing affecting the control of algae, or whether the tadpoles also excrete an alga inhibitor is something Dr. Seale and Dr. Frederick Williams, an associate professor of biology at Penn State are trying to find out.

The project is supported, in part, by a National Science Foundation grant.

Meanwhile, Dr. Seale says, "if you have frogs breeding in your pond -- leave them alone. They'll eat mosquitos and keep the algae nuisance down."

SEARCH FOR MELANISTIC HOG-
NOSED SNAKES FOR STUDY

Two Virginia Commonwealth University students (a graduate student and an undergraduate doing problems research) are developing a telemetry system for monitoring body temperatures in free-living snakes. We want to compare thermo-regulation

in melanistic hognosed snakes (Heterodon platyrhinos) with individuals that are the normal color.

We are having difficulty getting hognosed snakes, particularly the melanistic ones. DO YOU KNOW SOMEONE WHO COULD SUPPLY SUCH SNAKES ? CAN YOU SUGGEST ANY GOOD COLLECTING LOCALITIES ? We are

willing to trade or travel to pick up the snakes and will not harm them. Please write or call with any assistance or ideas.

(Dr.) Charles R. Blem, Associate Professor, Department of Biology VCU, 901 W. FRANKLIN ST. RICHMOND, VA. 23284

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(804) 770-~~6357~~ (VCU tel.)

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SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES



The Society is pleased to announce that it will publish a facsimile of the
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by John Edwards Holbrook

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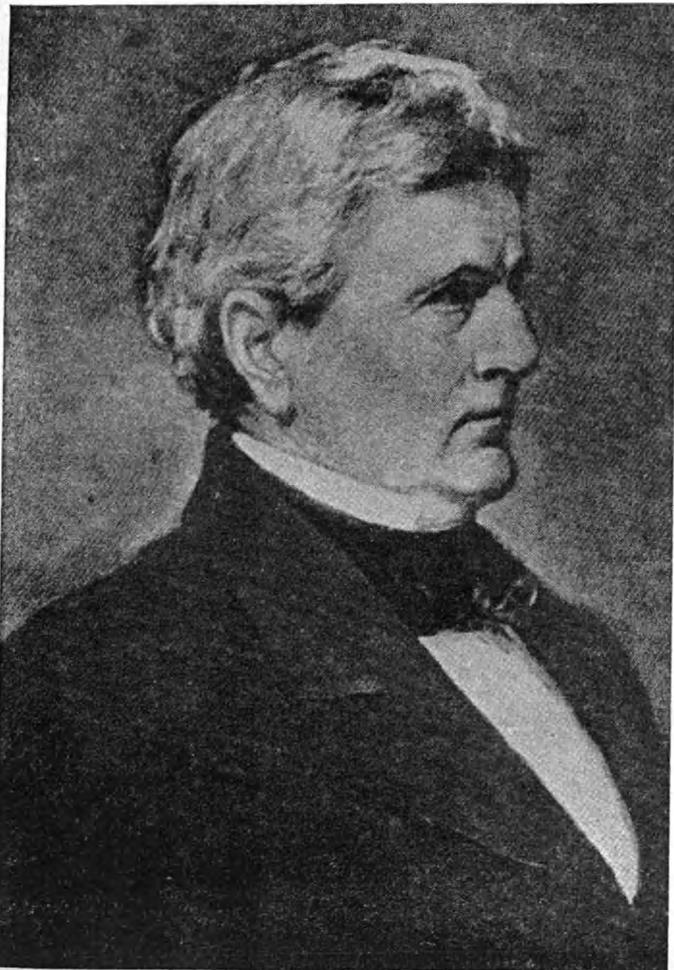
To be published October 1976

FULL DETAILS ON THE FOLLOWING PAGES

HOLBROOK'S designation as the Father of American Herpetology rests upon his major work, *North American Herpetology*, published over a century ago. Nothing surpassing it in size or beauty has ever been produced on the same subject, before or since. Holbrook's life's ambition was to publish descriptions of all known species of American fish, amphibians and reptiles, illustrated from life and in color much as his friend Audubon had done for the birds and mammals. But he surpassed Audubon in producing a beautifully-illustrated as well as scientifically-important book which, according to Agassiz, compelled Europeans for the first time to take notice of American science.

Holbrook was a physician by profession but spent most of his labor and fortune in producing his books on herpetology. He was a perfectionist and the color illustrations became an obsession with him. He employed the best wildlife artists of the day and in nearly every instance illustrated each species from living specimens. These were sent to him from all parts of the continent by his many correspondents, a veritable who's who of early American naturalists, among them DeKay, Kirtland, Harlan, Troost, Green, LeConte, Blanding, Storer and Nuttall. A first edition was issued in 1836-1840 but Holbrook became dissatisfied with it and he would sometimes refuse to send a new volume to a subscriber until the earlier one had been returned to be destroyed.

In 1842, Holbrook issued the complete second edition of his great work. This is considered the definitive edition and thus is the one being reprinted. Many plates were re-drawn and each species illustrated



with a full-page plate. The text includes a detailed description of each species with sections on color, size, distribution, habits and remarks. Holbrook's style of writing is particularly lucid: referring to the diamondback rattlesnake, he said "A more disgusting and terrific animal cannot be imagined than this; its dusky colour, bloated body and sinister eyes of sparkling grey and yellow, which combine to form an expression of sullen ferocity unsurpassed in the brute creation". As Holbrook had originally intended, the book still retains its great interest both for the scientist and the serious amateur.

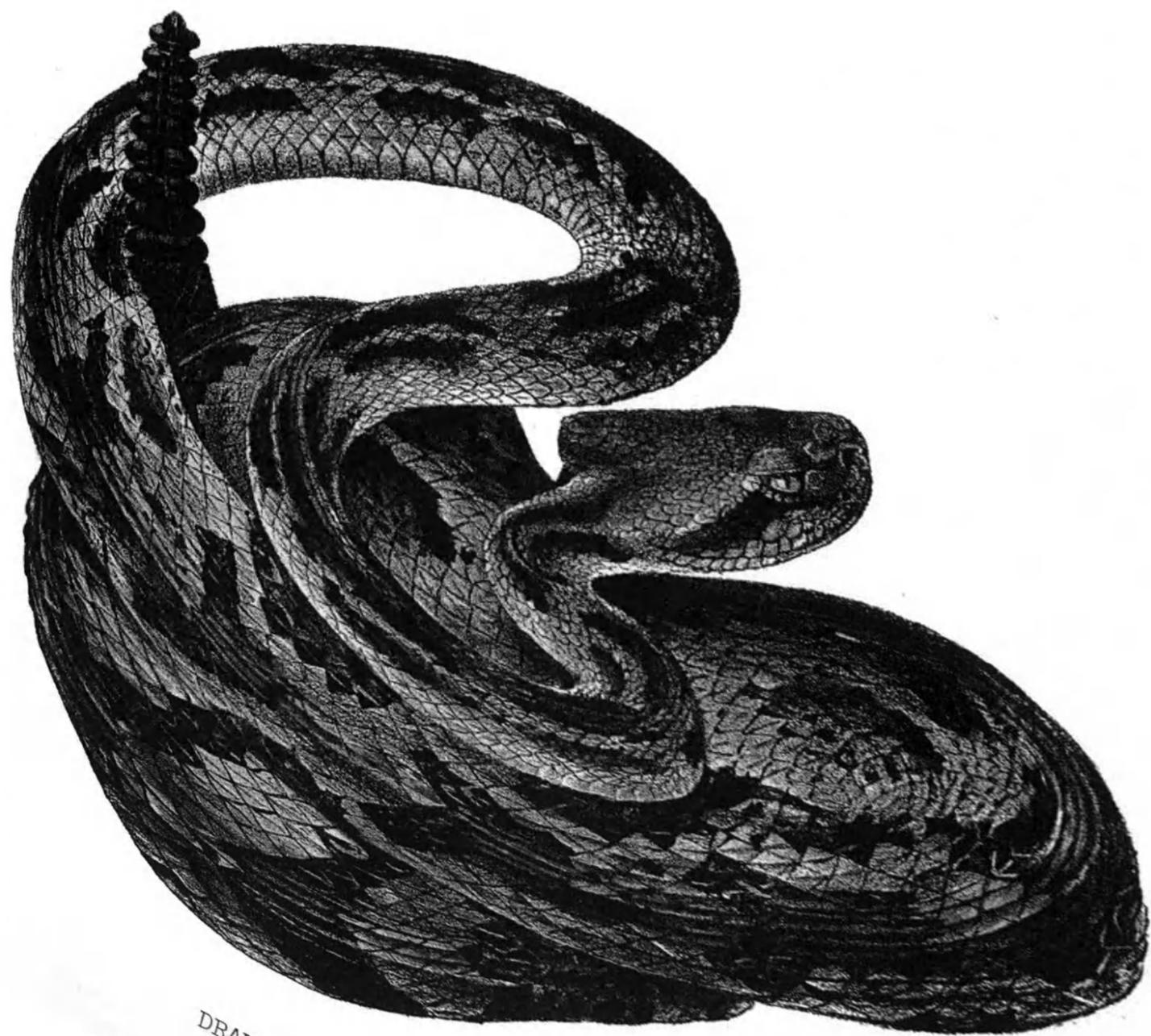
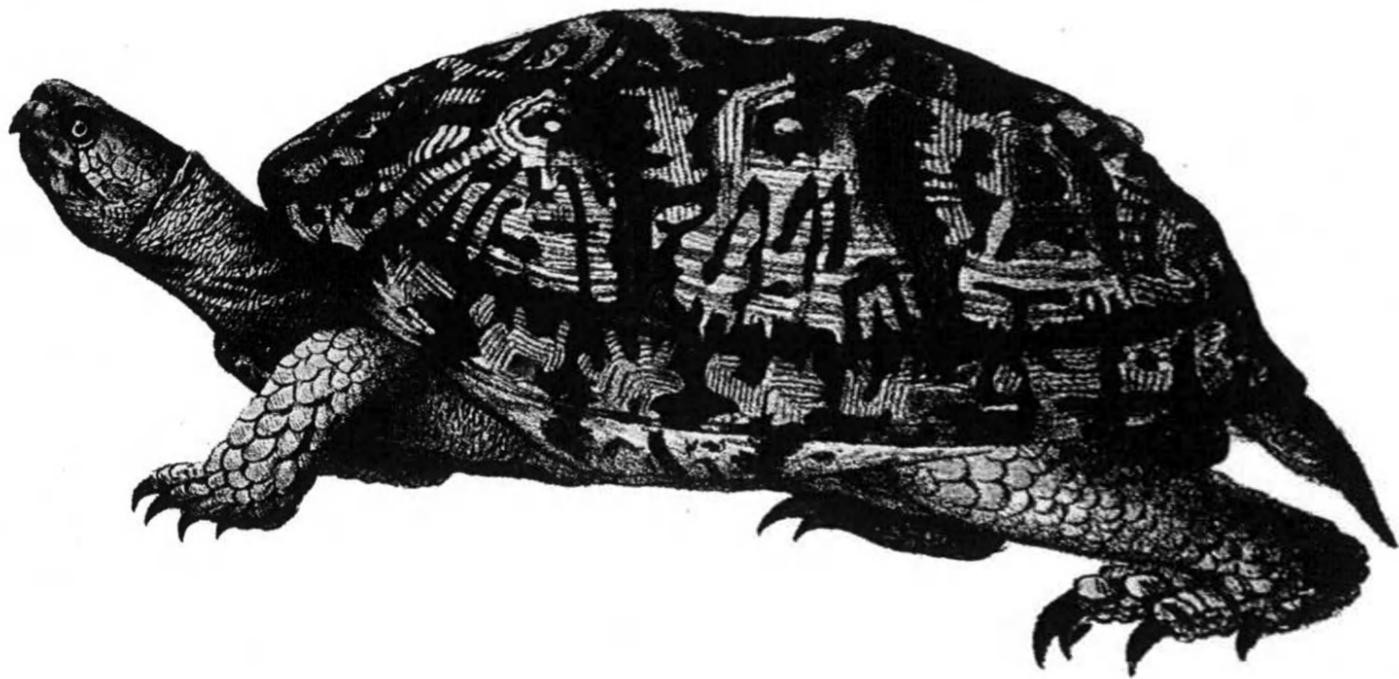
THE REPRINT EDITION. Due to the small number of copies printed and the value of the exquisite plates for framing, originals of Holbrook's magnificent treatise long ago became collector's items. These now command prices of nearly \$4000 a set on the second-hand market, making it one of the most costly natural history books ever published.

The reprint will be an exact facsimile of the entire 5-volume second edition, including all 147 of the plates. Nineteen of the best plates will be reproduced in full color including representative snakes, lizards, turtles, frogs and salamanders. The reprint is planned to match the quality and imposing size of the original: pages will measure 8½ by 11 inches (21.5 by 28 cm), the text will be printed on special acid-free paper that lasts for centuries and the whole will be sewn and sturdily bound in heavy library buckram.

The reprint will include several unique additions. There will be a full color portrait of Holbrook by David M. Dennis, the well-known wildlife artist. There will also be an introduction by Professor and Mrs. Richard Worthington including a new biography of Holbrook, a discussion of the publication of the first and second editions of his reptile book, and a detailed tabulation equating Holbrook's terminology with modern nomenclature.

THE PATRON'S EDITION. As was common practice in those days, the costs of publishing Holbrook's books were partially borne by patrons who subscribed to them in advance. In keeping with this, a patron's edition is being offered. This special edition will be strictly limited to only 150 copies and is designed to become a collector's item. Each copy will be signed by the authors of the introduction and individually numbered by the editor. A list of patrons will be recorded for posterity on a special page in both the regular and patron's editions. Patron's copies will be richly hand bound by the eminent American book craftsmen Fritz and Trudi Eberhardt. Our intent is to duplicate the bindings of Holbrook's originals, produced at a time when binding itself was an art. These will be constructed of the finest imported materials: scarlet-red morocco leather spine and corners over genuine hand-marbled boards with 24-karat gold top edge and ornamentation. The patron's edition is illustrated on the order form.

In addition, patrons only will receive a separate set of the 20 color plates on oversize sheets of heavy stock measuring 10 by 13 inches (25.5 by 33 cm) unbound in a portfolio. This set includes the Holbrook portrait which will be signed, dated and individually numbered by the artist in a limited edition of 150. As prints for framing, these plates alone make the patron's edition an exceptional value.

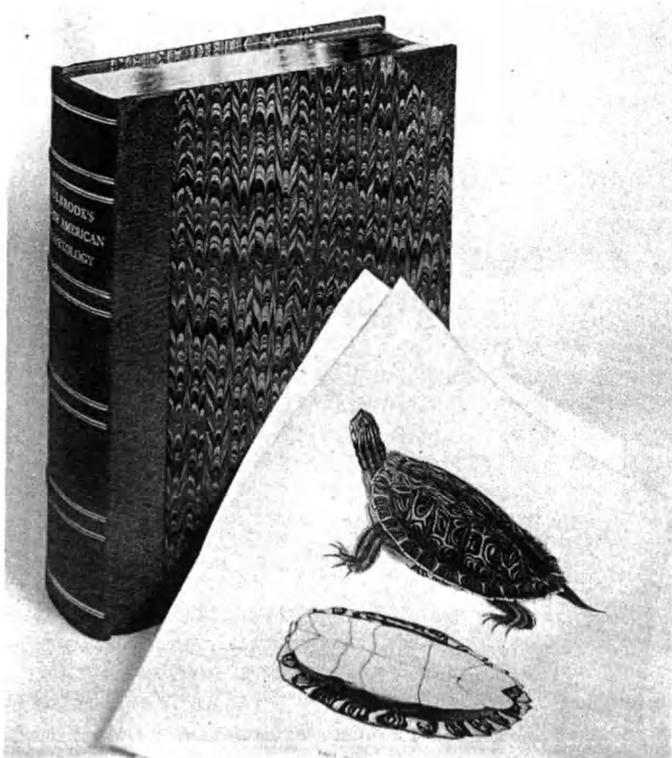


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Both editions consist of about 1000 pages including 147 full-page plates and a portrait, 20 of which are in full color. Page size is quarto (8½ by 11 inches, or 21.5 by 28 cm).

REGULAR EDITION: Clothbound with gold stamps.price, \$60



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This deluxe edition is strictly *limited to 150 copies* and will be issued according to the following specifications:

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- A list of patrons will be printed on a special page in both editions. We can insure inclusion of patrons' names only if reservations are received by the Society before July 1976. Patron's copies will be designated on a first-come, first-served basis.
- Each copy will be signed by the authors of the introduction and individually numbered by the editor.
- Patrons will receive a separate set of the 20 color plates, printed on large sheets (10 by 13 inches, or 25.5 by 33 cm) of heavy stock suitable for framing. These will be unbound, in a portfolio.
- One of the color prints presented to patrons will be the portrait of Holbrook by David M. Dennis. This limited edition of 150 prints will be signed, dated and numbered by Mr. Dennis.

TO ORDER

Orders may be placed with your own bookseller, or directly with the Society by writing Dr. Henri C. Seibert, Morton Hall, Ohio University, Athens, Ohio 45701, U.S.A. A price-list of other books, papers and journals published by the Society together with information on membership can be obtained from Dr. Seibert.

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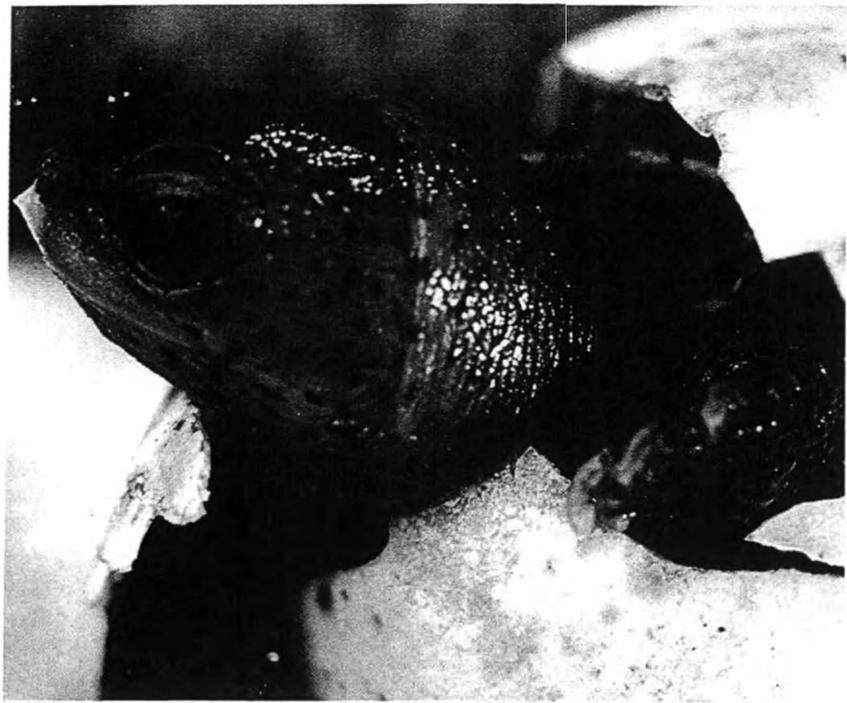
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