

volume 21
number 1
march 1990

herpetological
review

published by the society for the study of amphibians and reptiles

1990 SSAR OFFICERS

President

William S. Brown
Department of Biology
Skidmore College
Saratoga Springs, NY 12866, USA

President-elect

Linda E. R. Maxson
Department of Biology
Pennsylvania State University
University Park, PA 16802, USA

Secretary

J. Eric Juterbock
Department of Zoology
Ohio State University-Lima
Lima, OH 45804, USA

Treasurer

Douglas H. Taylor
Department of Zoology
Miami University
Oxford, OH 45056, USA

Publications Secretary

Robert D. Aldridge
Department of Biology
Saint Louis University
Saint Louis, MO 63103, USA

Immediate Past President

Henri C. Seibert
Department of Zoological and
Biomedical Sciences
Ohio University
Athens, OH 45701, USA

Directors

Ernest A. Liner (1990)
Martin J. Rosenberg (1990)
A. Dale Belcher (1991)
James L. Christiansen (1991)
Gustavo Casas-Andreu (1992)
Henry R. Mushinsky (1992)

SSAR EDITORS

Journal of Herpetology

Samuel S. Sweet, Editor
Department of Biological Sciences
University of California
Santa Barbara, CA 93106, USA

James L. Vial, Managing Editor
Faculty of Biological Sciences
The University of Tulsa
Tulsa, OK 74104 USA

Contributions to Herpetology Facsimile Reprints in Herpetology

Kraig Adler, Editor
Section of Neurobiology and Behavior
Cornell University
Ithaca, NY 14853, USA

Herpetological Circulars

Joseph T. Collins, Editor
Museum of Natural History
The University of Kansas
Lawrence, KS 66045, USA

Catalogue of American Amphibians and Reptiles

Jaime D. Villa, Editor
Teacher Enhancement Program
National Science Foundation
Washington, DC 20550, USA

HERPETOLOGICAL REVIEW STAFF

Editor

Martin J. Rosenberg
Department of Biology
Case Western Reserve University
Cleveland, OH 44106, USA

Managing Editor

John E. Simmons
Museum of Natural History
The University of Kansas
Lawrence, KS 66045, USA

Advertising Manager

Elizabeth A. Johnson
New Jersey Field Office
The Nature Conservancy
Box 181
Pottersville, NJ 07979, USA

Production Staff

Tom R. Johnson Illustrations

Section Editors

Geographic Distribution

Joseph T. Collins
Museum of Natural History
The University of Kansas
Lawrence, KS 66045, USA

Herpetological Husbandry

Bern W. Tryon
Knoxville Zoological Park
Box 6040
Knoxville, TN 37914, USA

Regional Societies

Stephen Hammack
Reptile Department
Fort Worth Zoo
Fort Worth, TX 76110, USA

Life History Notes

Peter J. Tolson
Toledo Zoological Gardens
2700 Broadway
Toledo, OH 43609, USA

Society For The Study Of Amphibians And Reptiles

Membership is open to anyone interested in amphibians and reptiles. Members have voting privileges in the Society. They receive the **Journal of Herpetology** (4 issues annually), **Herpetological Review** (4 issues annually), and occasional issues of **Facsimile Reprints in Herpetology**. Members may purchase other Society publications at reduced rates.

ANNUAL DUES 1990

| | |
|-------------------------------------|---------------------------------------|
| Student member.....\$25.00* | Sustaining member.....\$50.00* |
| Regular member.....\$35.00* | Contributing member.....\$75.00* |
| Institutional subscription.\$60.00* | Life member...(see below)...\$600.00* |

***Air delivery.** All memberships and subscriptions require a surcharge to defray air mail delivery costs if airmail is desired. Outside the US, \$25.00; within the US, \$12.00.

Make checks payable to SSAR. A receipt will be sent only upon request. Payment in US funds only. Non-US members please remit in US dollars only by either international money order, draft on a US bank, or by Mastercard or Visa (include account number and expiration date of credit card). Life memberships may be paid in 3 consecutive payments. Subscriptions to Herpetological Review only are available for \$12.00 annually.

Subscriptions outside of the US require a surcharge of \$8.00 for air delivery if airmail is desired. Subscribers to HR only are not members of the Society.

Catalogue of American Amphibians and Reptiles: subscription \$15 annually (\$3.00 air delivery surcharge if airmail is desired).

Individuals are encouraged to join at the higher membership categories. Money from such support substantially helps promote the publications and services of SSAR. For membership information, contact the Treasurer (see address in left column).

Published quarterly by the Society for the Study of Amphibians and Reptiles at Meseraull Printing, Inc., RFD 6 Box 1, Lawrence, KS 66046. Steve Meseraull, Printer. POSTMASTER: Send form 3579 to the editor. All rights reserved. No part of this periodical may be reproduced without written permission of the editor(s).

Copyright 1990 by the Society for the Study of Amphibians and Reptiles

ISSN: 0018-084X

Advertising: The publisher reserves the right to refuse any advertisement. The advertiser agrees to protect and indemnify the publisher from any claim, litigation or expense resulting from the advertiser's unauthorized use of any name, photograph, sketch or words protected by registered trademark.

Cover design by Leonard Grotta



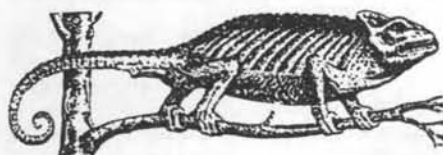
Herpetological Review

Volume 21

March 1990

Number 1

SSAR BUSINESS



SSAR MEETS AT FIRST WORLD CONGRESS OF HERPETOLOGY

The 32nd Annual Meeting of the Society for the Study of Amphibians and Reptiles was held jointly with the First World Congress of Herpetology (FWCH), 11-19 September 1989, on the campus of the University of Kent in Canterbury, United Kingdom. Nearly 1400 persons, representing some 61 countries (see chart), attended this largest and most diverse meeting of herpetologists ever held. The Herpetologists' League and Societas Europaea Herpetologica also met officially at the congress, which was co-hosted by the British Herpetological Society, Fauna and Flora Preservation Society, and the Zoological Society of London. Thirty leading national and international herpetological societies supported the congress as Affiliated Organizations.

The complexities of such a large meeting were enormous—with nearly 50 symposia, workshops, roundtables, exhibits, and other events and with numerous nationalities and languages represented—yet all was effectively managed by Ian R. Swingland, Conference Director, and the UK National Executive. Kraig Adler served as chairman of the Scientific Program Committee. Many features of the congress were familiar to regular attendees of SSAR meetings in North America, since several of the Society's traditional events were incorporated into the program.

World Congress of Herpetology (WCH), the parent organization which initiated and coordinated the First Congress, had its genesis in 1982, on the occasion of SSAR's 25th Annual Meeting in Raleigh, North Carolina, USA

(see *Herp Review*, 13:103, 1982). At that anniversary meeting, an *ad hoc* committee made the proposal and representatives of the world's major herpetological societies decided to establish the WCH and elected Kraig Adler, then the President of SSAR, as Secretary-General.

Since that time, the WCH organization has been firmly established, operating funds raised, a constitution written, and meeting plans laid which culminated in the historic inaugural congress last September. Because of the enormous enthusiasm displayed at Canterbury, a Second Congress is now being planned, to be held in four or five years.

Canterbury and the University of Kent

The cathedral city of Canterbury, renowned the world over, is one of Europe's most ancient cities and a settlement has existed on the site since the Stone Age. In 43 A.D. the Romans founded a village of wooden huts there and called it "Durovernum," remains of which can still be seen in the city. The ancient Norman fortress walls, gate towers, and timbered buildings—all

clustered around the magnificent cathedral, the Mother Church of England—preserve much of a medieval atmosphere, and congress delegates were able to stroll through the city's narrow, sometimes still cobbled streets. Canterbury also has rich literary associations, being the city of Chaucer, Christopher Marlowe, Charles Dickens, and Somerset Maugham, and it is one of the most visited places in the UK.

The University of Kent, on the other hand, is one of England's newest institutions, founded by Royal Charter in 1965. It occupies a 300-acre campus on a magnificent hillside overlooking the city from the north. Except for the plenary lectures, which were presented at the Marlowe Theater in the city, all other congress events were held on campus. Herpetological activities totally occupied the campus and the official WCH logo was everywhere to be seen. The logo (above) is from Conrad Gessner's *Historia Animalium* (Zürich, 1554), a chameleon perched precariously "out on a limb," as indeed the WCH felt itself to be in its early years!

Registration was conducted in the Senate, a centrally-located building, and most delegates roomed in one of two

Final summary of FWCH delegates, by country. Total attendance included 900 delegates, 316 accompanying persons, and 152 others (honorary officers, special guests, press officials, and others involved in the congress).

| | | | | | |
|--------------------|----|-----------------------|----|------------------|-------|
| Argentina | 8 | France | 45 | Panama | 1 |
| Australia | 32 | German Dem. Rep. | 5 | Papua New Guinea | 1 |
| Austria | 17 | Germany, Fed. Rep. of | 47 | Peru | 3 |
| Bangladesh | 1 | Greece | 4 | Poland | 1 |
| Barbados | 1 | Hungary | 7 | Portugal | 4 |
| Belgium | 10 | India | 10 | Saudi Arabia | 1 |
| Belize | 1 | Indonesia | 1 | South Africa | 10 |
| Botswana | 1 | Ireland | 5 | Spain | 39 |
| Brazil | 11 | Israel | 11 | Sri Lanka | 1 |
| Bulgaria | 1 | Italy | 31 | Suriname | 1 |
| Canada | 15 | Japan | 12 | Swaziland | 1 |
| Cayman Islands | 1 | Kenya | 1 | Sweden | 10 |
| Chile | 1 | Luxembourg | 1 | Switzerland | 25 |
| China—Beijing | 10 | Mauritius | 1 | Tanzania | 1 |
| China—Taipei | 2 | Mexico | 11 | U.K. | 153 |
| Costa Rica | 5 | Netherlands | 18 | U.S.A. | 269 |
| Czechoslovakia | 7 | New Zealand | 7 | U.S.S.R. | 24 |
| Denmark | 4 | Nigeria | 1 | Venezuela | 1 |
| Dominican Republic | 1 | Norway | 1 | Zimbabwe | 2 |
| Egypt | 1 | Oman | 1 | TOTAL DELEGATES | 900 |
| Finland | 1 | Pakistan | 1 | (Total Persons | 1368) |

residential colleges (Elliot and Rutherford), each a confusing stereoisomeric image of the other. Each college had a dining hall for meals as well as a bar, in which many lively discussions took place each evening. Two unique brands of beer—"Herpetology Ale" and "Tortoise Bitters"—were brewed specially for the congress, with souvenir bottles conveniently placed in each delegate's room! The self-contained nature of the campus and its pleasant surroundings led to good interactions and camaraderie.

Meeting of SSAR Board of Directors

The SSAR Board met from 1000 to 1630 h on 11 September in the Grimond Lecture Theater (this being one of the shortest board meetings in recent memory!). President Henri Seibert opened the meeting by announcing that Eric Juterbock had agreed to serve as Secretary since James Jacob had to resign the post. Ernest Liner agreed to serve out Juterbock's unexpired board term, since one individual cannot hold

two voting positions on the Board of Directors.

Treasurer Douglas Taylor announced that membership was down slightly from last year, probably a result of the dues increase, but SSAR is in better financial shape. Publications Secretary Robert Aldridge announced that more than 60,000 pounds of SSAR publications are now in storage at St. Louis University. Discussion centered on membership drives and publication sales (both anticipated in 1990).

Committee reports were mostly uneventful, although there was some discussion about the role of the Conservation Committee and the current paucity of future meeting sites. After significant and sometimes spirited discussion, a budget of \$126,000 was approved for 1990; this included the establishment of an Emergency and Special Projects Fund.

SSAR Business Meeting

President Seibert called the meeting to order at 1930 h on 14 September in Grimond Lecture Theater. Secretary

Juterbock reported the highlights of the Board meeting of three days before and Treasurer Taylor reported financial matters (see above). Chairperson James Murphy presented the slate of nominees for the autumn election on behalf of the Nominating Committee. The slate was accepted by unanimous vote. Harold Dundee reported on the 1990 meeting in New Orleans, leaving many to wonder if there would be time for business in between all of the eating and partying!

Martin Rosenberg, on behalf of the Resolutions Committee, presented the following resolutions:

"Whereas, James S. Jacob has served as Secretary of SSAR for the past eight years; and Whereas, he has performed said secretarial duties with great efficiency; and Whereas, his efforts have greatly enhanced communication between and among officers, committees, and members, Therefore, be it resolved that the Society extend its deepest gratitude to James S. Jacob for his many years of service to the Society.

"Whereas, Rodolfo Ruibal has served most ably as editor of the Society's scientific journal for seven years; and, Whereas, the Journal of Herpetology has achieved a high level of pre-eminence during his tenure as editor; and, Whereas, his efforts have promoted the distribution and sharing of knowledge and discovery among colleagues throughout the world, Therefore, be it resolved that the Society recognize Rodolfo Ruibal's invaluable and excellent service to the Society as Editor of the Journal.

"Whereas, Herpetological Circulars are major publications of the Society; and, Whereas, these publications are highly valued by the herpetological community; and, Whereas, Neil Ford has ably served as editor of this series for the past six years; Therefore, be it resolved that the SSAR express its gratitude to Neil Ford for bringing six Herpetological Circulars to publication during his tenure as Editor.

"Whereas, WCH Secretary-General Kraig Adler, FWCH Conference Director Ian R. Swingland, and WCH Treasurer Marinus S. Hoogmoed have devoted thousands of hours over the past half decade toward the organization of this meeting; and, Whereas, this First Congress represents an historic gathering of scientists from 61 countries; and, Whereas, this congress has set a high standard of excellence in all respects; Therefore, be it resolved that Kraig Adler, Ian R. Swingland and Marinus S. Hoogmoed be duly thanked for their successful efforts.



WINDSOR CASTLE

I am most grateful to the Earl of Cranbrook for this opportunity to send my best wishes to the Vice Presidents and Executives of the First World Congress of Herpetology. Life on earth may be indivisible, but it would be impossible for any one person to comprehend all the details of the ecology of every region and every species. The great value of this Congress is that it will fill in detailed knowledge about a particularly sensitive group of animals. It is from these bricks of specialised knowledge that we are able to build a comprehensive understanding of the state of the natural environment. This can then become the basis for effective conservation action.

I am sure that this inaugural World Congress will provide a successful and interesting series of meetings and I hope there will be many more in the future.

Letter of greetings from His Royal Highness Prince Philip, Duke of Edinburgh, K.G., K.T., the official Patron of the First World Congress of Herpetology.

*Whereas, the FWCH has been successfully conducted within the beautiful and historic city of Canterbury; and,

Whereas, the excellent performances by the English and Scottish dancers and the bagpipe music at the Westgate Gardens provided delegates and guests with an appreciation for the long history and great traditions of the United Kingdom; and,

Whereas, the University of Kent at Canterbury has provided outstanding facilities for the exchange of scientific information; and,

Whereas, the organizers of the FWCH have worked for many years in planning this inaugural world congress;

Therefore, be it resolved that SSAR acknowledge the support and contributions of the following: His Royal Highness Prince Phillip; Councillor A. G. Porter, Lord Mayor of the City of Canterbury; David J. E. Ingram, Vice-Chancellor, University of Kent; and the dozens of additional individuals who worked tirelessly to make this meeting a pleasant and effective one."

The resolutions were overwhelmingly accepted by an animated vote of the membership.

Finally, Henri Seibert passed the SSAR gavel, richly carved with herpetological motifs, to President-elect William Brown, who adjourned the meeting at 2020 h.

Student Travel Committee

Several years ago, SSAR, together with the Herpetologists' League and the American Society of Ichthyologists and Herpetologists, established a committee to raise funds to send North American graduate students to the congress. Auctions and other events were conducted to collect funds, including a raffle organized by Ronald Altig and Linda Trueb. The committee (David Cundall, chair; Ronald Altig, John E. Cadle, George C. Gorman, Dale R. Jackson, Linda Trueb, and R. Wayne Van Devender) eventually provided substantial travel grants totalling \$4500 to eight persons. SSAR is grateful to the people who successfully organized this program.

Opening Ceremonies

In plenary session at the Marlowe Theater, the First Congress was formally opened by the Secretary-General, Craig Adler. He noted the historic occasion of herpetology's first truly international congress with its dual themes of science and conservation, and he greeted the delegates on behalf of the WCH Executive Committee.

Ian R. Swingland, Conference Director, extended a welcome on behalf of the Secretariat and the UK National Executive, followed by remarks from David J. E. Ingram, Vice-Chancellor and administrative head of the University of Kent, our official host institution. A group photograph of the delegates was

taken that morning on the steps of the Marlowe.

Honorary Officers

At the request of the Secretary-General, the Earl of Cranbrook, a prominent British zoologist, invited a distinguished group of the United Kingdom's leading naturalists and public figures to serve as honorary officers for the First Congress, to demonstrate the widespread support for the congress in Great Britain and to make its planning activities more visible.

H.R.H. Prince Phillip, Duke of Edinburgh, K.G., K.T., President of the World Wide Fund for Nature (WWF; formerly called World Wildlife Fund) and a leader in international conservation, consented to be the official Patron of the First Congress. Prof. Angus d'A. Bellairs, the eminent British anatomist and herpetologist, served as Honorary President.

Among the 23 Honorary Vice Presidents were the Most Rev. Robert Runcie, Lord Archbishop of Canterbury and Primate of the Anglican Church; the President of the Zoological Society of London, Sir William Henderson; several leading naturalists and conservationists including, in addition to Lord Cranbrook himself, Sir David Attenborough, Prof. J. L. Cloudsley-Thompson, Mr. Gerald Durrell, Dr. J. F. Deryk Frazer, the Countess of Huntingdon, the Viscountess Massereene and Ferrard, the Baroness Nicol, the Hon. Miriam Rothschild, the late Sir Peter Scott, and Sir William Wilkinson; the Director of the British Museum (Nat. Hist.), Dr. R. H. Hedley; Prof. Sir Richard Southwood, Vice-Chancellor of the University of Oxford; Prof. R. J. Berry, President of the Linnean Society of London; and the Rt. Hon. Robin Leigh-Pemberton, Governor of the Bank of England and Lord-Lieutenant of Kent, in which county the congress was held.

Plenary Speakers

In order to highlight some of the most important current areas of research and conservation of amphibians and reptiles, several individuals were invited to present 50-minute plenary lectures at the Marlowe Theater, on the first and last days of the congress. They were introduced by noted personages associated with the congress:

• Carl Gans (USA): *The State of Herpetology*. Introduced by Angus d'A. Bellairs, Honorary President of the First Congress.

• Ilya S. Darevsky (USSR): *Evolution and Ecology of Parthenogenesis*. Introduced by Harold G. Cogger, Chairman of the WCH Constitution Committee.

• Linda R. Maxson (USA): *Molecular Perspectives on Tempo and Pattern in Amphibian Evolution*. Introduced by Marinus Hoogmoed, Treasurer of WCH.

• Russell A. Mittermeier (presenter; USA) and Ian R. Swingland (UK): *International Conservation*. Introduced by the Rt. Hon. the Earl of Cranbrook,

CANTERBURY

1 WORLD CONGRESS OF HERPETOLOGY - 11-19 SEPTEMBER 1989



SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

Commemorative poster donated by SSAR to all congress delegates. Copies of this full-color drawing of a box turtle (*Terrapene carolina*) by David M. Dennis are available for purchase from the SSAR Publications Secretary, Robert D. Aldridge (address inside front cover of this issue) at a cost of \$8 each postpaid (\$5 each for orders of 10 or more). Only about 500 copies of this limited-edition print remain for sale.

Convener of Honorary Officers for the First Congress and President, British Herpetological Society.

• Gerald Durrell (UK): *Conservation and Captivity*. Introduced by Ian R. Swingland, Conference Director of the First Congress.

• Timothy R. Halliday (UK): *Sexual Selection in Amphibians and Reptiles*. Introduced by Richard Fitter, Vice-President, Fauna and Flora Preservation Society.

• Ermi Zhao (China): *Biogeography of the Amphibians and Reptiles of the Islands Along the Chinese Coast*. Introduced by R. J. Berry, President, Linnean Society of London.

• Armand de Ricqlès (France): *Paleoherpetology*. Introduced by Ulrich Joger, General Secretary of Societas Europaea Herpetologica.

• S. Donald Bradshaw (Australia): *Ecophysiology of Desert Reptiles*. Introduced by Roger A. Avery, Chairman, UK National Executive for the First Congress.

• Eric R. Pianka (USA): *Community Ecology*. Introduced by Henri C. Seibert, President of SSAR.

• David B. Wake (USA): *Evolutionary Biology of Salamanders*. Introduced by James R. Dixon, President of Herpetologists' League.

All of these lectures and the Opening and Closing ceremonies were recorded by Q.E.D. Recording Services Ltd. (45

Birley Road, London N20 0HB, UK). Complete sets of the 11 tapes are available from Q.E.D. for £60 (approximately \$100) postpaid worldwide; payments can be made by VISA, MasterCard, or Amex. Individual cassettes are also available; address inquiries to Q.E.D. The plenary lectures will be published as a single volume; details to be announced later in *Herp Review*. It is also planned to produce a videotape summary of the congress; details will be announced later.

Symposia

A main feature of the congress were 27 symposia, covering an extremely broad range of topics; several symposia will be published. Roger Thorpe served as Symposia Manager. Each event was arranged by two conveners who usually also served as moderators; additional moderators occasionally participated. Most were half-day events, but a few (marked *) covered a full day. In the following listing, all authors of a given paper are given; this list differs from the Program

in some instances, but reflects the papers actually presented in Canterbury.

• *Conservation and Management of Species**. Emilio Balletto and Brian Groombridge, conveners. E. H. W. Baard; B. Banks, J. S. Denton, R. J. Flower, and T. J. C. Beebee; Q. M. C. Bloxam and S. J. Tonge; J. A. Campbell; K. Corbett; L. A. Fitzgerald, J. M. Chani, and O. E. Donadio; N. B. Frazer; A. Georges; M. P. Hayes and M. R. Jennings; D. R. Jackson; M. A. R. Khan; E. D. McCoy and H. R. Mushinsky; E. O. Moll; P. Sjögren; D. M. J. Spratt; D. R. Towns.

• *Effects of Environmental Pollution on Herpetofauna*. Arnold S. Cooke and Claes Andrén, conveners. C. Andrén and G. Nilson; R. Beattie; A. S. Cooke; C. P. Cummins; R. J. Hall; M. R. K. Lambert; P. Mohanty-Hejmadi and S. K. Dutta; B. A. Pierce; R. Tyler-Jones, R. C. Beattie, and R. J. Aston.

• *Captive Management of Amphibians and Reptiles*. René E. Honegger and Romulus Whitaker, conveners; Walter Sachsse, moderator. J. L. Behler; L. Durrell, D. Reid, and I. R. Swingland; B. Johnson; H. Rosier; W. Sachsse; D. I.

Werner; F. E. Wood and J. R. Wood; E. Zimmermann and H. Zimmermann.

• *Health and Disease*. John E. Cooper and Fredric L. Frye, conveners. P. C. Arena, K. C. Richardson, and L. K. Cullen; J. E. Cooper; F. L. Frye; F. L. Frye and C. Calvert; F. L. Frye and R. S. Funk; T. M. Környei; C. McAllister and S. J. Upton; G. A. Rubél and W. Kuoni; S. E. Solomon and R. Tippett; C. Warwick; R. A. Yates, D. J. Morafka, and J. P. Flanagan; P. Zwart, J. E. Cooper, and R. Ippen. Elkan Memorial Lecturer: F. L. Frye.

• *Sexual Selection and Communication in Amphibians and Reptiles**. Murray J. Littlejohn and Stevan J. Arnold, conveners. A. Arak; D. Crews; M. L. Dyson; H. C. Gerhardt; L. D. Houck; P. M. Narins; N. I. Passmore, P. J. Bishop, and M. L. Dyson; M. J. Ryan, A. S. Rand, and W. Wilczynski; P. Verrell; K. D. Wells and T. L. Taigen; B. D. Woodward.

• *Environmental Sex Determination*. Claude Pieau and Nicholas Mrosovsky, conveners. J. W. Bickham; C. Dournon; M. W. J. Ferguson, D. C. Deeming, P. T. Sharpe, E. Vallely, and A.



The First World Congress of Herpetology was attended by 1368 persons from 61 countries, the largest and most geographically diverse meeting of herpetologists ever held. Delegates assembled at the Marlowe Theater in Canterbury for the plenary sessions.

Watts; N. Mrosovsky; C. Pieau, M. Dorizzi, and G. Desvages; I. R. Swingland.

• *Sensory Processing in Amphibians and Reptiles.* Hans Schneider and John B. Phillips, conveners. A. Elefant; G. A. Engbretson; F. Gaillard; T. E. Hetherington; J. B. Phillips; G. H. Rodda; U. Sinsch; D. Vanderstighelen and R. F. Verheyen; W. Walkowiak; W. Wilczynski.

• *Long Term Studies of Amphibians and Reptiles.* J. Whitfield Gibbons and Henk Stribosch, conveners. C. Andr n and G. Nilson; K. A. Bjorndal and A. B. Bolten; C. M. Bull; J. D. Congdon; R. C. M. Creemers and H. Stribosch; A. C. Dunham and K. Overall; J. J. van Gelder; M. Martin; R. S. Oldham; C. J. Reading; J. Reid; M. R. Warburg.

• *Ecology and Behavior of Snakes.* Hubert Saint-Girons and Richard Shine, conveners; R. Duguy, J. W. Gibbons, and P. T. Gregory, moderators. S. J. Arnold; J. P. Baron; A. Bea and F. Brana; W. S. Brown and W. H. Martin; M. B. Charland, A. R. Gibson, P. T. Gregory, and C. R. Peterson; D. Duvall, D. Chiszar, and G. Schuett; N. B. Ford; F. R. Gehlbach; H. W. Greene; H. Heatwole; H. B. Lillywhite and R. W. Henderson; J. M. Macartney, M. B. Charland, and P. T. Gregory; T. Madsen; G. Nilson and C. Andr n; H. Saint Girons, R. Duguy, and G. Naulleau; R. A. Seigel and R. Shine; R. Shine and R. A. Seigel; R. Shine.

• *Ecology and Adaptations in Extreme Environments.* Donald Bradshaw and Leo J. Borkin, conveners. L. J. Borkin, V. A. Cherlin, A. M. Bassarukin, and M. Yu. Maymin; C. James; M. Lemire, R. Vernet, C. Grenot, and J. M. Francz; H. Mendelssohn and A. Bouskila; K. A. Nagy; H. Saint Girons and S. D. Bradshaw; V. H. Shoemaker; G. K. Snyder and J. R. Nestler; P. C. Withers.

• *Amphibian Community Ecology.* Robert Barbault and Masafumi Matsui, conveners. R. C. Bruce; C. D az-Paniagua; N. G. Hairston; R. G. Jaeger; R. F. Inger and H. K. Voris; P. J. Morin; C. A. Toft; H. M. Wilbur.

• *Herpetofaunas: Explorations and Studies.* Ermi Zhao and Donald G. Broadley, conveners. T. C. S. Avila-Pires, F. P. Nascimento, and O. R. da Cunha; J. M. Cei; H. G. Cogger; M. Henzl; M. S. Hoogmoed; R. F. Inger; U. Joger; K. Y. Lue and S. L. Chen; M. Matsui; T. J. Papenfuss and J. R. Macey; J. C. Poynton; C. J. Raxworthy.

• *Evolution and Phylogeny of Frogs.* Raymond F. Laurent and Michael J. Tyler, conveners. R. M. A. Blommers-Schl sser; D. C. Cannatella; A. J. Cardoso; L. S. Ford; D. M. Green; Z. R c k; B. Sanchiz and C. Martin; G. Wei.

• *The Inter-Relationships of Primitive Tetrapods: The Fossil Evidence.* Leonid P. Tatarinov and Robert Carroll, conveners. J. R. Bolt; J. A. Clack; M. Laurin; A. C. Milner and W. Lindsay; A. R. Milner; A. Panchen and T. Smithson; T. Smithson and A. Panchen; L. P. Tatarinov; D. M. Walsh.

• *Paleoherpetology: Impact on Neoherpetology.* Richard Estes and Borja

Sanchiz, conveners; Andrew Milner, moderator. D. C. Cannatella and K. de Queiroz; J. M. Clark; R. Cloutier and L. Trueb; J. A. Holman; P. A. Meylan and E. S. Gaffney; M. A. Norell; G. K. Pregill; J.-C. Rage; Z. Szyndlar and J.-C. Rage.

• *Evolution and Ecology of Island Herpetofaunas.* Thomas Schoener and Ronald Nussbaum, conveners. A. M. Bauer; C. P. Blanc; R. P. Brown and R. S. Thorpe; T. J. Case and D. Bolger; A. S. Gardner; H. Heatwole; I. Ineich; R. B. King; J. B. Losos; A. Malhotra; C. Moritz, T. Case, and D. Bolger; G. K. Pregill; T. W. Schoener; R. S. Thorpe, R. P. Brown, and M. B ez; D. R. Towns; J. W. Wright; W. W ster and R. S. Thorpe; G. R. Zug.

• *Evolution and Life Histories of Turtles.* Justin D. Congdon and Colin Limpus, conveners. R. J. Brooks, D. A. Galbraith, and M. L. Bobyne; J. D. Congdon; N. B. Frazer; D. A. Galbraith; A. Georges and R. Kennett; J. W. Gibbons; R. Kiester.

• *Molecular Systematics.* Herbert Dessauer and Eviatar Nevo, conveners. B. W. Bowen, A. Maylan, and J. C. Avise; J. E. Cadle; L. D. Densmore, P. S. White, and S. J. Kain; H. C. Dessauer and C. J. Cole; A. Georges and M. Adams; G. Gollmann; U. Joger; R. Lawson; R. W. Marlow; E. Nevo; R. S. Thorpe and A. M. Cumming.

• *Cytogenetics of Amphibians and Reptiles.* Ettore Olmo and Midori Nishioka, conveners; W. B hme, moderator. E. Arevalo-M., C. A. Porter, and J. W. Sites; M. King; S. Kohno, C. Ikebe, and M. Kuro-o; H. C. Macgregor; G. Mancino; A. Morescalchi; C. Moritz; E. Olmo, E. Odierna, and T. Capriglione; M. Schmid; L. Singh.

• *Modified Sexual Systems: Parthenogenesis and Hybridogenesis.* John W. Wright and Rainer G nther, conveners. R. L. Bezy; L. J. Borkin, R. G nther, Yu. M. Rozanov, and A. E. Vinogradov; W. M. Brown, L. D. Densmore, C. C. Moritz, D. Peccinini-Seale, V. Singh, D. K. Vyas, and J. W. Wright; I. A. Caune and L. J. Borkin; F. D. Danielyan; I. S. Darevsky and T. M. Sokolova; L. D. Densmore, C. C. Moritz, J. W. Wright, and W. M. Brown; J.-D. Graf and M. Polls-Pelaz; R. G nther; R. G nther and J. Plotner; H. Hotz and P. Beerli; F. Kraus and M. M. Miyamoto; L. A. Kupriyanova; B. E. Leuck; L. A. Lowcock; C. Moritz, C. Spolsky, H. Hotz, I. S. Darevsky, L. Kupriyanova, and T. Uzzell; M. Polls-Pelaz and J.-D. Graf; H. G. Tunner and S. Heppich; J. W. Wright, D. Peccinini-Seale, C. Moritz, J. Sites, D. Vyas, and W. Brown.

• *Modern Approaches to Systematics and Phylogeny of Amphibians and Reptiles.* William E. Duellman and Olivier Rieppel, conveners. J. W. Bickham; W. B hme; W. R. Branch; R. B. Cocroft and M. J. Ryan; W. E. Duellman; U. Joger; A. G. Kluge; J. M. Legler; J. B. Rasmussen; A. G. J. Rhodin; O. Rieppel; L. Trueb and D. C. Cannatella; J. W. Wright.

• *The Biology of the Pipidae.* Richard C. Tinsley and Linda Trueb, conveners.

A. M. B ez; H. R. Kobel; R. O. de S  and D. M. Hillis; R. C. Tinsley; L. Trueb.

• *Energetics of Amphibians and Reptiles.* Warren P. Porter and Raymond B. Huey, conveners. R. A. Avery; A. F. Bennett, B. C. Jayne, and T. Garland, Jr.; K. A. Bjorndal and A. B. Bolten; B. Green; C. Grenot and B. Heulin; K. A. Nagy; J. W. Patterson; W. P. Porter, A. E. Dunham, and J.-P. Chavaz; T. L. Taigen and K. D. Wells; C. R. Tracy.

• *Determinants of Organismal Function.* F. Harvey Pough and Roger S. Seymour, conveners; Robin M. Andrews, Alison Cree, and Dennis R. King, moderators. R. M. Andrews; A. Arillo and E. Balletto; D. Bauwens and R. Van Damme; T. Garland, Jr.; R. G. Jaeger; A. Hailey; D. R. King; K. L. Overall and A. E. Dunham; M. J. Packard and G. C. Packard; J. R. Spotila and M. P. O'Connor.

• *Functional Morphology.* Carl Gans and Jean-Pierre Gasc, conveners. V. Bels; D. Cannatella; C. Gans; J.-P. Gasc; W. H dl; E. Kochva; J. M. Legler; S. K. Saraswat and C. Gans; B. Shaffer; F. de Vree; P. C. Wainwright; D. Weishampfle.

• *Reproductive Endocrinology of Amphibians and Reptiles.* Paul Licht and Louis J. Guillette, conveners. J. Gavaud; L. J. Guillette; P. Licht; F. L. Moore; M. C. Moore; R. Pierantoni.

• *Developmental Processes.* Angus d'A. Bellairs and James Hanken, conveners. P. Alberch; S. V. Bryant and D. M. Gardiner; A. C. Burke; P. Collins and F. S. Billett; M. W. J. Ferguson and B. Westergaard; J. Hanken, D. W. Seufert, and C. H. Summers.

Roundtables and Workshops

In order to provide a variety of formats for participation in the congress, roundtables and workshops were arranged to complement symposia and posters. Roundtables allowed informally-organized discussions among experts on given topics, with audience participation, whereas workshops were practical demonstrations and lectures on the latest techniques, sometimes involving hands-on laboratory sessions. Trevor Beebe served as manager. As for symposia, most of these events had two conveners; multiple authorship refers to the form of abstracts published in the Abstracts volume, although only one author may have participated in the event.

roundtables

• *Conservation Needs Achieved.* Keith Corbett, convener. S. Lyster; D. Newman; S. Stewart; D. Stubbs; R. Whitaker.

• *Conservation Biology: The New "Modern Synthesis" and Its Relation to Herpetology.* C. Kenneth Dodd, Jr., Romulus Whitaker, and Gustavo Aguirre, conveners and moderators. K. Berry; C. K. Dodd, Jr.; A. Hailey; B. Magnusson; J. P. Ross; R. Seigel; R. Whitaker and C. K. Dodd, Jr.

• *Optimal Sizes of Eggs and Clutches.* Henry M. Wilbur and Laurie J. Vitt,

conveners. N. B. Ananjeva and S. Shammakov; J. Bernardo; C. M. Bull and I. Williamson; J. D. Congdon; C. P. Cummins; M. L. Crump; K. Y. Lue and K. S. Chuang; L. Schwarzkopf; R. Seigel, R. Shine and L. J. Vitt; B. Sinervo; P. Sjögren; J. Travis.

• *Antipredator Mechanisms*. Edmund D. Brodie, Jr. and Harry W. Greene, conveners. E. D. Brodie, Jr.; J. P. Caldwell; B. E. Dial; C. Edelstam; H. W. Greene.

• *Ecology and Conservation of the Tuatara*. Michael B. Thompson and Donald G. Newman, conveners; Marie-Charlotte Saint Girons, moderator. C. Carmichael; A. Cree; C. H. Daugherty; J. C. Gillingham; B. Green; L. J. Guillette and A. Cree; M. McIntyre; D. G. Newman; G. C. Packard, M. B. Thompson, and M. J. Packard; M. B. Thompson.

• *Herpetofaunas: A Biogeographic Review of the Continents*. Charles P. Blanc and Jay M. Savage, conveners. S. C. Anderson and A. E. Leviton; C. P. Blanc; D. G. Broadley; J. M. Savage; M. J. Tyler; P. E. Vanzolini.

• *Caecilian Biology and Evolution*. Michael Delsol and Marvalee H. Wake, conveners. J.-M. Exbrayat and M. Delsol; H. Greven; E. Gudynas; W. Himstedt; R. Laurent; J. Lescure and S. Renous; S. Renous, J.-P. Gasc, and J. Lescure; A. Smits; K. Schwenk; B. R. Seshachar; D. M. Walsh; M. Wilkinson; L. Zylberberg.

• *Snake Systematics and Phylogeny*. Herndon G. Dowling, Gregory A. Mengden, and Olivier Rieppel, conveners. H. G. Dowling; G. A. Mengden; J.-C. Rage; O. Rieppel; G. Underwood.

• *Laws, Research, and Conservation: A Conundrum*. Harold G. Cogger and Stephen R. Edwards, conveners.

• *Amateur Contributions to Herpetology*. Wolfgang Böhme, convener. H.-G. Horn; R. Guyétant; W. Sachsse; H. Zimmermann.

• *Medical and Herpetological Aspects of Venoms and Skin Toxins*. José M. Ceil and Sherman A. Minton, conveners. G. De Caro; D. L. Hardy; E. Kochva; D. Mebs; H. Rosenberg; D. A. Warrell; J. White.

workshops

• *Skeletochronology and Aging Methods*. Jacques Castanet and Ella Smirina, conveners. R. Leclair, moderator. M. H. Caetano; J. Castanet and E. Smirina; M. Esteban, P. Herrero, and B. Arano; M. W. J. Ferguson and T. Joanen; R. Leclair; A. Montori; M. Sander; G. R. Zug.

• *Field Methods and Biotelemetry*. Jan van Gelder and R. Stuart Mackay, conveners. J.-P. Gasc; J. J. van Gelder; K. Grossenbacher; R. S. Mackay; J. P. Martínez-Rica; G. Naulleau, J. J. Ducamp, and A. Mariani; T. Pilorge and J. Clobert; R. Podlousky; M. Stanner.

• *Molecular Techniques*. David M. Hillis and Craig Moritz, conveners. L. D. Densmore, F. L. Rose, S. J. Kain, and R. T. Purkiss; D. M. Hillis; L. R. Maxson; C. Moritz; R. Murphy; J. Sites and R. Murphy.

• *Amphibian Larvae*. Barry D. Valentine and Richard Wassersug, conveners and presenters.

• *Quantitative and Phylogenetic Analysis*. Roger S. Thorpe and Garth Underwood, conveners. U. Joger; G. Mengden; M. Miyamoto; R. S. Thorpe; G. Underwood; J. W. Wright.

• *Photographic Techniques*. David Curl and David M. Dennis, conveners and presenters.

Posters

Many delegates participated in the congress by bringing posters describing their research. 370 posters were erected. Special times were set aside when authors were present at their posters to conduct discussions. Richard Tinsley served as Posters Manager.

• *Conservation and Management of Species*. K. H. Berry; L. A. Brandt; D. Corke; S. K. Dutta and P. Mohanty-Hejmadi; S. J. Incháustegui and Y. Arias; F. C. Killebrew; G. Kuchling; G. Kuchling and A. A. Burbidge; A. Muth; R. J. Rao; S. Shammakov; M. P. Simbotwe; M. Vyas, T. P. Vyas, and A. K. Pandey; T. Waller, P. A. Micucci, and E. Richard.

• *Effects of Environmental Pollution on Herpetofauna*. S. K. Bhatti and U. S. Bhatti; U. S. Bhatti and S. K. Bhatti; R. B. Bury and P. S. Corn; D. Dolmen and I. Blakar; M. Puky and N. Oertel; D. H. Taylor, S. Strickler-Shaw and C. W.

Steele; R. Tzannetatos-Polymeri and A. A. Haritos.

• *Captive Management*. R. A. Acuña-Mesen; U. S. Bhatti and S. K. Bhatti; T. Boylan; L. G. Brown; J. F. Iaderosa; K.-H. Jungfer, W. Holmstrom, and J. L. Behler; S. V. Kudrjavtsev; V. K. Uteshev, O. I. Shubray, I. A. Serbinova, and B. F. Goncharov; C. Warwick; H. Zimmerman.

• *Health and Disease*. B. Bannert; J. E. Cooper, R. Ewbank, C. Platt, and C. Warwick; M. E. Cooper; N. J. Millichamp, J. Dziezyc, and J. P. Flanagan; G. R. Pisani and B. R. Stephenson; I. Rác and A. Kósa; V. Roca and M. J. Hornero; C. C. C. Samora, H. E. Coelho, R. E. C. Maitin, and R. C. Paulino; R. C. Sinha and R. P. Singh; J. C. Troiano.

• *Sexual Selection and Communication*. P. R. Y. Backwell and N. I. Passmore; U. S. Bhatti, S. K. Bhatti, and R. S. Sidhu; P. J. Bishop and N. I. Passmore; G. R. Bourne; M. Cherry and T. R. Halliday; F. M. Clarke and C. A. Hosie; L. Edsman; R. Günther and J. Plotner; T. R. Halliday and C. Giacoma; W. Hödl; C. A. Hosie; A. J. in den Bosch; R. W. Krohmer and D. Crews; R. M. M. de Orense; K. Ovaska; R. Pawley and V. H. Hutchison; C. J. Raxworthy; J. J. Schwartz; D. M. Sever; K. Summers; M. Tejedo; A. Zúderwijk.

• *Environmental Sex Determination*. M. T. Dimond; M. A. Ewert and C. E. Nelson; J. L. Harry, K. L. Williams, and D. A. Briscoe; B. Jones, III and J. A. Musick; H. Merchant-Larios and F. I. Villalpando; S. Tokunaga; R. C. Vogt.

• *Orientation, Navigation, Nervous System and Senses*. A. Elepfandt, B. Schanz, B. Traub, M. Hainich, E. Günther, and A. Fleig; J. A. Keinath and J. A. Musick; Y.-P. Mou.

• *Egg Games: Optimal Size and Clutch Size*. C. K. Beachy; M. V. Subba Rao and M. Ratnakumari; Y. L. Werner and E. Frankenberg.

• *Long-Term Studies*. C. M. Bull; J. Burger and R. T. Zappalorti; A. Chandola-Saklani and V. D. Joshi; C. P. Cummins; J. Elmberg; K. Fog; F. J. Mazzotti, L. A. Brandt, and J. R. Wilcox; C. J. Reading.

• *Snake Behavior and Ecology*. A. L. Aghasian; A. Bea and J. P. Martínez Rica; A. Bouskila; P. R. Brown; K. Claus and R. F. Verheyen; J. A. Butler; H. S. Fitch and G. R. Pisani; A. Forsman; M. J. Gaywood and I. F. Spellerberg; M. Hasegawa; W. H. Martin; J.-C. Monney; A. Mori; A. Moser; K. J. Nelson and P. T. Gregory; G. Naulleau, J. J. Ducamp, and A. Mariani; G. R. Pisani and B. R. Stephenson; B. A. Savitzky; A. Solórzano López; B. R. Stephenson and G. R. Pisani; M.-C. Tu, C. M. S. Tsoi, S. H. Fong, and S. C. Lee; P. Vozenilek; K.-N. Xie; M. Zuffi.

• *Ecology and Adaptations in Extreme Environments*. M. R. Warburg.

• *Community Ecology*. A. Channing; I. de la Riva de la Viña; C. K. Dodd, Jr.; G. Moreira and A. P. Lima; I. Pavignano and C. Giacoma; D. Sanders, D. Bauwens, and R. F. Verheyen; P. Walker.

• *Herpetofaunas: Explorations and*



Seal engraved by Hajime Fukada, Past President of Herpetological Society of Japan, to commemorate the First Congress. The Chinese characters read (right to left) "snake" and "propensity"—or "snake mania"—in allusion to herpetologists' devotion to their discipline and to the fact that the congress was held, appropriately enough, in the Chinese Year of the Snake. The seal is written in the Japanese *Ten* style of 1000-500 B.C.

Studies. D. E. Barnard, J. A. Keinath, and J. A. Musick; L. Bodson; D. G. Broadley; M. A. Carretero; M. A. Carretero, X. Fontanet, G. A. Llorente, A. Montori, X. Pascual, X. Santos, E. Filella, S. Gimenez, L. Jover, C. Llorente, and N. Horta; N. Carrillo de Espinoza; J. Castanet and R. Guyétant; J. Dorda Dorda; A. Dubois and A. Ohler; J. R. Formas; J.-P. Gasc; I. V. Ghira and B. Stugren; M. L. Golubev; R. M. Gomez Prieto; H. Grillitsch and F. Tiedemann; U. Gruber; W. D. Haacke, R. Loutit, and S. G. Braine; T. I. Kutenko; Z.-T. Kou; R. C. Longmore; M. T. O'Shea; C. Pérez-Santos and A. G. Moreno; T. S. Sattarov; M. V. Subba Rao and B. Nageswara Rao; N. N. Szczerbak; J. Terhivuo; H.-P. Ting and J. Zheng; B. S. Tuniyev; J. Zheng.

• *The Ecology of Tuatara.* J. F. Cockrem, B. T. Firth, A. Cree, and G. R. Eynon; M. E. McIntyre.

• *Skeletochronology.* S. C. Buchholz; M. H. Caetano; P. Campolongo, H. Francillon-Vieillot, C. Giacoma, F. Rossi, and S. Tripepi; J. Castanet, M. Baez, and A. de Ricqlès; M. Esteban, P. Herrero, and B. Arano; V. G. Ishchenko; A. Juarranz, D. Patón, and A. Morales; G. R. Zug.

• *Field Methods and Biotelemetry.* E. Ferrandis, E. Seva, and P. Gracia; P. E. Ouboter; S. A. Sharygin; G. Sorci.

• *Origin of the Amphibia and Reptilia: Paleontological Evidence.* M. F. Ivakhnenko; R. R. Reisz and M. Laurin; R. Werneburg.

• *Paleoherpetology: Impact on Neoherpertology.* S. C. Anderson and A. E. Leviton; V. M. Ckhikvadze; R. Hernández-R., F. Soberón-M., and M. A. Cabral; G. A. Zerova.

• *Island Herpetofaunas.* M. Gaulke; A. Malhotra and R. S. Thorpe; M. Mylonas and E. D. Valakos; H. Ota; V. Pérez-Mellado and M. P. Galindo Villardón; R. M. Polymeni; G. H. Rodda and T. H. Fritts.

• *Caecilian Biology and Evolution.* J. M. Exbrayat and M. Delsol; W. Himstedt.

• *Molecular Systematics.* B. Arano, M. Esteban, and P. Herrero; C. Corti, M. Capula, and G. Nascetti; L. D. Densmore, F. L. Rose, S. J. Kain, and R. T. Purkiss; M. García-Paris and B. Arano; T. Hayashi and M. Matsui; H.-W. Herrmann, U. Jogger, and G. Nilson; F. R. Méndez-de la Cruz and G. Casas-Andreu; A. H. Price and D. M. Hillis; P. S. White and L. D. Densmore; C. W. Zeyl.

• *Cytogenetics.* R. G. Belcheva and Th. S. Sofianidou; B. D. Bell; T. Capriglione, A. Cardone, G. Odierna, and E. Olmo; M. Capula, F. Andreone, G. Nascetti, and L. Bullini; M. Capula, G. Nascetti, and L. Bullini; A. Cardone, T. Capriglione, G. Odierna, and E. Olmo; C. Chang and A. S. Rand; B. Fritz, W. Ulrich, and J. P. Fritz; E. H. Gadsden; P. Herrero, B. Arano, and M. Esteban; L. A. Kupriyanova; Z.-P. Lin, Z.-X. Wang, and K.-Q. Pan; S. G. Stewart and D. J. Morafka; M. Toriba; G. Wei and X. Ning; G. Wei, X. Ning, and D.-J. Li.

• *Parthenogenesis and Hybridogenesis.* R. L. Bezy; L. J. Borkin, R. Günther, Yu. M. Rozanov, and A. E.



Official congress badge—a metal base painted in gold and blue—donated by Ilya S. Darevsky and his Soviet colleagues and presented to congress delegates.

Vinogradov; W. M. Brown, L. D. Densmore, C. Moritz, and D. Peccinini-Seale; I. A. Caune and L. J. Borkin; F. D. Danielyan; I. S. Darevsky and T. M. Sokolova; L. D. Densmore, C. C. Moritz, J. W. Wright, and W. M. Brown; J.-D. Graf and M. Pols Pelaz; R. Günther; R. Günther and J. Plotner; H. Hotz and P. Beerli; N. Kamezaki; M. W. Klemens; F. Kraus and M. M. Miyamoto; L. A. Kupriyanova; B. E. Leuck; L. A. Lowcock; C. Moritz, C. Spolsky, H. Hotz, and I. Darevsky; M. E. Oliveira, M. Paillette, H. Rosa, and E. G. Crespo; D. Peccinini-Seale, C. Moritz, J. Sites, and D. Vyas; M. Polis-Pelaz and J.-D. Graf; H. G. Tunner and S. Heppich; J. W. Wright; J. W. Wright, D. Peccinini-Seale, C. Moritz, and J. Sites.

• *Systematics and Phylogeny.* L. Bauer; D. P. S. Bhatti; R. P. Brown and R. S. Thorpe; H. Griffith; H. J. Herrmann; A. V. Koroljov, S. M. Moody and M. M. White; A. Ohler; A. G. J. Rhodin; H. Sisniegas; W. Wüster and R. S. Thorpe; A. Young-Downey and J. Moreno.

• *Snake Systematics and Phylogeny.* R. A. Knight, L. D. Densmore, and E. D. Rael; I. Reháč; L. M. Reyes, E. Habacon, R. Tansiel, and D. Morafka; J. B. Slowinski; A. A. Tokar; G. Underwood.

• *Phylogenetic Analysis.* U. Caramaschi; D. R. Frost and R. Etheridge; A. Gubányi and Z. Korsós; T. Hikida; R. S. Thorpe.

• *Energetics.* Y.-K. Bai; R. A. Coulson, T. D. Coulson, and J. D. Herbert; T. Dellinger; B. E. Dial; N. M. Grimmond; F. V. Paladino, M. P. O'Connor, and J. R. Spotila; R. Vernet.

• *Ecological Physiology.* M. Alcobendas; M. E. Allen and O. T. Oftedal; D. J. Baer, O. T. Oftedal, and C. L. Kirk; N. G. Basso and J. D. Williams; C. Carey and J. R. Hazel; C. B. Daniels, P. J. Hayball, H. A. Barr, P. B. Frappell, and T. E. Nicholas; H. Ditrach and H. Splechtna; A. S. Gardner; W. Geise; L. E. Hunt; A. I. Kehr; G. Perry and R. Dmi'el; C. F. D. Rocha; M. G. Rovedatti, P. M. Castañé, and A. Salibián; R. Ruibal and E. J. Carroll, Jr.; A. Salibián; G. Sarig and G. Avital; R. C. Sinha and S. K. Singh; E. D. Valakos; R. Van Damme, D. Bauwens, M. A. Castilla, and R. F.

Verheyen; B. Viertel; P.-C. Wang, X. Ji, and W. Ma; R.-M. Wu; R. L. Wyman and M. P. Frisbie.

• *Functional Morphology.* P. C. Arena and K. C. Richardson; L. J. Barbadillo; V. L. Bels; J. Cleuren, G. De Gueldre, and F. De Vree; J. Cleuren, V. Timmerman, and G. De Gueldre; J.-P. Gasc and S. Renous; V. Goosse and V. L. Bels; J. Klembara; T. M. Környei; D. B. Miles; J. L. Putnam; S. Renous, V. Bels, and J. P. Gasc; N. Salomatina; J. P. N. Singh; L. A. Somma; J. Weisgram and H. Splechtna.

• *Reproductive Physiology.* D. G. Brust; R. L. Burke; J. M. Ceí, N. Ibanez, M. Zerani, and A. Polzonetti-Magni; H. Y. Cheng; C. Gascon; T. U. Grafe; S. Jacobs and J. H. Van Wyk; E. Limatola, F. Angelini, E. Restucci, and A. Boccia; K. Y. Lue and K. S. Chuang; T. M. Martínez; J. Matter; R. C. Noble, D. C. Deeming, and M. W. J. Ferguson; V. K. Uteshev, V. I. Popov, V. N. Parfenov, and B. D. Vassiliev; T. P. Vyas and M. Vyas.

• *Developmental Processes.* L. Alibardi and V. B. Meyer-Rochow; M. Auber-Thomay; F. S. Billet, D. A. Goulding, and P. Collins; F. Braña, F. Gonzalez, M. J. Arrayago, and A. Bea; P. Collins and F. S. Billet; M. R. El-Toubi; A. Goncharenko; C. Martín, M. García-París, and B. Sanchíz; J. O. Ogunranti; B. D. Palmer; R. Putti, L. Varano, A. Cavagnuolo, and V. Laforgia; S. Richter; A. H. Savitzky; R. R. Talavera; J. P. Teixeira and E. G. Crespo; H.-P. Ting.

• *Medical and Research Aspects of Venoms.* D. Kh. Khamidov, M. Sh. Akramov, M. G. Khafizova, L. Ja. Jukelson, S. Tjurin, and R. S. Salikhov; K.-N. Xie; K.-N. Xie and P.-N. Yu; P.-N. Yu; P.-N. Yu and K.-N. Xie; L. Ya. Yukelson, N. S. Auybova, S. M. Leigerman, and N. Sultanalieva; X.-C. Zhang, C.-X. Pang, Y.-G. Li, B. Wang, X.-F. Zhu, J.-J. Li, and S.-J. Li; X.-C. Zhang, C.-X. Pang, A. Hong, Y.-G. Li, B. Wang, X.-F. Zhu, J.-J. Li, and S.-J. Li.

• *Anuran and Urodele Ecology and Behavior.* N. Ancona; J. M. R. Baker; J. A. Diaz and L. M. Carrascal; R. A. Duff; S. E. Endel; X. Fontanet and N. Horta; S. Gafny and A. Gasith; L. García-Hidalgo and C. M. González; H. S. R. Glaser; R. A. Griffiths and P. de Wijer; K. Kabisch and S. Bauch; M. S. Khan; M. Lizana, F. Guerrero, and M. Gil Costa; W. E. Magnusson; R. Mittmann and D. Neumann; J. C. Ortiz and H. Ibarra-Vidal; S. K. Raut; R. Schabetsberger; I. Schlupp and R. Podlucky; B. Seidel; M.-T. Song.

• *Lizard Ecology and Behavior.* D. B. Carter; A. M. Castilla and D. Bauwens; S. C. Castillo; A. Chandola-Saklani and V. D. Joshi; A. Foà, A. Nieri, and G. Tosini; S. J. Inchaustegui and Y. Arias; L. S. Melkumian; C. J. Pollo and V. Pérez-Mellado; S. R. Singh, U. S. Bhatti, and S. K. Bhatti; S. R. Singh and B. S. Kaur.

• *Chelonian Ecology and Behavior.* P. Crucitti, A. Campese, and M. Malori; V. E. Frolov; D. Margaritoulis; I. N. S. Nuijta; J. M. Sutherland and R. Woods; D. S. Wilson.

Other Events and Presentations

In addition to the main scientific program described above, there were numerous other events. The IUCN Species Survival Commission, chaired by George B. Rabb, met at the congress, as did several of its specialist groups concerning reptiles. A meeting of the African Amphibian Group was arranged by Jay M. Savage. A Herpetological Quiz, covering world herpetology and including laboratory displays, was organized by Martha Crump and assisted by Garth Underwood.

An auction of donated herpetological materials (books, prints, original artwork, paraphernalia), organized by Michael Lambert, was held one evening before a large, "spirited" audience. About \$4000 was raised by Joseph T. Collins, the auctioneer, and his assistants, Ruth Zantlinger and Ellin Beltz; the proceeds will support worthy amphibian and reptilian conservation projects, worldwide.

A two-hour-long Herpetological Audiovisual Extravaganza was held, consisting of three sound-and-slide programs which required six computer-controlled slide projectors and a 4-by-10-m screen. "Herpetology Past and Present," an hour-long presentation by David M. Dennis and Kraig Adler, featured photos of herpetologists, their institutions, and illustrations of amphibians and reptiles from earliest times to the present, accompanied by classical

and modern music, and was international in coverage.

Two shorter AV programs by Dennis and J. Eric Juterbock, "Amphibians of the Appalachians" and "Herpetology of the American West," comprised photos of animals and their habitats, accompanied respectively by the music of Aaron Copeland and Igor Stravinsky, and included breathtaking full-screen panoramas of some of the most famous herpetological localities and North American scenery. These three programs, officially sponsored by SSAR, were shown a total of seven times, by popular demand, and were described by members of the French contingent as "formidable!"

There were a large number of commercial exhibits, arranged by Thomas E. S. Langton, including book and print dealers, publishers, conservation displays, and herpetological society membership booths. In addition, numerous congress memorabilia were produced for sale, such as men's ties, crystal paperweights, medallions, and T-shirts decorated with the congress chameleon logo.

The congress Press Office, staffed by two persons, provided regular reports to television and print media of the most important research and conservation news from the congress.

Publications

Each delegate received several congress publications, including a 110-

page Program. The 334-page Abstracts volume, containing half-page summaries of each oral and poster presentation, was organized by Tim Halliday. (Unfortunately, no extra copies are available for sale.) Delegates also received a specially-bound congress edition of SSAR's latest book, *Contributions to the History of Herpetology*, by Kraig Adler, John S. Applegarth, and Ronald Altig, as a gift from the Society.

WCH Executive and Business Meetings

The Executive Committee of the World Congress met four times during the congress and the Business Meeting attracted about 200 delegates. Business included ratification of the WCH Constitution, endorsement of WCH's continuing editorial responsibility for the series *Amphibian and Reptilian Species of the World*, establishment of a Committee on Nomenclature to respond to requests from the International Commission on Zoological Nomenclature, election of new members to the Executive and International Herpetological Committees (EC and IHC) of WCH, passage of resolutions, and discussion of a venue for the Second Congress.

After discussion at the Business Meeting, the new Constitution was approved unanimously. Among other provisions, this affords a mechanism for election of new EC and IHC members



The Executive Committee of the World Congress of Herpetology, in session at Canterbury. Left to right, seated: Michael R. K. Lambert (UK), Marinus S. Hoogmoed (*Treasurer*; Netherlands), P. E. Vanzolini (Brazil); standing: Gustavo Casas-Andreu (Mexico), Robert L. Carroll (Canada), Ermi Zhao (China), Ilya S. Darevsky (USSR), Rainer Günther (German D.R.), Donald G. Broadley (Zimbabwe), Harold G. Cogger (Australia), Kraig Adler (*Secretary-General*; USA), Ian R. Swingland (*Ex officio*; UK), and Hubert Saint Girons (France). Also present but not pictured: José M. Ceí (Argentina/Portugal) and David B. Wake (USA).

(who will serve for two inter-congress terms, with half of both committees being replaced at each congress to provide for continuity and renewal) and future congresses at intervals of 3-5 years.

The Secretary-General and some other members of the EC declined renomination and ten persons were thus newly elected to the EC, which now consists of (new members*): Roger A. Avery*, Wolfgang Böhm*, Donald G. Broadley, Robert L. Carroll, Gustavo Casas-Andreu, Harold G. Cogger, J. C. Daniel, Ilya S. Darevsky, William E. Duellman*, Tim R. Halliday*, Marinus S. Hoogmoed, Konrad Klemmer*, Michael R. K. Lambert, Jean Lescure*, Jay M. Savage*, P. E. Vanzolini, Marvalee H. Wake*, Yehudah Werner*, Romulus Whitaker*, and Ermi Zhao.

The 50-person IHC is now comprised of (new*): Rafael A. Acuña Mesen*, Pere Alberch*, Jean-Louis Amiet, Natalia B. Ananjeva*, Claes André*, E. Nicholas Arnold, Ana Maria Báez*, İbrahim Baran, Willy Beçak, Ben D. Bell, Leo Borkin*, S. D. Bradshaw*, William R. Branch, E. R. Brygoo, Jacques Castanet*, Charles H. Daugherty*, Alain Dubois*, J. Ramón Formas, Darrell Frost*, Carl Gans, David M. Green*, Harold Heatwole, René E. Honegger, Robert F. Inger, Ulrich Joger*, Raymond F. Laurent*, Murray J. Littlejohn*, Shou-hsian Mao, Linda R. Maxson*, Roy W. McDiarmid*, Göran Nilson*, Georges Pasteur, Eric Pianka*, Jens B. Rasmussen*, Armand de Ricqlès, Olivier Riéppel*, Zbyněk Roček*, Borja Sanchiz*, Yoshio Sawai, Richard Shine*, Malumo P. Simbotwe*, Zdeněk V. Špinar, Ian R. Swingland*, Leonid P. Tatarinov, Franz Tiedemann, Richard C. Tinsley*, Linda Trueb*, Michael J. Tyler, Richard Wassersug*, and George R. Zug.

Three resolutions were introduced and discussed. The first, concerning the use of turtle-excluder devices (TEDs) on nets of shrimp boats in the Gulf of Mexico, to reduce the killing of sea turtles, was passed. This resolution subsequently was sent to the Hon. George H. W. Bush, President of the USA. The second resolution concerned the conservation of European herpetofauna and asks for governmental attention to various aspects of conservation. This statement was also passed and copies were sent to the European Parliament and other European governmental bodies. A third resolution, intended to recognize the important contributions of amateur herpetologists to captive husbandry, was, after lengthy discussion, defeated. The delegates, although sympathetic with the intention, felt that such a statement could be misused by some dealers and unscrupulous amateurs.

Formal invitations to hold the next congress in Adelaide (Australia), San José (Costa Rica), or Singapore were discussed. Further invitations are being solicited, but the EC expects to make a final decision early in 1990.

Social Activities

Social activities were held every evening during the conference, to give relief from the intensive daytime scientific sessions and to provide other opportunities for interaction and discussion. The Lord Mayor of Canterbury and the City Council hosted an elaborate reception at the old Westgate Gardens in the city, at which we were entertained by the Canterbury Pipe Band, a highland bagpipe band dressed in full Scottish regalia, and two local troupes, including Morris dancers, demonstrating traditional English country dances. Other evenings featured a discothèque, receptions (the wine was excellent), and film programs.

The WCH banquet was a formal affair, with music by Dixieland and jazz bands, at which the congress hosted the Lord Mayor, the Sheriff of Canterbury, the university's Vice-Chancellor, and other Canterbury and university dignitaries. As was fitting for an occasion of this nature in the United Kingdom, the Secretary-General, on behalf of the delegates, led the formal tribute—called the "loyal toast"—to Her Majesty Queen Elizabeth II.

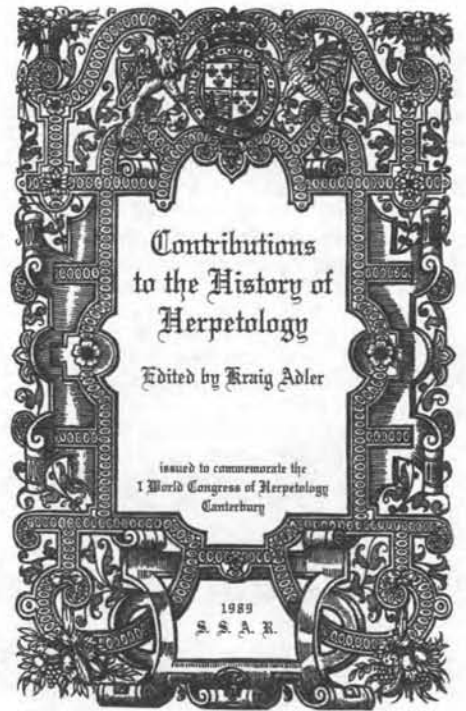
One day midway through the meeting was free of all scientific sessions, allowing delegates and families to relax or participate in guided tours to London, Paris, and other places, although tours were also conducted on other days. Some delegates visited Down House, home of Charles Darwin, now a museum just a short distance west of Canterbury.

On the final evening of the congress there was an enormous outdoor barbecue on a hill overlooking the city, where delegates and their families ate pork ribs and chicken *ad libitum*, washed down with another special congress brew, "Snake Bitters." The 70-member Regimental Band of the Royal Green Jackets, a regular British Army unit stationed near Canterbury, displayed the famed pageantry of the British military by playing martial music while marching in several drill formations to entertain the audience.

On other evenings there were numerous informal gatherings of groups of herpetologists, some of which had never met before as a group (for example, herpetologists from the Soviet Union and China, who met for the first time, and another group from throughout Latin America) and, in other cases, national groups (Canada, New Zealand, etc.) and groups with taxonomic or functional areas in common.

Closing Ceremonies

On the last day, following the final plenary lectures at the Marlowe Theater downtown, the First Congress was brought to a formal close by Kraig Adler. He noted the intensity of the week's activities, the evident enthusiasm for the next congress, and the presence in the audience of numerous senior colleagues from around the world



Contributions to the History of Herpetology, a book published by SSAR to commemorate the First Congress, was issued in a special edition at Canterbury. The book includes biographies of 152 leading herpetologists (with their portraits and signatures), an index to 2500 authors in taxonomic herpetology, and academic lineages of 1300 herpetologists worldwide. The regular cloth-bound edition is available for \$20 postpaid from the Publications Secretary, Robert D. Aldridge (address inside front cover of this issue); see full description in the March 1989 issue of *Herp Review* (centerfold).

as well as many young herpetologists, the youngest of whom was a 15-year-old amateur from Ohio in the USA.

As examples of the eagerness to attend this congress, Adler mentioned one delegate who sold his automobile to obtain the necessary funds, and another who borrowed from friends and relatives overseas and who expects that it will take 10 years to repay the loans. He then called on Michael Lambert, authorized by the WCH Executive Committee to read out the following resolution of appreciation:

* "Recognizing the contribution made in convening the two World Congress committees (the Executive Committee and International Herpetological Committee) and by integrating the interests of the entire herpetological community with those in the United Kingdom for the First World Congress of Herpetology, and the dedication and personal commitment of the Secretary-General on behalf of herpetology and herpetologists worldwide, the profound thanks of the Congress participants are due to Kraig Adler."

• "Acknowledging the assistance in the development and functions of the World Congress of Herpetology, the Executive Committee, on behalf of the world's herpetologists, wish to express their gratitude to:

"1. William Duellman, David Wake, and John Wright, members of an original ad hoc committee which initiated the founding of the World Congress and put the proposal to American and foreign representatives attending the Silver Anniversary Meeting of the Society for the Study of Amphibians and Reptiles and of the Herpetologists' League in Raleigh, North Carolina, August 1982.

"2. Members of the World Congress Constitution Committee: Harold Cogger (Chairman), Natalia Ananjeva, Richard Goris, René Honegger, Jay Savage, and P. E. Vanzolini.

"3. Members of the First World Congress Subsidy Panel: Marinus Hoogmoed (Chairman), Roger Avery, Wolfgang Böhme, John Burton, Carl Gans, Harold Cogger, Michael Lambert, Raymond Laurent, and Jay Savage.

• "Recognizing the value of the work put into developing and maintaining the smooth running of the First Congress, the Executive Committee, on behalf of the participants, have very great pleasure in expressing their deepest gratitude to all those people in the United Kingdom involved with administering the First World Congress of Herpetology, especially: Ian Swingland (Conference Director), together with Fiona Lawson, alias Mrs. Ian Swingland (Records Manager), without whose phenomenal and stalwart efforts the First World Congress of Herpetology might not have happened at all, as well as the following persons:

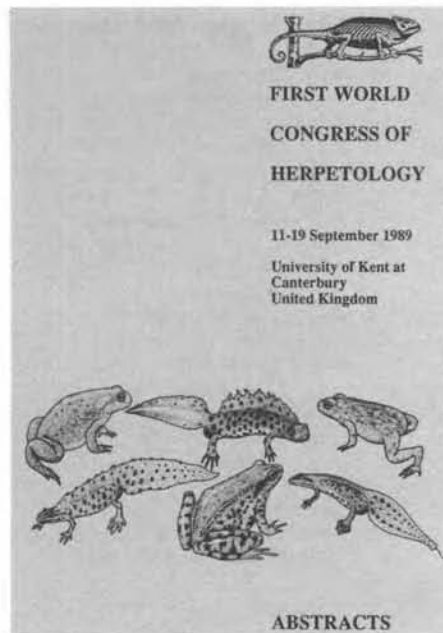
"David Bateman (Database Manager), Richard Griffiths (Stewards Manager), the Earl of Cranbrook (Convener of Honorary Officers), Roger Avery

(Chairman, UK National Executive), Roger Thorpe (Symposia Manager), Richard Tinsley (Posters Manager), Timothy Halliday (Abstracts Manager), Henry Arnold (Films Manager), Trevor Beebee (Workshops and Roundtables Manager), Michael Lambert (Auction Manager), Garth Underwood (Quiz Manager), and the Senior Stewards: Quentin Bloxam, Arnold Cooke, John Cooper, Keith Corbett, Peter Davies, Brian Groombridge, Thomas Langton, Robert Oldham, Peter Olney and David Stubbs.

"At the University of Kent: David Ingram (Vice-Chancellor), Peter Jordan (Conference Officer), Elizabeth Cable (Deputy Conference Officer), Neville Holloway (Catering Manager), and John Pell (Audio-Visual Aids Manager). In the City of Canterbury: Arthur G. Porter (Lord Mayor of Canterbury) and William Preston (Secretary, Canterbury City Council).

"Richard Griffith's team of Congress stewards, especially Margaret Bray, David Curl, David Galbraith, Adrian Hailey, Hinrich Kaiser, Michael Klemens, Mark O'Shea and Ralph Wycherley, and including Begona Arano, Paul Beckwith, Joseph Bernardo, David Bird, Lee Brady, Anne-Marie Brennan, Richard Brown, Angela Buckley, Rob Colby, Will Crampton, Jenny Daltry, Paul Edgar, James Foster, Luis García-Hidalgo, Rosa Gómez-Prieto, Andras Gubányi, Olive Lindstrand, Anita Malhotra, Tricha Murphy, Miklós Puky, Sheik Rashid, S. K. Raut, Julie Roberts, Zbyněk Rocěk, Antonio Salas Jaramillo, Robert Schabetsberger, Birgit Stangl, Mary Swann, Verina Waight, Gang Wei, Rona Williams, Jaclyn Wolfheim, Pieter de Wijer, Galina Žerova, and Robert Macey.

• "Some accompanying persons, to assist needy overseas delegates, became booksellers, namely Dolores Adler and Patricia Zug.



The 334-page Abstracts volume contained half-page summaries of all oral and poster presentations. The drawings, by Tim Halliday, depict the six British amphibians. Britain's reptiles appeared on the cover of the Program.

• "Numerous other individuals and organizations have contributed towards the organization of the First World Congress of Herpetology in a variety of ways, and the Executive Committee take this opportunity to thank them also. These include: Martha Crump (Herpetology Quiz originator), Joseph Collins (auctioneer), assisted by Ruth Zantinger and Ellin Beltz, David M. Dennis (originator and organizer of the Audio-Visual Extravaganza) and his collaborators, J. Eric Juterbock and Kraig Adler; the Society for the Study of Amphibians and Reptiles for donating the Congress Poster (painted by David Dennis) and the book Contributions to the History of Herpetology (edited by Kraig Adler); and Ilya Darevsky and his colleagues in Leningrad for the official congress badge.

• "And for being everywhere at the same time (besides Ian Swingland): Kraig Adler."

After the names of persons newly elected to the Executive and International Herpetological Committees of the World Congress were reported, Kraig Adler announced the results of the Executive Committee's election of senior officers earlier in the day. Robert L. Carroll (Canada) was elected Treasurer and Marinus S. Hoogmoed (Netherlands) as the new Secretary-General. Marinus Hoogmoed then assumed his new office and, after some brief remarks, declared the First Congress closed.

J. ERIC JUTERBOCK
SSAR Secretary



Scheduled intermissions allowed speakers and their audience—here, from the symposium on "Health and Disease"—to talk informally, in lounges near the meeting rooms.

SSAR ELECTION RESULTS

The results of the 1989 SSAR election are as follows:

President-elect Linda E.R. Maxson
Secretary J. Eric Juterbock
Treasurer Douglas H. Taylor
Board - Regular Henry R. Mushinsky
Board - Zoological

Parks Gustavo Casas-Andreu
A total of 658 members voted in this election.

The Society extends its gratitude to the Nominating Committee (James B. Murphy, Chair) and to the SSAR Elector (Ruth M. Zantinger) for their hard work, and to the outgoing president and board members for their service during their terms.

NEWSNOTES

LONGEVITY SURVEY

The deadline for submitting data to the new edition of *Longevity Survey of Reptiles and Amphibians in North American Collections* is 31 May 1990. Please submit data to Kevin Bowler or Andy Snider, Audubon Zoo, 6500 Magazine Street, New Orleans, LA 70178, USA

CROCODILIAN SYMPOSIUM PROCEEDINGS

A separately bound reprint of the symposium *Biology of the Crocodylia* that appeared in Volume 29, number 3 of the *American Zoologist*, September 1989, is available from Valentine Lance, Center for Reproduction of Endangered Species, San Diego Zoo, P.O. Box 551, San Diego, CA. 92112, USA. The reprint is soft-bound, 232 pages in length and consists of 15 major papers, a brief biography of Professor Roland Coulson, to whom the symposium was dedicated, and an afterword by Professor Carl Gans. Copies may be purchased for \$10 U.S., including postage. Make checks payable to the Zoological Society of San Diego, include a notation on the check "account #3-2022-875/972-Lance," and mail to V. Lance. Prepaid orders only please in U.S. dollars.

DALLAS ZOO SEEKS ZOOLOGIST

The City of Dallas Park and Recreation Department is seeking qualified applicants for the position of Zoologist 12 in the Reptile Department of the Dallas Zoo. Responsibilities include research program development and coordination as well as assisting department curators.

Qualified applicants must have a bachelor's degree in zoology or a related field and two years of research experience. Knowledge of the behavior, ecology and physiology of reptiles is highly desirable, as is a degree beyond the bachelor's level.

Salary range is \$22,344-27,132, depending

upon education and experience. Applicants should state they are applying for the Zoologist 12/Reptile Department position in the Park and Recreation Department, and submit applications/resumes by 15 May 1990 to: Staffing Manager, Personnel Department, 1500 Marilla, City Hall Room 6AM, Dallas, TX 75201, USA

SOCIETIES

ADDRESS CHANGES

The following address changes have been submitted since the list of herpetological societies was printed in the September 1989 issue of *Herpetological Review*:

American Society of Ichthyologists
and Herpetologists
Florida State Museum
University of Florida
Gainesville, FL 32611, USA

Herpetologists' League
Texas Natural Heritage Program
Texas Parks & Wildlife Department
4200 Smith School Road
Austin, TX 78744, USA

Nordisk Herpetologisk Forening
Mr. Henrik Bringsoe, Chairman
Esthersvej 7
DK-4600 Koge
Denmark

Oklahoma Herpetological Society
c/o Bob Ball, Newsletter Editor
Route 1, Box 59
Goodwell, OK 73939, USA

Terrariengemeinschaft Berlin E. V.
Mr. Peter Grossman
Lepsiusstrasse 53
D-1000 Berlin 41
Federal Republic of Germany

Society officers are encouraged to forward to the SSAR Regional Society Liaison (see inside front cover of *HR*) any address changes for their society. Newly formed societies are invited to announce their existence in this column.

FEATURES

SEXUAL SELECTION AND COMMUNICATION IN AMPHIBIANS AND REPTILES

The First World Congress of Herpetology was held at the University of Canterbury in England from 11-19 September 1989. In attendance were over 1,000 amphibian and reptile biologists from over 60 countries. Included in the Congress program were six workshops, 11 roundtables and 27 symposia. One of the latter, the subject of this article, was devoted to studies of sexual selection and communication in amphibians and reptiles (17 September). It was convened and

HOLBROOK PORTRAIT



John Edwards Holbrook (1794-1871), the Father of North American Herpetology, was a physician living in Charleston, South Carolina. His two classic books, "North American Herpetology" (first edition, 1836-1840; second edition, 1842) were the first comprehensive surveys of the North American herpetofauna. In 1856-1857, Daniel Huntington painted an oil portrait of Holbrook, which has now been reproduced in full color as a poster measuring 8 3/4 x 11 1/4 inches and printed on heavy, acid-free stock suitable for framing. Copies are available for \$6.00 each or \$4.00 in quantities of 10 or more, postpaid, from SSAR Publications Secretary, Robert D. Aldridge, Department of Biology, St. Louis University, St. Louis, Missouri 63103, U.S.A. (Copies of SSAR's 1976 reprint of Holbrook's "North American Herpetology," 1032 pages, 147 plates with 20 in color, clothbound, are also available from Dr. Aldridge, at \$60.00 postpaid.)

moderated by Murray Littlejohn (University of Melbourne, Australia) and Stevan Arnold (University of Chicago, USA).

Darwin (1871) developed the theory of sexual selection in order to account for the evolution of behavioral and morphological characters (usually exhibited by males) that function solely in the acquisition of mates. The symposium largely was focused on one aspect of sexual selection, intersexual selection or mate choice. This can be defined operationally as any pattern of behavior that leads to members of one sex (usually females) being more likely to mate with certain members of the opposite sex than with others (Halliday 1983a). The second aspect of sexual selection, competition among members of one sex (usually males) for access to members of the opposite sex, also received some attention.

Intersexual selection implies that information is being sent by certain individuals and is

being received by others. In other words, there is communication between sender and receiver, with some aspect of the behavior of the former influencing the behavior of the latter (Slater 1983). The functions of communication during intersexual encounters include the following (Tinbergen 1953; Halliday 1983b): (1) orientation or attraction of partners, often over a considerable distance; (2) "persuasion," whereby one partner increases the sexual motivation of the other in order to elicit a positive sexual response; (3) synchronization of the activities between partners to ensure the highest probability of successful reproduction; (4) species identification, and (5) assessment of some aspect of the "quality" of an individual as a mating partner.

The symposium reported studies of intersexual communication in the context of all five functions listed above. First, physiological (especially endocrinological) mechanisms which ensure intersexual synchrony in the reproduction of reptiles were considered. The majority of papers discussed aspects of mate choice by females of conspecific males. Finally, the role of sexual selection at the level of groups of populations and species was considered, especially in the context of species identification and the speciation process itself.

In this article, I briefly review the papers which comprised the symposium on sexual selection and communication in amphibians and reptiles. The reader will notice that all but one of the 11 papers deals with amphibians, and that of these, all but two deal with anurans.

Reproduction is the single most important event in the life of any organism. To be successful, individuals must time reproduction such that young are produced during a season when they are most likely to survive. In addition, there must be a high degree of synchronization among partners for successful reproduction. David Crews (University of Texas at Austin, USA) discussed his work on two North American reptile species which achieve these two types of synchronization in rather different ways.

In the lizard *Anolis carolinensis*, seasonal changes in the environment trigger neuroendocrine events in males which stimulate both spermatogenesis and the production of male sex hormones by the testis. These hormones then feed back onto centers in the brain to activate both aggressive (directed to other males) and sexual (to females) behavior patterns. Crews has found that male behavior can profoundly influence the rate at which the ovaries of females become ready for reproduction. Male courtship display speeds ovarian growth, whereas aggression among males inhibits it.

Synchronization occurs differently in the snake *Thamnophis sirtalis*. Lengthy winter hibernation and the need to produce young by late summer have resulted in the uncoupling of the processes of spermatogenesis, steroid production and mating behavior in males. Males mate at a time when their testes are regressed; higher spring temperatures directly activate courtship. Female ovaries are also regressed at this time, and develop only after mating activates crucial neuroendocrine events.

The concept of persuasion in intersexual

communication was developed by Lynn Houck (University of Chicago, USA), who presented the results of her studies of sexual behavior in the North American plethodontid salamander *Desmognathus ochrophaeus*. As in many salamander species, male *D. ochrophaeus* deliver courtship pheromones to females during the initial stages of courtship. These pheromones are produced by specialized glands maximally developed only in sexually active males, and are delivered to females only during courtship (thus they are not the same as sex attractants, which operate over longer distances and before the initiation of courtship).

Houck demonstrated experimentally that exposure of females to the male's courtship pheromone renders them fully sexually responsive in a time shorter than that shown by females exposed to males in the absence of pheromone. The courtship pheromone apparently functions to "persuade" the female to mate by increasing her sexual responsiveness above some critical threshold level. In other experiments, Houck has demonstrated that there is considerable variation among males in their success at inseminating females. At least some of this variation may be due to differences among males in the timing of pheromone delivery.

Behaviors which males use to attract and/or stimulate females may incur costs as well as the obvious benefit of increased mating success. Thus a behavior might attract predators as well as potential mates. In frogs, calls used to attract females also may be costly because they are energetically expensive to produce; in some species, calling is the most expensive activity an individual can perform. Kent Wells and Ted Taigen (University of Connecticut, USA) studied the energetics of calling in two treefrogs, with particular emphasis on how the cost of calling changes with increased levels of acoustic competition among males.

In the North American frog *Hyla versicolor*, males call for longer durations when exposed to the calls of other males, but show a decrease in calling rate. Because of this trade-off, vocal interactions among males appear to have little influence on the energetics of calling in this species. Males appear to be close to their maximum ability to call most of the time, the ceiling of which probably is set by the availability of glycogen in muscles. The situation is rather different in *H. microcephala* from Central America. When exposed to the calls of other males, a male of this species adds notes to his own call and increases his rate of calling; the cost of calling increases with increasing chorus size.

Increased rate of calling is only one means by which a male can attempt to maximize the efficiency of his own calls in attracting females. Another is for the male to time the production of his calls so as to avoid overlap with the calls of his neighbors. In this way he increases the conspicuousness of his own calls. Peter Narins (University of California at Los Angeles, USA) predicted that avoidance of overlap should occur in choruses of the Puerto Rican frog *Eleutherodactylus coqui*, because it is the properties of the call notes themselves (not internote intervals) that are important in male aggression and female attraction. Narins developed a model based on this prediction in which a given male actively avoids overlap with, at most, two

neighbors. When Narins tested his model with data collected from natural frog choruses he found that, indeed, males avoid overlap with one or two neighbors.

Frog calls have been studied using a number of different approaches, including behavioral studies of phonotaxis, computer modeling and neurophysiological investigations of the auditory system. Michael Ryan and his colleagues (University of Texas at Austin, USA) presented evidence that physiological properties of the female auditory system might direct the evolution of male calls. In the frogs *Physalaemus pustulosus* (Central America) and *Acris crepitans* (North America) the auditory system of females is able to process a range of acoustic parameters far wider than the range which is typical of the species. As a consequence, once a call type evolves, properties of the female auditory system can exert directional selection on certain call characteristics (e.g., dominant frequency), thus directing their evolution. The sensory apparatus of the female clearly is an important factor in shaping the evolution of male vocalizations.

Chorus behavior in a natural population of the South African frog *Hyperolius marmoratus* was described by Neville Passmore and his associates (University of the Witwatersrand, South Africa). Male frogs and their calling sites were individually marked, and the males' activities were monitored in detail over a four week period. Chorus sizes varied greatly, and the night-to-night turnover of males was high. Considerable variation among males in mating success was found, with some males mating repeatedly and some not at all. However, large males were no more likely to obtain matings than were smaller males. A better predictor of male mating success was the number of nights that a male spent calling to attract females; the more nights, the greater his chances of mating.

That large males were not at an advantage in natural choruses is surprising, for experiments on phonotactic responses of female *H. marmoratus* have shown that call characteristics typical of larger males are preferred by females. In such experiments it is usual for there to be little or no background noise upon which specific call stimuli are superimposed. What is the relationship of the results of phonotaxis experiments to patterns of male mating success seen under more complex, natural conditions?

To answer this question, Mandy Dyson (University of the Witwatersrand, South Africa) studied male mating success in a caged population of *Hyperolius marmoratus* in which she manipulated male density (and thus the amount of background noise each male was forced to call against). Large males, producing the most attractive calls, were more likely to mate than were smaller males at low densities. However, at higher densities, Dyson found that this large-male advantage disappeared, with patterns of male mating success becoming random with respect to body size. Dyson suggested that increased background noise at higher densities resulted in high levels of acoustic interference. As a consequence, female mating preferences could not be effectively expressed.

Male mating tactics and patterns of male mating success have been studied extensively in the bufonid anurans. Considerable

variation exists both within and among species in the tactics used by males to acquire mates, e.g., calling from fixed sites, the adoption of silent satellite tactics and intense scramble competition. Similarly, there is great variation in the degree to which males of certain phenotypes are more successful in mating.

Anthony Arak (University of Oxford, England) considered the causes of intraspecific variation in male behavior in toads. He argued that individual males adopt tactics likely to give them the highest probability of mating based on their own phenotype (e.g., body size) and prevailing conditions at the breeding site. Of the latter, male density and the ratio of males to reproductive females (the operational sex ratio) are the most important factors. Female bufonids are far from passive, however. In many species, females prefer as mates those males that produce the most conspicuous calls. However, as with *Hyperolius marmoratus*, the extent to which a female can effectively express her choice depends upon the intensity of competition among males.

That females benefit from choosing particular males as mates is obvious in those cases where males defend some resource necessary for successful reproduction by females. The situation is less clear in those species in which males provide only genes to their offspring. Bruce Woodward (University of New Mexico, USA) reported the results of experiments on the relationships between male body size and offspring performance in North American anurans (*Scaphiopus*, *Bufo*, *Hyla*).

Woodward found that mating success among males is non-random in many natural breeding assemblages. Female choice might be responsible for the mating advantage enjoyed by larger males. By carefully splitting clutches of eggs of individual females between large and small fathers, Woodward showed that offspring performance is greater when fathers are large than when small. For example, juvenile *S. multiplicatus* grow faster if their fathers are of large body size. For anurans that occupy temporary ponds, differences in the timing of metamorphosis and/or size of offspring at metamorphosis might make all the difference between successful or failed reproduction. Woodward argued that female choice for larger mates is advantageous if larger males sire superior offspring.

Encoded within the call of a male frog are a number of types of information, such as his species identity and body size. Both types of information may be used by females in making mating decisions. Carl Gerhardt (University of Missouri, USA) analyzed call preferences in two North American treefrogs, *Hyla versicolor* and *H. chrysoscelis*. In experiments on phonotactic responses in both species, females preferred synthetic calls with characteristics typical of their species. However, for calls with characteristics within the limits of their species, females preferred calls which are both energetically expensive to produce and which are produced by large males. Gerhardt suggested that females use the same male calls to select both mates of the correct species and mates of superior phenotype. Interestingly, field studies of natural breeding populations of these treefrogs revealed no tendency for large males to have a mating

advantage, a result echoing that for *Hyperolius marmoratus*.

Gerhardt also explored the possibility that the presence of one species might select for greater differences in the call of another, decreasing the likelihood of mistaken interspecific mating (and reproductive failure). Call pulse rate in *Hyla chrysoscelis* was found to vary over a broad geographic scale, but this variation apparently was unrelated to the presence of *Hyla versicolor*.

The evolution of behavioral mechanisms which prevent interspecific gene flow also was considered in the last paper in the symposium. Paul Verrell (University of Chicago, USA) reported that geographically isolated populations of the salamander *Desmognathus ochrophaeus* may differ so greatly in aspects of their sexual behavior that they fail to mate with one another in the laboratory. The degree of sexual isolation among populations increased with increasing geographic distance, presumably because distant populations have been separated for the longest time and have the lowest rates of gene flow. Interestingly, sexual isolation was not significantly related to the degree of genetic differentiation among populations.

Verrell's data indicate that differences in sexual behavior which prevent gene flow among species occur in sympatry may evolve while populations are isolated from one another in allopatry, perhaps under the influence of sexual selection. Observation of heterosexual encounters among individuals from different populations revealed considerable variability in just when in the courtship sequence such encounters break down to result in isolation. Both olfactory and behavioral differences among populations are implicated in the emergence of sexual isolation.

LITERATURE CITED

- Darwin, C. 1871. *The Descent of Man, and Selection in Relation to Sex*. John Murray, London, 475 pp.
- Halliday, T.R. 1983a. The study of mate choice. In: P. Bateson (ed.), *Mate choice*, pp. 3-32. Cambridge University Press, Cambridge.
- Halliday, T. 1983b. Information and communication. In: T.R. Halliday and P.J.B. Slater (eds.), *Animal Behaviour*, vol. 2: Communication, pp. 43-81. Blackwell Scientific Publications, Oxford.
- Slater, P.J.B. 1983. The study of communication. In: T.R. Halliday and P.J.B. Slater (eds.), *Animal Behaviour*, vol. 2: Communication, pp. 9-42. Blackwell Scientific Publications, Oxford.
- Tinbergen, N. 1953. *Social Behaviour in Animals*. Methuen, London. 150 pp.

PAUL A. VERRELL

Department of Ecology and Evolution
The University of Chicago
940 East 57th Street
Chicago, IL 60637, USA



Announcement

SNAKES OF THE AGKISTRODON COMPLEX

by the late Howard K. Gloyd
and Roger Conant

Due to unforeseen delays, publication of this book will be delayed until late summer 1990. The color plates are printed and the text is now completely typeset and in page proof, but additional work is required to prepare the text for printing.

SSAR greatly regrets this inconvenience to subscribers and asks for their continuing patience.—The Editor

PHORID FLY LARVAE AS PREDATORS OF TURTLE EGGS

The egg is one of the most vulnerable stages in the life cycle of turtles. Mortality factors include: erosion of the surrounding substrate, mechanical damage to the shell, changes in the physical-chemical conditions of the substrate (humidity, temperature, salinity, etc.), infection by pathogens such as bacteria or fungi, and predation by various vertebrates and invertebrates (Acuña 1980; Moll & Legler 1971; Pritchard et al. 1984; Dodd 1988). Invertebrate predators include crabs (Márquez et al. 1976), ants (Hughes 1974; Witherington 1986), and fly larvae.

Fly larvae have been reported from eggs of *Malaclemmys terrapin* (Aldrich 1916), *Trionyx muticus* (Muller 1921), *Graptemys pseudogeographica* (Vogt 1981), and *Lepidochelys olivacea* (Polimeni 1988). The flies in these cases were all Sarcophagidae. Manuel Benitez (pers. comm.) has found unidentified fly larvae in decomposing eggs of *Caretta caretta* buried 30-40 cm below the soil in El Salvador. Two species of flies of the family Phoridae have been reported from eggs of *Pseudemys scripta* in Panama (Moll & Legler 1971). We report here the presence of one of these species of Phoridae from eggs of *Rhinoclemmys pulcherrima*.

From a natural nest found in March 1988 in the city of Puntarenas (Puntarenas Province), Costa Rica, six eggs of *Rhinoclemmys pulcherrima* were placed in an incubator in which the temperature was maintained at 28°C. The eggs were partially buried in sterilized soil. After 113 days in the incubator, three of the eggs became darker and appeared to have stopped developing. One of these

three eggs was dissected and was found to contain fly larvae. The remaining two eggs were then transferred to a cage covered with fine mesh cloth. Within one week adult flies emerged from these two eggs. The other three eggs from the nest hatched normally.

Some of the flies emerging from the original two eggs were transferred to bottles containing a nutrient medium composed of agar (4 g), banana (100 g), dry active yeast (a few grains), propionic acid (2 g), and water (95 ml). The remaining flies were left in contact with the decomposing eggs where another generation was completed. These flies from the second generation, having exhausted their food supply of decomposing eggs, were then placed in bottles with nutrient media. The cage containing the emerged flies was cleaned and supplied with two fresh eggs from a captive (unmated) turtle of the same species. The eggs were first washed in water and were then partially buried in autoclaved soil and held at ambient temperature (18-26° C); a fine mist of water was applied to the soil every four days in order to avoid dehydration.

The flies reproduced very well on the nutrient media and apparently interbred with those of the second generation from the original field collected turtle eggs. The eggs from the captive turtle were readily attacked and adult flies emerged in ca. two weeks.

The flies were identified as a species of Phoridae, *Megaselia scalaris* (Loew) (identification by Brian Brown, University of Alberta). This species is extremely polyphagous, having been previously reported from various insect hosts (especially insects in culture), rotting plant tissue, feces, and as a cause of human myiasis (Robinson 1971). *Megaselia scalaris* has also been reared from viable frog eggs: a phyllomedusine in Costa Rica and a leptodactylid in Puerto Rico (Villa & Townsend 1983). We have encountered only one previous record of *M. scalaris* from turtle eggs (Moll & Legler 1971).

When turtle eggs are transferred from the field to the laboratory many of the eggs are frequently found to be infected by bacteria or fungus (Acuña 1980; Wyneken et al. 1988). It is possible that *M. scalaris* locates turtle eggs, in the field as well as in the laboratory, by means of odor from rotting eggs. Nonetheless, when flies were placed with fresh eggs from the captive turtle they demonstrated no difficulties in locating the turtle eggs. Another possible source of attractant for the flies is the cloacal secretions that have been observed in *R. pulcherrima* during deposition of eggs (Monge-Nájera et al. 1988). These cloacal secretions may not have been removed by simple washing in water. Eggs of *Pseudemys scripta* are reported to be most vulnerable during hatching but this was not the case in *R. pulcherrima*.

The adult females of *M. scalaris* oviposited on the surface of the captive turtle eggs and in the soil covering the eggs. Studies of the ultrastructure of the egg shell of *R. pulcherrima* have demonstrated the existence of pores ranging in size from 100 to 700 micrometers (Acuña 1987). Newly hatched larvae of *M. scalaris* were found to have a maximum diameter of 470 micrometers and are therefore quite capable of entering the eggs through larger pores. Once inside the shell the fly larvae probably utilize proteolytic enzymes to break through the egg mem-

brane. Larval feeding within the egg causes the egg to become dehydrated, which in turn results in shell breakage. Flies were observed pupating within the egg and adults probably depend upon shell breakage for emergence from the egg.

Megaselia scalaris is certainly one of the most polyphagous of all insects, attacking a wide range of rotting materials as well as non-rotting but defenseless meat. In the case of turtles this fly appears to be capable of attacking both developing eggs (Moll & Legler 1971) and non-developing eggs (our results). Further study is needed to determine its role as a mortality agent of turtle eggs under natural conditions and whether rates of attack differ between turtle species.

ACKNOWLEDGMENTS

We would like to thank Vilma Castillo Centeno for her enthusiasm in stimulating this study, Bernal Badilla V. for constructing the screen cages, Rafael Hernández for helping in the preparation of the media, and Brian Brown for the identification of the flies.

LITERATURE CITED

- Acuña-Mesen, R.A. 1980. Aspectos biológicos de la fase terrestre de la tortuga lora *Lepidochelys olivacea*. M.S. thesis, Universidad de Costa Rica. 115 pp.
- . 1987. Comparación de la ultraestructura de la cáscara del huevo de la tortuga *Rhinoclemmys pulcherrima* con la de los huevos de otros reptiles. *Rev. Biol. Trop.* 35:41-48.
- Aldrich, J.M. 1916. *Sarcophaga* and allies in North America. Vol. 1, Thomas Say Foundation, Entomol. Soc. Amer., Lafayette, Ind.
- Dodd, C.K., Jr. 1988. Synopsis of the biological data on the Loggerhead Sea Turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish Wildl. Serv., Biol. Rep. 88. 110 pp.
- Hughes, G.R. 1974. The sea turtles of south-east Africa. II. The biology of the Tongaland loggerhead turtle *Caretta caretta* L. with comments on the leatherback turtle *Dermochelys coriacea* L. and the green turtle *Chelonia mydas* L. in the study region. *Oceanogr. Res. Invest. Rep.*, No. 36. 96 pp.
- Marquez, R., A. Villanueva and C. Penaflores. 1976. Sinopsis de datos biológicos sobre la tortuga golfinia, *Lepidochelys olivacea* (Eschscholtz, 1829) en México. *Inst. Nacional de Pesca, Sinopsis Pesca* 2. 61 pp.
- Moll, E.O. and J.M. Legler. 1971. The life history of a Neotropical slider turtle, *Pseudemys scripta* (Schoepff), in Panama. *Sci. Bull. Los Angeles County Mus. Nat. Hist.* 11:1-102.
- Monge-Nájera, J., B. Morera and M. Chavez. 1988. Nesting behaviour of *Rhinoclemmys pulcherrima* in Costa Rica (Testudines: Emydidae). *Herpetol. J.* 1:308.
- Muller, J.F. 1921. Notes on the habits of the softshell turtle *Amyda mutica*. *Amer. Midl. Nat.* 7:180-184.
- Polimeni-Salinas, J.G. 1988. Incubación artificial de huevos de la tortuga lora *Lepidochelys olivacea* (Reptilia: Chelonidae) sometidos a diferentes sustratos de incu-

- bación. Lic. thesis, Universidad Nacional Autónoma, Costa Rica. 160 pp.
- Pritchard, P.C.H., P.R. Bacon, A.F. Carr, R. Marquez and R. Witham. 1984. Manual sobre técnicas de investigación y conservación de las tortugas marinas. Simposio sobre tortugas del Atlántico occidental, San Jose, Costa Rica. 134 pp.
- Robinson, W.H. 1971. Old and new biologies of *Megaselia* species. *Studia Entomol.* 14:331-332.
- Villa, J. and D.S. Townsend. 1983. Viable frog eggs eaten by phorid fly larvae. *J. Herpetol.* 17:278-281.
- Vogt, R.C. 1981. Turtle egg (*Graptemys*: Emydidae) infestation by fly larvae. *Copeia* 1981:457-459.
- Witherington, B.E. 1986. Human and natural causes of marine turtle clutch and hatching mortality and their relationship to hatching production on an important Florida nesting beach. M.Sc. thesis, University of Central Florida, Orlando.
- Wyneken, J., T.J. Burke, M. Salmon and D.K. Pedersen. 1988. Egg failure in natural and relocated sea turtle nests. *J. Herpetol.* 22:88-96.

RAFAEL ARTURO ACUÑA-MESÉN
and
PAUL E. HANSON
Escuela de Biología
Universidad de Costa Rica
San Jose, Costa Rica

GEOGRAPHIC VARIATION IN THE EGG-LAYING STRATEGY OF THE MOLE SALAMANDER, *Ambystoma talpoideum*

There have been several conflicting reports on the egg-laying strategy of the mole salamander, *Ambystoma talpoideum* (Bishop 1943; Mosimann and Uzzell 1952; Shoop 1960; Semlitsch 1985; Semlitsch et al. 1988). Two distinct types of egg-laying patterns have been reported. The first, described by Bishop (1943) for Mississippi and Louisiana, Mosimann and Uzzell (1952) for South Carolina, and Shoop (1960) for Louisiana, indicates that females oviposit small, fragile clusters of eggs (4-41) on twigs, sticks, or grass stems. Shoop (1960) noted that often many clusters appear on the same twig, and may or may not be laid by the same female. The second, described by Semlitsch (1985), indicated that South Carolina females haphazardly scatter their eggs singly across the pond bottom on debris, leaves, and twigs (Fig. 1). A. Braswell (pers. comm.) has also noted this single-egg-laying strategy for North Carolina females. At least three explanations are possible for these observations: 1) one or more of the observations are erroneous, 2) *A. talpoideum* constitutes two cryptic species, each displaying a different strategy, or 3) this species has two distinct egg-laying strategies which vary geographically.

Although widely separated populations are differentiated, no present evidence suggests

two cryptic species within *A. talpoideum* (Lowcock, pers. comm.). Larvae from the Mississippi Valley Physiographic Province (Oktibbeha Co., MS and Shelby Co., TN), however, are distinctly different in pigmentation pattern from individuals found in the Atlantic Coastal Plain Physiographic Province (Union Co., NC; Aiken, Allendale, Barnwell, Charleston, Hampton, Orangeburg, and Sumter Counties, SC; Semlitsch, pers. obs.). Further detailed systematic biochemical and morphological studies of geographic variation are clearly needed to fully eliminate this possible explanation.

One of the reports of *A. talpoideum* egg-laying appears erroneous. Mosimann and Uzzell (1952) reported finding seven masses containing 10-41 eggs and nine adult *A. talpoideum* in a small pond in Dorchester Co., SC. Their report, however, is based on indirect evidence; neither did they observe directly *A. talpoideum* ovipositing nor did they rear larvae from those eggs to metamorphosis. Indeed, *A. talpoideum* is abundant in Charleston Co., SC and one of us (RDS) has found numerous ponds with single eggs presumably laid by *A. talpoideum* and also egg masses presumably laid by *A. tigrinum*. Larvae reared from similar egg masses collected in Aiken Co., SC have been identified as *A. tigrinum*. The single eggs, attached to decaying leaves, could easily have been overlooked if we had been "expecting" egg masses such as previous reports described. The egg masses of *A. tigrinum* in South Carolina have a similar appearance and contain a similar number of eggs (24-98) as do *A. talpoideum* egg masses reported from Mississippi and Louisiana. The egg masses of *A. tigrinum* in South Carolina, however, have a much thinner and "softer" external envelope than do those of *A. maculatum*, which Mosimann and Uzzell (1952) used for the comparative basis of their identification. Mosimann and Uzzell (1952) present the only early description of *A. talpoideum* eggs from the southeastern Atlantic Coastal Plain and we believe the eggs were identified incorrectly. Moreover, all other earlier descriptions of *A. talpoideum* eggs are from southern Mississippi or Louisiana (Bishop 1943), where *A. tigrinum* is altogether absent or rare (Dundee 1988; R. Altig pers. comm.).

Finally, we believe that *A. talpoideum* does exhibit two different egg-laying strategies: oviposition of single eggs on the Atlantic Coastal Plain and egg masses in the Mississippi Valley Physiographic Province. We have reared larvae to metamorphosis from eggs of both types (masses and single) from several natural ponds in both regions that, unquestionably, are *A. talpoideum* (preserved specimens are available for examination). In 10 years of study, South Carolina *A. talpoideum* females (both metamorphic and paedomorphic) have only oviposited eggs singly in natural habitats, dishpans, plastic wading pools, and cattle tanks. Masses have never been observed.

We believe that this variable egg-laying strategy of *A. talpoideum* is unique among salamanders and has gone undetected for years because of the difficulty of finding single eggs in natural ponds and expectations of finding egg masses. We know of no other salamander that is capable of variable egg-laying and suggest that a study of this species' geographic distribution, environmental

advantage (e.g., predation and desiccation resistance), and evolutionary significance would be informative.

ACKNOWLEDGMENTS

We thank A. Braswell, J.W. Gibbons, M. Jackson, T. Lamb, J. Pechmann, and C.R. Shoop for comments on this manuscript and R. Altig and L. Lowcock for their information.

LITERATURE CITED

- Bishop, S.C. 1943. Handbook of Salamanders: The Salamanders of the United States, of Canada, and of Lower California. Comstock Publ. Co., Inc., Ithaca, NY.
- Dundee, H.A. 1988. *Ambystoma tigrinum* locality records—be wary. *Herp. Review* 19:53.
- Mosimann, J.E., and T.M. Uzzell, Jr. 1952. Description of the eggs of the mole salamander, *Ambystoma talpoideum* (Holbrook). *Chicago Acad. Sci., Nat. Hist. Misc.* 104:1-3.
- Semlitsch, R.D. 1985. Reproductive strategy of a facultatively paedomorphic salamander *Ambystoma talpoideum*. *Oecologia* 65:305-313.
- Semlitsch, R.D., D.E. Scott, J.H.K. Pechmann. 1988. Time and size at metamorphosis related to adult fitness in *Ambystoma talpoideum*. *Ecology* 69:184-192.
- Shoop, C.R. 1960. The breeding habits of the mole salamander, *Ambystoma talpoideum* (Holbrook), in southeastern Louisiana. *Tulane Stud. Zool.* 8:65-82.

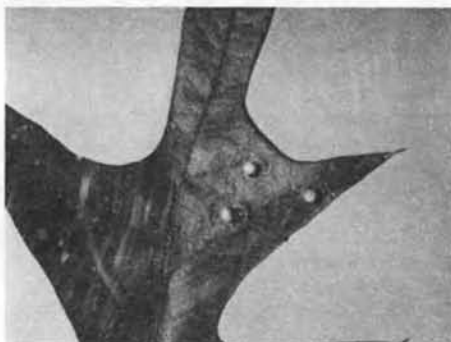


Figure 1. Eggs of the salamander, *Ambystoma talpoideum*, from Aiken Co., South Carolina, found attached to leaf litter at the bottom of an artificial breeding pond. Eggs are deposited as the female walks along the pond bottom and adhere to leaves, twigs, and other debris.

RAYMOND D. SEMLITSCH*

Department of Biology
Memphis State University
Memphis, TN 38152, USA
and

SUSAN C. WALLS

Department of Biology
University of Southwestern Louisiana
Lafayette, LA 70504, USA

*Current Address: Zoologisches Institut der
Universität Zürich, Winterthurerstrasse 190,
CH-8057, Zürich, Switzerland

TECHNIQUE

A NEW PROCEDURE FOR DERMESTID BEETLE PREPARATION OF SKELETONS FROM FORMALIN-FIXED SPECIMENS

Dermestid beetles (Coleoptera: Dermestidae) have long been used to prepare vertebrate skeletons (e.g. Hildebrand 1968). Fixed specimens (those either fixed in formalin, stored in 70% ethanol, or both) are difficult or impossible to skeletonize using standard dermestid techniques. Attempts to make these specimens more palatable to dermestids include application of beef fat or bacon grease (De La Torre 1951) or cod liver oil (Hooper 1956). In our experience dermestids stop feeding once the superficial layer of grease is removed and the process must be repeated. Alternatives to dermestid cleaning (maceration, hand cleaning) are time and labor intensive and usually do not produce skeletons of equivalent quality.

While preparing large series of skeletons from both fixed and fresh reptile specimens, we have found a method yielding far better results than any others we have tried. The only material needed for treatment is fresh muscle tissue or blood. The procedure is as follows.

1. Fixed specimens (to be skeletonized) are skinned, eviscerated, and soaked in cold or room temperature tap water for 1-3 days, depending upon body mass. Water changes may be made, but do not appear necessary.
2. A "blood solution" is prepared. A fresh specimen is soaked in a container of cold tap water until the water is full of blood and body fluids. It is useful to make one or more large incisions to allow the fluids to leave the body. A ratio of ca. 5:1 (body volume: water volume) works well. If the specimen is frozen it may remain soaking until thawed (overnight or longer for large specimens).
3. The fixed specimen is then soaked in this "blood solution" for 3-14 days (depending largely on body mass) at room temperature. It is then removed, excess blood removed by blotting or air drying, and the damp specimen placed in the dermestid colony. It is not recommended that it be placed in the colony while very wet, unless it is of a size that can be cleaned in one day or so, as dampness tends

to promote mold. Depending upon the condition of the dermestid colony, it may also help to remove all other food sources while the fixed specimen is present.

In some cases the dermestids do not completely clean the specimens. Even repeating the blood soaking procedure as many as six or seven times with a single specimen was usually more efficient and quicker than using cod liver oil or grease. In many cases specimens were completely cleaned after one blood soaking. This was rarely the case with other treatments.

This procedure does not require a fresh cadaver as a blood source each time. We have had excellent results by saving pieces of muscle tissue whenever fresh reptiles (e.g. zoo or pet shop specimens) were available. We have successfully used pieces that had been stored frozen for at least four years. Frozen muscle pieces from any fresh cadavers could readily be stockpiled for future use. This method might work with mammalian muscle and blood (e.g. from butcher shops) but we have not tried this.

Many variables may affect the success of this procedure, including concentrations and amount of fixative, length of time stored in fixative or preservative, and buffers present. These factors were unknown in nearly all the specimens that we prepared. We could not ascribe the observed variation in our results of these factors. We believe that extreme precision in temperatures, times or volumes used is not critical. Larger specimens tend to take more time for each step of the process than do smaller ones.

We have not had any major problems with this procedure. The odor produced by an extended blood soaking is comparable to that produced by maceration, so that adequate ventilation is required. We have not observed bone discoloration known to be due solely to this procedure. Many of our fixed specimens were noted during the skinning process to have discolored bones and we suspect that much of this is due to the action of the fixative. In any case, discoloration would seem a small price to pay for an otherwise clean skeletal preparation. We have not tested this method with terrestrial isopods (Maiorana and Van Valen 1985).

LITERATURE CITED

- De La Torre, L. 1951. A method for cleaning skulls of specimens preserved in alcohol. *J. Mammal.* 32:231-232.
- Hildebrand, M. 1968. *Anatomical Preparations.* (Univ. Calif. Press) viii, 100.
- Hooper, E.T. 1956. Selection of fats by dermestid beetles, Dermestidae. *J. Mammal.* 37:125-126.
- Maiorana, V.C. and L. Van Valen. 1985. Terrestrial isopods for preparing delicate vertebrate skeletons. *Systematic Zoology* 34:242-245.

PAUL GRITIS

Department of Biology
Lehigh University
Bethlehem, PA 18015, USA
and

SOPHIE ANN BRUNNER

Division of Amphibians and Reptiles
Field Museum of Natural History
Chicago, IL 60605, USA

HERPETOLOGICAL HUSBANDRY

This section of *Herpetological Review* deals specifically with the husbandry of captive reptiles and amphibians. Articles concerning any aspect of successful exhibit design, techniques for maintenance and breeding, egg incubation, and rearing of the young are acceptable based on the success of the husbandry program, the quality of written work, and the overall value of the presented material to the herpetological community. Reproductive articles should stress the actual methods and specimen manipulation involved but may also include observations of behavior, growth, and statistical data. Of particular interest are reports describing consistently successful, long term programs which deal with large numbers of a single species or genus.

Longer husbandry manuscripts should be divided into appropriate sections including Literature Cited. Black and white photos and line drawings are acceptable. All manuscripts will be reviewed by the Section Editor, and frequently by another individual within the particular area of expertise. Reports which do not deal with herpetological husbandry *per se* (for example, the description of eggs and young from a wild-caught gravid female) will be forwarded to the Editor for consideration as a Feature Article. In order to reduce publication time, husbandry articles should be sent directly to the Section Editor, Bern W. Tryon, Knoxville Zoological Park, Box 6040, Knoxville, Tennessee 37914, U.S.A.

REPRODUCTION IN THE PANCAKE TORTOISE, *Malacochersus tornieri*, IN CAPTIVE COLLECTIONS

The pancake tortoise has long been of interest to zoos and collectors, yet captive reproduction in this species is still sporadic and fortuitous. This paper will report on the breeding activity in two *Malacochersus tornieri* collections in the Washington, D.C. area, and review the published literature on the subject.

The National Zoological Park (NZIP) acquired its first female pancake tortoise, which is still in the collection, in May 1965, but did not add any males until April 1972. Since then the collection has fluctuated considerably, from 1.2 to 4.7 adults housed in one or more groups, but has typically consisted of 1.3 adults in one exhibit. NZIP presently has 3.6 adults in two separate groups.

The private collection of Anne F. Darlington (AFD) consists of 1.1 adults acquired as subadults in March 1986 and a subadult female added in February 1988.

HUSBANDRY

Caging and environment. Housing of the NZIP animals has varied but usually they have been maintained as a group in an indoor exhibit similar to the current one. This is a 2.5x2.5 m enclosure with a 50/50 sand and potting soil substrate, and rockwork around the periphery forming crevices for the specimens and planters for live *Euphorbia* and *Sansevieria*. An 80 watt fluorescent fixture positioned 2.5 m above the substrate is set to give 12 h of illumination in summer and 9 h in winter. Skylights

provide supplemental sunlight. Daylength at this 39° N latitude is 15 h in June and 9.5 h in December. The mean ambient cage temperature is 28.5° C, with an average daily fluctuation of 5.3° C. A 30x100 cm heating pad buried 5 cm under the substrate provides a hot spot exceeding 40° C. A water bowl is always available.

NZIP specimens maintained off-exhibit are kept in a 1.2 m square plywood box with wooden hideboxes. A year-round 12 h day-length is produced by an 80 watt broadspectrum fluorescent fixture suspended 75 cm above the substrate of crushed oyster shell. The ambient temperature averages ca. 28° C and is supplemented by a 250 watt infrared heat lamp which produces an area over 40° C. These specimens are placed in a pan of water three times a week.

The AFD collection is housed outdoors in the Washington, D.C. area when the weather permits. This typically means the tortoises are outdoors continuously from mid-June to mid-September but only during warm, dry, daylight hours in the spring and fall. The enclosure is a fenced 2.5x3 m area of grass with wooden and terra cotta pipe hideboxes, and a pan of water. Other tortoise species also occupy the pen.

When indoors, the AFD *M. tornieri* are housed in a 1.5x2 m cage with wooden hideboxes. A 12 h photoperiod is provided by an 80 watt broadspectrum fluorescent fixture 35 cm above the oyster shell substrate. The ambient temperature averages 24° C during the day and 20° C at night, with a heating pad on continuously at over 42° C. Twice a week the tortoises are placed in pans of water. When nesting is anticipated, a pan of slightly moistened, hard-packed soil is placed in the cage.

Diet. The NZIP pancake tortoises receive the Reptile House's herbivore diet. Until 1985, this was a salad of vegetables and fruits, supplemented with canned dog food and a vitamin and mineral powder, but since then it has consisted of alfalfa hay with soaked dry dog food, some vegetables, fruits, and supplements. The adults are fed twice a week. The AFD collection is fed mostly greens with some vegetables and a small amount of fruit, at least four times a week. When outdoors the tortoises can graze freely, but rarely do so.

COURTSHIP AND AGGRESSIVE BEHAVIOR

Season. Courtship in the NZIP collection is seen year-round at a low level of frequency. The AFD male typically only courts while outdoors, but then does so one or more times a week. Grimpe (pers. com.) reports that courtship is so common at all times of year at the Tulsa Zoological Park (TZP) that the sexes are periodically separated to reduce the stress on the females.

Courtship behavior. At NZIP, a male typically chases a female and mounts from behind, extending his front legs so that his body is nearly vertical. While mounted, the male either gapes or fully opens and closes his mouth at intervals of ca. one sec, without distinct vocalization. Males have occasionally been seen biting females on the neck. The AFD male courts the adult female in the same manner, without any biting. However, his

behavior with the subadult female has included additional sequences. On several occasions, he circled the subadult female and systematically bit each of her appendages. When he climbed atop her, instead of assuming the copulatory mount he remained horizontal, holding her down with his body, biting and scraping with his forelegs at her head and forelimbs to keep her retracted. He kept her thus immobilized for as long as 10 min and then left without attempting copulation. On other occasions, he chased, mounted and copulated with the subadult female as with the adult, without biting or otherwise attempting to immobilize her.

Loweridge and Williams (1957) describe male pancake tortoises viciously biting the females during courtship, even gripping and dragging them by their marginals. Wilke (1983), however, refers only to chasing and copulation.

During the summer of 1988 the AFD male was seen chasing a juvenile *Geochelone carbonaria* on several occasions. Loweridge and Williams (1957) relate that a male repeatedly attempted to mate with a *Kinixys b. belliana*.

Size at maturity. The AFD male was acquired at 117 mm CL and 165 g mass, and first displayed courtship behavior at 124 mm CL and 213 g. Both females were ca. 130 mm CL, 250 g when the male began to court them, and the adult female was 145 mm CL and 400 g at her initial oviposition. An NZP male raised from a hatchling commenced courtship upon being introduced to the group at 115 mm CL, 215 g, when he was 3.5 years old, but was sexed a year earlier.

Aggression. In the first six months after introduction, this same NZP male made five attacks upon another male in the group, who had to be separated permanently. These generally consisted of bites to the hind legs, but on one occasion the aggressor had overturned the other male and was found standing on him, biting his limbs. The victim is blind from cataracts, which may have been a causal factor. No other incidents of male-male aggression have been observed, though both these males have been housed for extended periods in mixed-sex groups.

Beattie (1971), however, relates a similar case of an adult male repeatedly ramming and biting a juvenile one, and also describes an adult female initially showing aggression toward this juvenile "to establish pecking order." When the AFD subadult female was first introduced to the pair, the male immediately approached and sat for several minutes with his snout and front marginals actually touching hers. This was interpreted by the observer, perhaps anthropomorphically, as an act of intimidation. In the aggregate, these incidents suggest that groups of *M. tornieri* may form dominance hierarchies which could have an impact on the success of breeding programs. Additional observations are required, however, before the existence, strength, and nature of such hierarchies can be determined.

EGG LAYING

Season. Eggs have been found in all months of the year except February at NZP, with a slightly greater concentration from November

through January. The AFD female has laid from October through January. Wilke (1983) gives a July to November nesting season, and Grimpe (pers. com.) a September to January one, though eggs have been laid at NZP through the winter to May. Shaw (1970) reports egg production throughout the year, with a somewhat higher level from September through December.

Gravidity. Gestation has not been determined for either collection, but the relative periods of breeding and laying of the AFD pair imply a period of at least 60 days. Observation of nesting behavior is the first indication in either collection that a female is gravid. Experience to date indicates that palpation is not successful in *M. tornieri*, since no eggs have ever been felt, even when a female was palpated only a few days before laying.

False-nesting. At NZP, pancake tortoises have repeatedly been observed digging nests without eggs later being found. Gyarmaty (1988) also observed that several days of nesting behavior precedes oviposition. The AFD female engaged in two-to-four days of false-nesting before each of the first season's clutches, typically while remaining in the hidebox, and was twice seen digging the day after laying. No observations were made of the November 1988 clutch. In January 1989, the AFD female was observed digging nests on nine of eleven consecutive days, and so was given oxytocin. After laying an egg on the surface of the soil, she vigorously made covering motions with her hind legs for 10 minutes. Later that day and the following afternoon she was again observed making covering motions.

Nesting. All the AFD nesting behavior has occurred in the mid- to late afternoon. Most occurs at the same time of day at NZP, but some early morning and evening nesting also takes place. The female seems to prefer a very warm, well-lit location for the nest, and tips her head down and touches her chin to the soil before commencing. The nests are dug with the alternating rear leg movements typical of other tortoise species (Obst 1986), except the female does not urinate on the soil before or during digging. The completed nests are 6-9 cm deep, and the elongated eggs are placed horizontally. Also, at NZP eggs are often partially buried or left exposed on the surface, even when a seemingly suitable area for nesting is available.

Clutch characteristics. The AFD female laid four clutches in the 1987 season and two the following season. The first season the intervals averaged 28 days with a range of 27 to 29 days. Her second season, the interval was 45 days, but the second oviposition was induced with oxytocin. *M. tornieri* in the collection at TZP range from one to six clutches/yr/female (Grimpe, pers. com.), and Wilke (1983) reports one to four. Both sources indicate the shortest clutch interval as 23 days, and that the intervals would average ca. 40 days. Since it is not always possible when an egg is found at NZP to identify which female laid it, the number of clutches/yr/female or the interval cannot be determined. However, one season there were 12 eggs from five females, indicating an average of up to 2.4 eggs/female. This

is consistent with the 19 eggs from seven or eight females in 1966 reported by Shaw (1970), and the three clutches/yr/female given by Obst (1986).

In November of 1988 the AFD female laid a clutch of two eggs. Two egg clutches have also been reported by Grimpe (pers. com.) and Gyarmaty (1988), but have not been recorded at NZP.

EGGS AND INCUBATION

Fertility and hatch rates. Three of the seven AFD eggs hatched (43%), one fertile egg spoiled (14%), two were infertile, and one is currently incubating. Four of the NZP eggs have hatched (6%), four were fertile but died in the egg, 11 were found broken (17%), and 46 were presumed infertile (71%). Low fertility and hatch rates seem common in captive *M. tornieri*. Wilke (1983) obtained 15 hatchlings from 23 eggs (65%), and Shaw (1970) had 31 of 76 hatch (41%). Grimpe (pers. com.) reports that of 52 eggs, seven hatched (13%), two died in the egg (4%), 35 were infertile (67%), four were found broken (8%) and four are now incubating.

Incubation methods and times. The NZP incubation method has varied over the years. The first hatchling, in 1978, incubated in the exhibit substrate. Two others were from eggs artificially incubated in covered 10 gal aquariums heated with plumber's heat tape. The eggs were partially buried in dampened potting soil in plastic containers. The containers were placed in the aquarium on a layer of pea gravel and a relatively high humidity was maintained by adding water to the gravel. The mean temperature of this setup was 26.7°C (range 25.0°-30.2°C). The most recent hatchling was set up in a human incubator with a mean temperature of 30.8°C (range 29.0°-33.8°C) and moderate humidity. The incubation periods (to pipping) for the first two were 169 and 237 days, but the eggs may not have been found immediately after they were laid. The last was 99 days, and the egg was definitely found on the day of deposition.

The AFD eggs were maintained in a poultry incubator which was set for 30°C (range 24-34°C). The eggs were placed on a mixture of sand and peat moss which was kept moderately dry. Incubation times (to emergence) were 177, 184 and 188 days. Wilke (1983) reports incubation times of 117 to 188 days, with a mean of 147, at 28°C and 95% R.H., and Grimpe (pers. com.) gives incubation times of 122, 167 and 187 days at 26-30°C. Shaw (1970) reports a mean of 178 days for 28 eggs, ranging from 113 to 221 days, using various incubation methods with temperatures fluctuating between 26 and 35°C.

HATCHLINGS

Size. As the embryo completes development, the carapace width is oriented along the length of the egg. To fit within the narrow diameter of the egg, the carapace length is reduced considerably by a deep fold across the plastron. Thus when the hatchling first emerges it is highly bowed, and significantly wider than it is long. When the plastron has flattened, after about 24 h, the hatchling becomes nearly circular and the carapace is only moderately domed. See Table 1 for egg

and hatchling dimensions.

Husbandry. Both the NZP and AFD young are treated the same as the adults with regard to diet, environmental conditions and provision of water and hideboxes, except that they are fed four or more times per week and their food is finely chopped. They share the same strongly herbivorous dietary preferences as their parents. Their response to water is also as individually variable as in the adults. They have been maintained on an oyster shell substrate, housed in a variety of containers which are secure against their abilities to climb and squeeze through narrow cracks.

Growth. Hatchlings in both collections have quadrupled their weight by seven months old and doubled their carapace lengths by nine months of age. Wilke (1983) reports even faster gains. Gender identification may be possible at two to three years of age under captive conditions. Grimpe (pers. com.) reports that the first two TZP hatchlings were sexed as males by tail size and observations of mounting at three years old, though they were not responsible for fertile eggs until five years of age. An NZP male was first sexed at about two years, six months old.

Survival rates. Mortality in the hatchlings varies but is commonly low. Of the four NZP hatches, a one-year-old juvenile and a nine-year-old male survive, a five-year-old female died of pneumonia, and a two-year-old juvenile died of intestinal impaction. The AFD hatchlings are only one year old or less, but doing well. Wilke (1983) and Grimpe (pers. com.) both have 100% survival rates (four and seven years, respectively) after their first hatches. Shaw (1970), however, reports only 10 of 31 hatchlings (32%) still alive at the end of the 10 year period covered.

DISCUSSION

Clearly the reproductive potential of *M. tornieri* is greater than implied by the one egg per season reported in the early literature (Loveridge and Williams 1957). However, the fertility and hatch rates in existing collections are too low for that potential to be realized. This may be due to the lack of some or all of the necessary environmental cues in captivity that control the breeding season. Alternatively there may be a genetic incompatibility of the individual specimens. *M. tornieri* has a discontinuous distribution, with isolated populations occurring only in rocky terrain where

suitable cover is available (Eglis 1967). Thus it is possible that there is sufficient genetic disparity to result in reduced viability of offspring if the parents came from different areas. In addition, some as yet unidentified problem with diet, husbandry or incubation methods may be reducing the rate of reproduction. At present, no conclusions can be drawn from the data available, and further study is required to resolve the issue.

ACKNOWLEDGMENTS

We would like to give special thanks to Rusty Grimpe, Reptile Curator, Tulsa Zoological Park, for his generous provision of data, and to Dale Marcellini, Curator of Herpetology, National Zoological Park, for editing the manuscript.

LITERATURE CITED

- Beattie, K. 1971. Aggressiveness. *In: Int. Turt. Tort. Soc. J.* 5(4):4-5.
- Eglis, A. 1967. Flat and fast: the pancake tortoise. *Int. Turt. Tort. Soc. J.* 1(2):29,44-45.
- Grimpe, R. Personal communication. Tulsa Zoological Park, Tulsa, OK. January 10, 1988 and January 30, 1989.
- Gyarmaty, C. 1988. Births and hatchings: Columbus Zoo AAZK Chapter. *Animal Keepers Forum* 15(1):5.
- Loveridge, A. and E.E. Williams 1957. Revision of the African tortoises and turtles of the Suborder Cryptodira. *Bull. Mus. Comp. Zool.* 115(6):283-294.
- Obst, F.J. 1986. Turtles, tortoises and terrapins. St Martin's Press, NY. pp. 886, 165-166.
- Shaw, C.E. 1970. The hardy (and prolific) soft-shelled tortoise. *Int. Turt. Tort. Soc. J.* 4(1):6-9,30-31.
- Wilke, H. 1983. Breeding the pancake tortoise, *Malacochersus tornieri*, at Frankfurt Zoo. *Int. Zoo Yearbook* 23:137-139.

ANNE F. DARLINGTON

Dames & Moore
7101 Wisconsin Ave., Suite 700
Bethesda, MD 20814, USA
and

ROBERT B. DAVIS

National Zoological Park
3000 Connecticut Ave., NW
Washington, D.C. 20008, USA

LIFE HISTORY NOTES

Life History Notes is analogous to Geographic Distribution. Individual notes are to concern only one species, and authors are requested to choose a keyword which best describes the nature of their note (e.g., Reproduction, Longevity, Morphology, etc.). Figures are permissible to illustrate any data, but should **replace** words rather than embellish them. The section's intent is to convey information rather than demonstrate prose! Articles submitted to this section will be reviewed and edited prior to acceptance.

Standard format for this section is as follows: SCIENTIFIC NAME (in caps), COMMON NAME (in parentheses) as it appears in **Standard Common and Current Scientific Names for North American Amphibians and Reptiles**, (Second edition, Collins, Conant, Huheey, Knight, Rundquist and Smith, 1982), KEYWORD (in caps). DATA on the animal (one, or at most two, references may be **briefly** cited in text—**DO NOT** include complete literature reviews—use summary articles wherever possible). Place of deposition or intended deposition of specimen(s), and catalog number(s). Then, skip a line and close with SUBMITTED BY (Name(s) in caps, and address(es) in full—no abbreviations).

(NCN) used for common name = no recognized common name.

Recommended citation for articles appearing in this section is as for Geographic Distribution.

ANURA

ELACHISTOCLEIS BICOLOR. AMPLEXUS BEHAVIOR. On 25 November 1987 a pair of *E. bicolor* was observed in amplexus at Roque Saenz Pena (26° 47' S - 60° 27' W), Chaco, Argentina. Axillary amplexus was observed in open water; the male was glued to the back of the female by a secretion produced by a glandular area of the male's chest behind the axilla. Externally, the glandular area appears as a porous, slightly darker pigmented area of skin that covers ca. 17-20% of the ventral surface. The secretion is strong enough to keep the frogs bonded together after placement in chloreto. The natural process of detachment is unknown. The specimens were deposited in the collection of the Fundacion Miguel Lillo, Tucuman, Argentina (FML 04357).

Submitted by G.J. SCROCCHI and E.O. LAVILLA, Instituto de Herpetologia, Fundacion Miguel Lillo 251, 4000 Tucuman, Argentina

CERATOPHRYS CRANWELLI (Escuerzo). **OVIPOSITION.** On 28-30 October 1985, oviposition in *C. cranwelli* was observed at Monte Quemado (25° 28'S - 62° 52' W) Santiago del Estero, Argentina. Males called from open areas on the margins of a pond; amplexus occurred in shallow water. During amplexus the frogs swam slowly on the surface, then dived suddenly, spraying ca. 25 eggs into the water when the cloacas were nearly perpendicular to the surface.

During oviposition the female produced a series of lateral movements with the femurs,

Table 1. *Malacochersus tornieri* egg and hatchling sizes [mean (range)].

| | | Length (mm) | Width (mm) | Mass (g) | n= |
|-------|------------|------------------|------------------|------------------|----|
| NZP | eggs | 44.8 (32.0-51.0) | 28.1 (16.6-38.4) | 21.8 (10.5-29.2) | 52 |
| | hatchlings | 39.1 (35.2-44.2) | NA | 15.3 (13.3-16.6) | 4 |
| AFD | eggs | 46.8 (44.7-48.5) | 26.6 (21.8-28.7) | 20.2 (18.9-21.9) | 7 |
| | hatchlings | 38.0 (37.4-39.0) | 38.8 (38.4-39.3) | 14.2 (13.4-15.1) | 3 |
| Wilke | eggs | 43 NA | 28 NA | 19 NA | 23 |
| | hatchlings | 38 NA | 38 NA | 11.6 NA | 11 |
| Shaw | eggs | 46.6 (42.7-51.5) | 28.9 (25.5-31.7) | 23.4 (19.1-27.7) | 27 |
| | hatchlings | 39.2 (36.5-47.5) | 38.8 (37.8-42.4) | 15.9 (12.4-23.3) | 8 |

after which the pair returned to the surface, moved forward 3-5 m, and repeated the process several times during the same night. The eggs floated for a couple of minutes, then scattered individually as they sank slowly to the muddy bottom.

As tadpoles of this species are carnivorous and sedentary, we infer that this behavior results in a selective advantage that reduces fraternal cannibalism. Voucher specimens (FML 03635) were deposited in the collection of the Fundacion Miguel Lillo, Tucuman, Argentina.

Submitted by **E.O. LAVILLA** and **G.J. SCROCCHI**, Instituto de Herpetologia, Fundacion Miguel Lillo 251, 4000 Tucuman, Argentina

CAUDATA

PLETHODON DORSALIS (Zigzag Salamander). **MASS MOVEMENT.** Mass movements such as breeding migrations have been well documented in aquatic-breeding terrestrial salamanders in the families Ambystomatidae (Peckham and Dineen 1955. Proc. Indiana Acad. Sci. 6:278-280; Semlitsch 1985. Copeia 2:477-489), Salamandridae (Hurlbert 1969. Ecol. Monogr. 39:465-488), and Plethodontidae (Semlitsch and McMillan 1980. Brimleyana 3:97-105). Breeding migrations are unknown in plethodontid salamanders that lay eggs on land as reproductive activities occur within the normal home ranges of individuals (Duellman and Trueb 1986. Biology of Amphibians. McGraw Hill, New York 670 pp.). However, vertical and horizontal movement related to moisture level has been observed in *Plethodon cinereus* (Heatwole 1962. Ecology 43:460-472; Smith 1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Survey, Urbana 298 pp.).

On the evening of 21 February 1981 I observed a mass unidirectional movement of *Plethodon dorsalis* in the LaRue-Pine Hills Ecological Area of the Shawnee National Forest in Union County IL. While driving on F.R. 345 between the face of the Pine Hills bluff and LaRue swamp (T11S, R3W, Sec 16 and Sec 9) just after sunset during a brief but heavy rain, I encountered roughly 100 salamanders crossing the road. All but one were descending from the bluff toward the swamp.

Southern Illinois experienced a drought in 1980, with total precipitation recorded at Cairo, IL (ca. 70 km SE of site) 28% below the 1941-1970 30-year mean (NOAA 1980. Climatological Data, National Summary 31[1-13]). Whereas January 1981 was also abnormally dry, with precipitation 91% below average, February 1981 was only 5% below normal (USDA 1981. Weekly Weather and Crop Bulletin 68[1-8]).

It appears that this mass movement of salamanders was in response to a period of increased moisture during the drought. *Plethodon cinereus* is less mobile and forages less efficiently during dry periods (Jaeger 1972. Ecology 53:535-546). Movement to a site that retains moisture (such as the vicinity of the swamp) may allow salamanders to continue to forage efficiently during dry periods.

I wish to thank Geri Hawley, Thomas Locke, and Gail Nachel for assistance in removing salamanders from the road, and Dale R. Jackson for commenting on the manuscript.

Submitted by **JOHN G. PALIS**, Florida Natural Areas Inventory, 254 East Sixth Avenue, Tallahassee, FL 32303, USA

TESTUDINES

CHELYDRA SERPENTINA (Common Snapping Turtle). **FEEDING BEHAVIOR.** Snapping turtles are particularly catholic in food selection. Nevertheless, the near exclusive diet of duckweed (*Lemna*) by a large (32.8 cm CL) male from Lake Co. Illinois seems worthy of note. In a biotelemetry study of turtles at Chain O'Lakes State Park, this turtle was observed feeding at the surface of a duckweed covered pond on ten occasions between 23 May and 3 August 1988. Feeding times ranged from 1250 h to 1655 h with pond temperatures (10 cm depth) varying from 19° to 34° (mean 29°) C. Although the dense duckweed obscured details of the feeding process, the turtle appeared to be using neustophagia (Belkin and Gans 1968. Ecology 49:768-769). Periodically raising the head just above the surface, the animal would then open and close its jaws several times in succession. After foraging for 1 to 10 min in a small area (ca. 1 m²), it would move several meters and repeat the procedure.

The turtle was hand-captured and fecal samples were obtained on May 23, 29, and June 13. On July 26 the stomach was flushed (Legler 1977. Herpetologica 33:281-284). Composition of the 45 ml of feces collected was *Lemna* 92%, other plants 6%, and animal remains (insect, mollusks, amphibian bones) 2%. Composition of 50 ml of regurgitate from the flush was *Lemna* 95.5%, vascular plants 2%, and animal matter (snails and fish) 2.5%.

Lemna has been previously reported in snapping turtle diets but not as a staple (Ernst and Barbour 1972. Turtles of the United States. The University Press of Kentucky, Lexington, p. 24). Diets of 21 other snapping turtles collected at the site comprised ca. equal amounts of plant and animal material but no other individual had consumed more than trace amounts of duckweed. Fish was the most important animal food occurring in 38% of the samples and comprising 24% of the total volume consumed.

Submitted by **JENNIFER BUDHABHATTI** and **EDWARD O. MOLL**, Department of Zoology, Eastern Illinois University, Charleston, IL 61920, USA

HYDROMEDUSA MAXIMILIANI. **ECOLOGY.** *H. maximiliani* has a wide distribution in SE Brazil, ranging from Espirito Santo (20° S) to Sao Paulo (Luderwaldt 1926. Rev. Museo Paulista 14:403-468). Virtually nothing has been published about the ecology of this species.

On 7 and 12 November 1988, 15 active individuals (2.10.3) were observed in a 1 km section of a small rocky stream 1-3 m wide in a subtropical rain forest at 900 m elevation in the Carlos Botelho State Reserve (24° 03' S; 47° 59' W) (water pH = 7.9, water temperature = 16-18° C, air temperature = 16-20.5° C). The cloacal temperature of the turtles ranged from 16°-20.0° C, \bar{X} = 18.7° C; N = 12. The temperature of an individual captured while basking on a stone in a small patch of sunlight

was 19° C. The body temperatures recorded for active *H. maximiliani* are the lowest recorded for a neotropical turtle, and only comparable to some Emydids (Brattstrom 1965. Amer. Midland Nat. 73:376-422).

The shells of adult *H. maximiliani* have a cryptic shape similar to that of a dead leaf (the carapace in juveniles is saw-toothed and lighter in color); the turtles rest at curves in the stream where dead leaves accumulate. Low light levels in the forest make the turtles very cryptic in these microhabitats.

Feces were examined from five newly-captured turtles and included remains of several insect orders: Coleoptera; Isoptera; Hemiptera; and Neuroptera as well as several unidentified insect larvae. The decapod crustacean *Aegla odebrechi* was the most common food item found in feces. No vertebrate remains were found in feces; grains of quartz and plant fibers found in the feces were probably taken incidentally. A female captured in November 1988 laid three 40 x 25 mm eggs in January 1989.

I thank S. Pacagnella for logistical support during this study. A.S. Abe and W. Magnuson provided comments on the first draft of the manuscript.

Submitted by **CARLOS YAMASHITA**, Universidade Paulista Julio de Mesquita Filho, Instituto de Biociencias, Zoologica, Rio Claro, Sao Paulo 13.500 Brazil

LEPIDOCHELYS KEMPI (Kemp's Ridley Sea Turtle). **REPRODUCTION.** Kemp's ridley, the most endangered of the world's sea turtles, has a highly restricted nesting distribution. Approximately 95% of the nesting population emerges on a single 32 km beach (Rancho Nuevo) in Tamaulipas, Mexico. Only a small number of nesting records exist for localities elsewhere in Mexico and in Texas; there is one unconfirmed report from Colombia (Ross et al. 1989. The status of Kemp's Ridley, Report to the Center for Marine Conservation, Washington, DC, 51 pp.).

On 30 May 1989 at 0930 h EST, a Kemp's ridley nested on Florida's west coast at Madeira Beach (27° 47' N; 82° 48' W, Pinellas Co., 146th Ave. and Gulf Blvd.). This represents the first documented nesting of *Lepidochelys kempi* in Florida. Although this species is regularly recorded along Florida's west coast, most of these animals have carapace lengths that indicate that they are immature (Ogren, L. 1989. Pp. 116-123, Proc. First Int'l. Sympos. on Kemp's Ridley Sea Turtle Biology, Conservation, and Mgmt. [C. Cailouet and A. Landry, eds.]. Texas A&M Univ. Seagrass Program [TAMU-SG-89-105]).

The ridley deposited 116 eggs, which is a normal complement for this species; daytime nesting is also typical. The nest was inundated by storm tides on 6 June and relocated within a few hours to higher ground. Eighteen hatchlings emerged at dawn on 27 July, and an additional 6 on 28 July, after incubation periods of 58 and 59 days, respectively. Several hatchlings that died in the nest have been deposited in the American Museum of Natural History (AMNH 135224-27).

The nest site was on a highly developed stretch of coast, with high-rise condominiums and a seawall immediately adjacent. Dozens of tourists witnessed the turtle's emergence and nesting. A videotape of the

nesting sequence is archived at the Florida Marine Research Institute.

An attempted nesting by a second Kemp's ridley was recorded that same month on the east coast of Florida. On 22 May 1989 (1150 h EST), a ridley emerged at Phipps Ocean Park, in Palm Beach (Palm Beach Co., 4 km north of Lake Worth Bridge). The turtle excavated a nesting chamber but did not deposit eggs. A second sighting of what was presumed to be the same turtle was made by JF on 5/30; crawls observed in the same vicinity on 5/23 and 5/31 are also attributed to this animal. No eggs were deposited during any emergence, as far as is known. A photograph of this ridley taken by JF on 22 May 1989 is archived at the Florida Marine Research Institute. Neither the west coast nor the east coast ridley was tagged.

Submitted by **ANNE MEYLAN, PATRICIA CASTANEDA, and COLLEEN COOGAN**, Florida Marine Research Institute, 100 8th Avenue, S.E., St. Petersburg, FL 33701; **TONY LOZON**, Florida Environmental Preservation Association, 78 146th Ave., Madeira, FL 33708; and **JOHN FLETEMEYER**, Town of Palm Beach, P.O. 2029, Palm Beach, FL 33480, USA

LACERTA PARVA. COURTSHIP AND REPRODUCTION. The sexual behavior of this species is as yet undescribed. Only some morphometrical statistics on preserved animals—including eggs and young—are available (Peters, G. 1962. Die Zwerggeckse (*Lacerta parva* Blgr.) and ihre Verwandtschaftsbeziehungen insbesondere zur Libanon-eidechse (*Lacerta fraasii* Lehrs). Zool. Jahrb. Syst. Jena 89:407-478).

Three wild-caught animals (2.1) were obtained from a dealer in June 1987. Animals were housed in a 50x30x30 cm glass terrarium, with a layer of sand, some rocks and branches. It was heated by a 25W spotlight for 5-8 h/day (increasing with the natural day-length) resulting in ground temperatures of 15-35°C ($\bar{X} \approx 18^\circ\text{C}$).

After hibernation at 3-5°C from 5 December 1987 to 17 January 1988, 21 matings of these four lizards were observed from 4 February to 30 April 1988. The male approached the female and secured a mouthgrip on the side of her tail or body. Save for a few forward steps, receptive females remained passive. In 20.5±9.5 (5-44) seconds [$\bar{X} \pm \text{S.D.}$ (range)] the male reached, by quick snapping movements, a position just before her hind legs. He then curled his body as she raised her tail base and they copulated.



Figure 1. Copulation of *Lacerta parva*.

Just after intromission was achieved, the male bit the female's femur and within one or two seconds relocated his grip to the fibula-tibia of the same leg (Fig. 1). Rarely the femur bite was skipped. While in copula, one or two of the male's front legs (most often the one underneath him) vibrated rapidly. I once observed that a male had not inserted his hemipenis. Five seconds after "copulation" began, an amber-colored droplet appeared on each of the two terminal tips of the hemipenis. Three seconds later the male pulled his cloaca away from hers. As in all other sessions, the male released his bite-hold just after genital contact ended. Copulation took 11.1±3.2 (7-22) seconds. Immediately thereafter the male made fast (1-2 sec) semi-circles to figure 8's, over or under but especially in front of her, preceded by pushing his snout against the female. He stopped each circling movement on snout contact with the side of her head or body (Fig. 2), then rested his head on the female. These actions, which somewhat depended on her activity, decreased in frequency and velocity from a maximum of 10/min at the beginning to less than once in 4 min near the end. They lasted for 28±12 (15-68) min. In between these motions the male adopted an attentive posture close to the female, sometimes even on top of her, or on the rock under which she hid for a moment: His head and body were extremely raised with his very fingertips touching the substrate. At the same time he made quick lateral scanning movements with his head.

In view of the very open habitat of the species (Peters 1962, op. cit.), a functional explanation of this behavior is that the male is on the look-out for competitors: In this phase activities of other species in neighbouring cages caused fast dashes in their direction. If the female walked off, he either followed or prevented her from moving by increased circling thereby effectively barring her way. These behaviors preventing her "escape" are unique among the mating strategies of 24 (of the around 60 known) species of *Lacerta* and *Podarcis* observed by me. If more than one female was present, the male seemed unable to discern the recently mated one, and he divided his attentions, often even focusing on the wrong female, possibly since she tends to be more active than a recently courted one.

Sexual receptivity in the female lasts from one to six days after oviposition (one observation on day 11). On other occasions females reject the male with bites and tail vibrations.

Females laid 1-3 clutches of 4-5 eggs in March, April and May. A young female produced a first clutch of only two eggs in her



Figure 2. A male *Lacerta parva* circles a female after copulation.

first mating season.

At oviposition eggs measured 7.1±0.4 (6.0-7.9) x 12.0±1.0 (10.0-13.7) mm with masses of 0.39±0.05 (0.35-0.49) g (n=22). Eighteen eggs developed. Just before hatching they reached 11.4±0.9 (10.0-12.9) x 18.8±1.5 (16.2-20.8) mm and 1.37±0.22 (1.16-1.71) g. Incubation took 49±3 (45-52, n=14) days at 25°C, and 32 days (32-34, n=4) at 30°C. SVL of hatchlings (n=18) was 25.7±1.7 (23-28) mm, CL 42.7±3.5 (38-48) mm; mass = 0.51±0.03 (0.48-0.56) g.

After completion of the studies the animals will be deposited in the Rijksmuseum van Natuurlijke Historie (RMNH), Leiden.

Submitted by **HERMAN A.J. IN DEN BOSCH**, Zoologisch Laboratorium, Division of Ethology, University of Leiden, P.O. Box 9516, NL-2300 RA Leiden, The Netherlands

SERPENTES

TANTILLA RUBRA RUBRA (Red Blackhead Snake). **ARBOREALITY.** The genus *Tantilla* is considered a nocturnal, fossorial form that lives under rocks, surface litter or in underground retreats feeding on arthropods, annelids, slugs, spiders and insect larvae. On 16 August 1978, a specimen (EAL 4566) was observed climbing a rough barked tree in a cleared, open area at 0930 h. It was clear and sunny. When first observed the snake was thought to be a vine or root until it was realized that it was moving upwards. It was ca. 3 m above the ground and out of reach when observed. It had to be flicked off with a collecting rake to make the capture. It was collected 9.8 km SW Cerralvo and 16.7 km W on Rancho El Milagro, Picachos Mts., elev. 457 m, Nuevo Leon, Mexico by Ernest A. Liner, Richard M. Johnson and Allan H. Chaney.

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, LA 70364-2598 and **ALLAN H. CHANEY**, 1600 W Johnston 29, Kingsville, TX 78363, USA

XENOCHROPHIS FLAVIPUNCTATA (Common Keelback). **REPRODUCTION.** On 4 February 1989 a freshly laid clutch of 25 eggs was found in a community cage of this species at a local animal dealer's shop in Bangkok. The clutch was taken home and placed on a substrate of moistened vermiculite in an enclosed plastic jar. Incubation was achieved by leaving the clutch exposed to daily atmospheric temperatures. In Bangkok during February the mean maximum temperature is 32.7°C and the mean minimum 22.8°C. The mean maximum temperature in March is 33.8°C and the mean minimum is 24.6°C.

On 19 March 1989 neonates began emerging from the eggs and by the morning of March 20 the last had left the egg. Distractions prevented measurement until the sixth day after hatching. One hundred percent of the eggs hatched, but three of the hatchlings escaped. Of the 22 measured on 25 March 1989 the largest had a SVL of 141 mm., the smallest 110 mm. The \bar{X} SVL was 121.55 mm. Hatchlings first began shedding the fourth day after hatching and the last of them had

completed their first shed six days after leaving the egg.

Submitted by **MEREL J. COX**, 695/17 Pracharaj Road, Soi Homhual, Bangkok 10800, Thailand ●

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records have a standard format, and all authors should adhere to that format, as follows: **SCIENTIFIC NAME, COMMON NAME** (as it appears in **Standard Common and Current Scientific Names for North American Amphibians and Reptiles**, Second edition. Collins, Conant, Huheey, Knight, Rundquist and Smith, 1982), **LOCALITY**, (use metric for distances), **DATE** (day, month, year), **COLLECTOR(S)**, **VERIFICATION BY**, **PLACE OF DEPOSITION** AND **CATALOG NUMBER** (required), **COMMENTS**, **CITATION(S)**, **SUBMITTED BY** (give name and address in full—no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged). Photographs may substitute for a preserved specimen only when the live specimen could not be collected (e.g., it was a protected species or it was found in a protected area). Photographs must be deposited in a university or museum collection, and the catalog number(s) provided.

Please submit new geographic distribution records, in the standard format only, to Joseph T. Collins, Museum of Natural History, The University of Kansas, Lawrence, KS 66045, USA. Short manuscripts are discouraged, and are only acceptable when data cannot be presented adequately in the standard format.

Recommended citation for new distribution records appearing in this section is: Jones, J. 1980. Geographic distribution: *Lampropeltis triangulum multistrata*. *SSAR Herp. Review* 10(1):1.

(NCN) = no recognized common name.

ANURA

BUFO PUNCTATUS (Red-spotted Toad). MEXICO: BAJA CALIFORNIA SUR: Isla Santa Margarita. 17 September 1983. Francisco Reynoso. Verified by L. Lee Grismer. Universidad Autonoma de Baja California Sur (UABCS 0621-0627). New insular record and first record for this species on a Pacific island in Baja California (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston, MA).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico ●

HYLA CRUCIFER (Spring Peeper). USA: ILLINOIS: Dupage Co: Wood Dale Grove Forest Preserve, North Conservation Area (T40N, R11E, S15). 3 April 1988. M. Redmer. Verified by G.S. Casper. Milwaukee Public Museum Herpetology Photo Collection (MPM P-151). Confirms suspected occurrence of species in DuPage County (Cebula J.J. 1982. DuPage Conservationist 18(1):3-5); new county record (Smith P.W. 1961. Illinois Nat. Hist. Surv. Bull., 28(1):298 pp).

Submitted by **MICHAEL REDMER**, 21 W. 103 Par Ln., Itasca, IL 60143, USA ●

PSEUDACRIS STRECKERI STRECKERI (Strecker's Chorus Frog). USA: ARKANSAS: Yell Co.; NE 1/4 of NW 1/4 of Sec 22, T6N, R20W. 13 March 1986. Glyn Turnipseed and Bill Shepherd. Verified by Glyn Turnipseed. Univ. Kansas Mus. of Nat. Hist. (KU 209976-209977). Perry Co.: Upstream from Toadsuck Lock and Dam, (NE 1/4 of Sec 12, T5N, R15W). 9 March 1985. Bill Shepherd and Kenneth Lee Smith. Verified by Bill Shepherd. Arkansas State University Museum of Zoology (ASUMZ 4318 and 4319). Faulkner Co.: Northwest of Lollie (SW 1/4 of SE 1/4 of SE 1/4, of Sec 10, T4N, R15W). 24 March 1985. Bill Shepherd and Mel White. Verified by Bill Shepherd. (ASUMZ 4320 and 4321). These records represent a significant eastward range extension of ca. 156 km from Franklin Co. (Dowling 1957. Occ. Pap. Univ. Arkansas Mus. 3:1-51) to Falkner Co.

Submitted by **GLYN TURNIPSEED**, Department of Biology, Arkansas Tech University, Russellville, AR 72801 and **BILL SHEPHERD**, Arkansas Natural Heritage Commission, Little Rock, AR 72204, USA ●

RANA AREOLATA CIRCULOSA. (Northern Crawfish Frog), USA, ARKANSAS: Pope Co. (NW 1/4 of NE 1/4 of Sec 32, T8N, R20W). 2

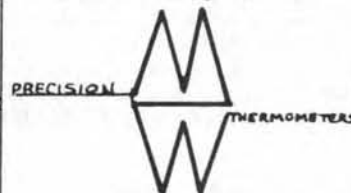
March 1977. Glyn Turnipseed. Verified by Glyn Turnipseed. Univ. of Kansas Museum of Nat. Hist. (KU 209981-209983). Yell Co.: (SE 1/4 of SE 1/4 of SE 1/4 of T6N, R20W, Sec. 7). 2 March 1977. Rich and Linda Shott. Verified by Glyn Turnipseed. (KU 209978-209980). New county records, and a significant east-

CLOACAL QUICK-READING THERMOMETERS

(Formerly Schultheis)

0/50°C

CALL OR WRITE TO PRESENT MANUFACTURER



MILLER & WEBER Inc.

Dept. H

1637 George Street
Ridgewood, Queens
New York, 11385

718-821-7110

Mfg. Since 1941

THE HEAT IS ON!



AFFORDABLE

C-95 8" x 9" heat pad \$18.00
C-95L 9" x 22" \$40.00

FOB Hinsdale

SEND FOR VALENTINE'S EQUIPMENT CATALOG . . .

QUALITY WIRE AND CAGE BUILDING SUPPLIES!!
EVERYTHING YOU NEED FOR COMPLETE ANIMAL CARE.

with VALENTINE'S OWN 14 WATT HEAT PAD (c95L pad 39 watts)

THOUSANDS ARE IN USE IN ZOOS AND HERPETOLOGICAL FACILITIES NATIONWIDE!

here's why:



UNIQUE CONSTRUCTION

HEAT PAD IS PORCELAIN, NOT METAL, FOR A "SOFTER" MORE EVENLY DISTRIBUTED HEAT AREA. 8 FT HEAVY DUTY CORD. MOISTURE PROOF, SMOOTH SURFACE FOR EASY CLEANING.

FUNCTIONAL SIZING

AVAILABLE IN 8" x 9" or 9 1/2" x 22" SIZES . . . PERFECT FOR ANY APPLICATION. ONLY 3/8" HIGH AND EASILY CONCEALED.

SUPER VERSATILITY

COVER WITH ARTIFICIAL TURF OR SOD FOR NATURAL PLANTLIKE ENVIRONMENT. COVER WITH CERAMIC TILE, GRAVEL, ROCK, SAND, BEDDING OR DISPOSABLE LINER TO PROVIDE ROCKY SETTING. PERFECT SOURCE OF "BELLY HEAT" TO PROPERLY DIGEST FOOD.

VALENTINE EQUIPMENT COMPANY

7510 S. MADISON • P.O. BOX 487
HINSDALE, IL 60522

(708) 323-7070 • FAX (708) 323-7076

ward range extension (ca. 88.5 km) (Dowling 1957. Occ. Pap. Univ. Arkansas Mus. 3:1-51).

Submitted by **GLYN TURNIPSEED**, Department of Biology, Arkansas Tech University, Russellville, AR 72801, USA ●

RANA CATESBEIANA (Bullfrog). USA: WISCONSIN: Brown Co: Barkhausen Waterfowl Preserve, along western shore of Green Bay, Suamico (T25N, R20E, Sec 34/36). 1987. M. McFarland. Verified by P.A. Cochran. Photographic slide on file at University of Wisconsin-Green Bay Richter collection (1488s). First published county record (Cochran et al. 1987. SSAR Herp. Rev. 18:21,23), although acoustic records (calling males) were reported previously (Mossman and Hine. 1984. The Wisconsin frog and toad survey: establishing a long term monitoring program. Wisconsin Dept. of Nat. Res., Bureau of Endangered Resources. 13 pp.).

Submitted by **MIKE MCFARLAND**, Barkhausen Water Fowl Preserve, 2024 Lakeview Drive, Suamico, WI 54173, and **RIANA BISHOP**, Division of Natural Sciences, St. Norbert College, De Pere, WI 54115, USA ●

SAURIA

ANOLIS (CTENONOTUS) DISTICHUS (Bark Anole). BAHAMAS: GRAND BAHAMA ISLAND: 24.1 km east of Freeport. 10 October 1988. H.A. Dundee. Verified by A. Schwartz. Subspecies not determined but Schwartz suggests a Bahamian subspecies (except *ocior* or *biminiensis*), most likely *dapsilis*. Tulane University (TU 21140). New island record. Dr. P. Fluck (pers. comm.) says this species (along with *Anolis [Norops] sagrei*) was on Grand Bahama as early as 1968. The species is locally common.

Submitted by **HAROLD A. DUNDEE**, Department of Biology, Tulane University, New Orleans, LA 70118, USA ●

ANOLIS SAGREI (Brown Anole). USA: FLORIDA: Brevard Co: Mobile home park along Hwy A1A, Melbourne Beach. 7 January 1988. P.A. Cochran. Verified by P.A. Cochran. Milwaukee Public Museum (MPM 23363). New county record (Godley et al. 1981. SSAR Herp. Rev. 12:84-86; Ashton and Ashton. 1985. Handbook of Reptiles and Amphibians of Florida. Part two. Lizards, Turtles and Crocodylians, Windward Publ. Co., Miami). The presence of more than one size class and the discovery of egg shell fragments among tufts of fiberglass insulation on the underside of a mobile home indicate that a reproducing population has been established.

Submitted by **P.A. COCHRAN**, Division of Natural Sciences, St. Norbert College, De Pere, WI 54115, USA ●

ANOLIS SAGREI SAGREI (Brown Anole). USA: LOUISIANA: Orleans Par: New Orleans, vic. Japonica St. and Claiborne Ave. 28 Oct. 1988. Stephanie Stevens. Verified by Robert A. Thomas. Louisiana State University Museum of Natural Sciences (LSUMZ 47957).

Jefferson Par: Metairie, corner Airline Hwy (US 61) and N. Wilson St., Exotic Gardens Nursery. 5 Nov. 1988. R.A. Thomas and Patrick J. Thomas. Verified by R.A. Thomas and Douglas A. Rossman. (LSUMZ 47958-67). New state record. The latter is obviously an introduction at the nursery, presumably via plants imported from wholesalers in Florida. Population level is exceedingly high with all age classes present and has survived and prospered through at least two winters. Brown anoles are now seen in adjacent neighborhoods. The former (18.3 km east of the latter location) is presumed to have arrived on a plant purchased at the nursery (no additional specimens have been seen). Nearest known localities are Harris Co., TX (547 km west, Dixon 1987. Amphibians and reptiles of Texas. Texas A&M Univ. Press, College Station) and Marion Co., FL (785 km east, Ashton and Ashton 1985. Handbook of Reptiles and Amphibians of Florida. Part two. Lizards, Turtles, and Crocodylians. Windward Publ., Miami).

Submitted by **ROBERT A. THOMAS, PATRICK J. THOMAS, JENNIFER OUTLAW COULSON**, and **THOMAS COULSON**, Louisiana Nature and Science Center, New Orleans, LA 70187-0610, USA ●

CNEMIDOPHORUS SEXLINEATUS SEXLINEATUS. (Six-lined Racerunner). USA: ILLINOIS: Williamson Co., 3.5 km E Crab Orchard (T9S, R4E, S13). 15 June 1982. W.T. McDowell and S.L. Turner. Verified by R.A. Brandon. Southern Illinois University at Carbondale (SIUC R-2107-2109). New county record. (Smith. 1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1-298).

Submitted by **WILLIAM T. MCDOWELL**, Biological Sciences Program, Southern Illinois University, Carbondale, IL 62901, USA ●

COLEONYX VARIEGATUS PENINSULARIS (San Lucan Banded Gecko). MEXICO: BAJA CALIFORNIA SUR: Isla Santa Margarita. 17 October 1983 and 29 April 1984. Francisco Reynoso. Verified by L. Lee Grismer. Universidad Autonoma de Baja California Sur (UABCS 0640, 1053-54). New insular record (Dixon 1970. Cat. Amer. Amph. Rept. 96:1-96.4).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico ●

GEHYRA MUTILATA (Stump-toed Gecko). MEXICO: BAJA CALIFORNIA SUR: La Paz. 20 September 1983. Clara M. Jimenez. Verified by L. Lee Grismer. Universidad Autonoma de Baja California Sur (UABCS 2885). First record of this species in Baja California (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston, MA).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico ●

HEMIDACTYLUS FRENATUS (House Gecko). MEXICO: BAJA CALIFORNIA SUR: La Paz. Verified by John W. Wright. Universidad Autonoma de Baja California Sur (UABCS 0331). First record of this species in Baja California (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston, MA).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico ●

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: ARKANSAS: Sebastian County: south side of Science building on the campus of Westark Community College, Grand at Waldron, Fort Smith, Arkansas. 8 June 1987. J.J. Wages. Verified by T.M. Buchanan and M.A. Paulissen. University of Arkansas, Department of Zoology (UADZ 3550). A breeding population has existed on the Westark campus for at least 17 years (T.M. Buchanan, pers. obs.) and geckos can be found on all buildings on campus except the library (which was built in 1987 and may not have been "colonized"). First record for Arkansas (Dowling 1957. Occ. Pap. Univ. Ark. Mus. 3:1-51; Heidt, et al. 1979. Checklist of reptiles of Arkansas. Ark. Acad. Sci. Biota Surv. Checklist no. 20, 3pp.).

Submitted by **MARK A. PAULISSEN** and **THOMAS M. BUCHANAN**, Division of Science, Mathematics and Engineering, Westark Community College, P.O. Box 3649, Ft. Smith, AR 72913, USA ●

JAPALURA KUMAONENSIS (NCN). Pakistan: NWFP, Manshera District, Shaheed Pani, in cleared, grassy, open areas in otherwise coniferous forest, near the local snowline (2300-3000 m elev.). 8 May 1988. Khalid J. Baig. Verified by W. Auffenberg. Florida Museum of Natural History, University of Florida (UF 72787). Additional specimens in the Pakistan Museum of Natural History, Islamabad. These represent the first records of this genus and species from Pakistan. The only earlier record with definite locality data is mentioned in Smith (1935. Fauna of British India, Vol. 2, Sauria. Taylor and Francis, London, 440 pp), who listed it from Almora, Nainital, Kumaon District, Uttar Pradesh Province, India. This range extension is expected since the Himalaya ranges are continuous between the two definitely known localities.

Submitted by **KHALID J. BAIG**, Pakistan Museum of Natural History, Markaz F-7, Block 2, Islamabad, PAKISTAN ●

SCELOPORUS TORQUATUS MIKEPRES- TONI (NCN). MEXICO: NUEVO LEON: 19.6 km NE San Antonio de Pena Nevada, Puerto de Pena Nevada, 2743 m elev. 16 July 1980. Ernest A. Liner and Richard M. Johnson. E.A. Liner private collection (EAL 4751); 24.3 km NW San Antonio de Pena Nevada on La Joya road, Puerto de Pena Nevada area, 3002 m. 14 July 1980. E.A. Liner and R. M. Johnson. (EAL 4755, 2 specimens); 19.6 km NE San Antonio de Pena Nevada, Puerto de Pena Nevada, 2743 m. 6 August 1980. E.A. Liner. (EAL 4771); 18.3 km SW Zaragoza at La Encantada,

2743 m. 6 August 1980. E.A. Liner. (EAL 4780, 6 specimens); 18.5 km NE San Antonio de Pena Nevada at Puerto de Pena Nevada, 2743 m. 23 July 1983. E.A. Liner and Allan H. Chaney. (EAL 4966, 3 specimens); 19.6 km NE San Antonio de Pena Nevada (by road) at Puerto de Pena Nevada, 2743 m. 21 July 1986. E.A. Liner and A.H. Chaney. (EAL 5029); 19.6 km NE San Antonio de Pena Nevada (by road) at Puerto de Pena Nevada, 2743 m. 22 July 1985. E.A. Liner and A.H. Chaney. (EAL 5035, 2 specimens); 1.5 km SW La Encantada, 2743 m. 22 July 1985. E.A. Liner and A.H. Chaney. (EAL 5036, 2 specimens). All verified by Ernest A. Liner. First records for the state of Nuevo Leon and extends the form ca. 35 km airline W from the only known locality (Marcela, Tamps., the type locality) (Smith and Alvarez 1974. Trans. Kans. Acad. Sci. 77:219-224).

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, LA 70364-2598 and **ALLAN H. CHANEY**, Department of Biology, Texas A & I University, Kingsville, TX 78363, USA

SERPENTES

ARIZONA ELEGANS ARENICOLOR (Texas Glossy Snake). USA: TEXAS: Anderson Co: Frankston, 2 km S FM 837. 27 June 1986. T. Cole. University of Texas at Arlington (UTACV R-17946); US Hwy 287, 1.6 km NW jct FM 860. 10 September 1988. M.E. Dorcas and J.R. Mendelson III. (UTACV R-24826). Both verified by M.E. Dorcas. New county records that better define northeast extension of range. (Dixon 1987. Amphibians and Reptiles of Texas. Texas A&M University Press).

Submitted by **MICHEL E. DORCAS** and **JOSEPH R. MENDELSON III**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76109, USA

ARIZONA ELEGANS PACATA (Peninsula Glossy Snake). MEXICO: BAJA CALIFORNIA SUR: 20 km N (by Mexican Highway 1) of La Paz. 24 October 1982. Francisco Reynoso. Verified by L. Lee Grismer. Universidad Autonoma de Baja California Sur (UABCS 0223). Extends range 211 km S of previous known southern locality at Ciudad Insurgentes (Dixon and Fleet 1976. Cat. Amer. Amph. Rept. 179.1-179.4).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico

CROTALUS ENYO ENYO (Lower California Rattlesnake). MEXICO: BAJA CALIFORNIA SUR: Isla Coronados. 12 June 1984. Luke George. Verified by L. Lee Grismer. Universidad Autonoma de Baja California Sur (UABCS 0987). New insular record (Murphy and Ottley 1984. Ann. Carnegie Mus. Nat. Hist. 53:207-230).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico

DRYMARCHON CORAIS COUPERI (Eastern Indigo Snake). USA: FLORIDA: Jefferson Co: 17.7 air km SE Wacissa (T3S, R4E, S20). 27 November 1988. John G. Palis. Verified by David L. Auth. Florida State Museum, University of Florida (UF 72746). New county record (Ashton and Ashton 1988. Handbook of Reptiles and Amphibians of Florida, Part One: The Snakes. 2nd. Ed. Windward Publ., Inc. Miami, FL. 176 pp.).

Submitted by **JOHN G. PALIS**, Florida Natural Areas Inventory, 254 East Sixth Avenue, Tallahassee, FL 32303, USA

ELAPHE VULPINA (Fox Snake). USA: WISCONSIN: Calumet Co: Brillion Nature Center (T20N, R20E, Sec 34). 24 August 1987. Mary Sobota. Verified by P.A. Cochran. Photographs on file at University of Wisconsin-Green Bay Richter Collection (1486-1487). New county record (Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Pub. Mus. 205 pp.).

Submitted by **MARY SOBOTA**, Division of Natural Sciences, St. Norbert College, De Pere, WI 54115, USA

ERIDIPHAS SLEVINI SLEVINI (Baja California Night Snake). MEXICO: BAJA CALIFORNIA SUR: Isla Santa Margarita. 17 September 1983. Francisco Reynoso. Verified by L. Lee Grismer. Universidad Autonoma de Baja California Sur (UABCS 0590). New insular record (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston, MA).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico

FARANCIA ABACURA ABACURA (Eastern Mud Snake). USA: FLORIDA: Calhoun Co: 1.3 km E Clarksville on state hwy 20 (T1S, R9W, S6). 17 September 1988. John G. Palis. Verified by David L. Auth. Florida State Museum, University of Florida (UF 72743). New county record (Ashton and Ashton. . . 1988. Handbook of Reptiles and Amphibians of Florida, Part One: The Snakes. 2nd Ed. Windward Publ., Inc. Miami, FL, 176 pp.).

Submitted by **JOHN G. PALIS**, Florida Natural Areas Inventory, 254 East Sixth Avenue, Tallahassee, FL 32303, USA

LAMPROPHELTIS GETULUS HOLBROOKI (Speckled Kingsnake). USA: TEXAS: Anderson Co: FM 59, 0.5 km N jct FM 2961. 10 September 1988. M.E. Dorcas and J.R. Mendelson III. Verified by M.E. Dorcas. University of Texas at Arlington (UTACV R-24825). New county record. (Dixon 1987. Amphibians and Reptiles of Texas. Texas A&M University Press).

Submitted by **MICHAEL E. DORCAS** and **JOSEPH R. MENDELSON III**, Department of Biology, The University of Texas at Arlington, Arlington, TX 76109, USA

LICHANURA TRIVIRGATA TRIVIRGATA (Mexican Rosy Boa). MEXICO: BAJA CALIFORNIA SUR: Isla Santa Margarita. 29 April 1984. Francisco Reynoso. Verified by L. Lee Grismer. Universidad Autonoma de Baja California Sur (UABCS 0876). New insular record (Yingling 1982. Cat. Amer. Amph. Rept. 294.1-294.2).

Submitted by **FRANCISCO REYNOSO**, Museum de Zoologia, Universidad Autonoma de Baja California Sur. Box 21, La Paz, BCS, 23000, Mexico

MASTICOPHIS FLAGELLUM FLAGELLUM (Eastern Coachwhip). USA: TEXAS: Gregg Co: ca. 2 km E Kilgore College, 2600 Dudley Road. 26 August 1988. David McGarity. Verified by M.E. Dorcas. University of Texas at Arlington (UTACV R-24827). New county record. (Dixon 1987. Amphibians and Reptiles of Texas. Texas A&M University Press).

Submitted by **MICHAEL E. DORCAS**, Department of Biology, The University of Texas at Arlington, Arlington, TX 76109, USA

OPHEODRYS VERNALIS BLANCHARDI (Western Smooth Green Snake). USA: NEW MEXICO: Torrance Co: Manzano Mountains, 4 km N and 6.5 km W Tajuque, (T7N, R5E, S36), ca. 2225 m elev. 2 August 1986. J.N. Stuart. Verified by W.G. Degenhardt. Museum of Southwestern Biology, University of New Mexico (MSB 49629). First record for state's Central Highlands (Grobman, A.B. 1941. Misc. Publ. Mus. Zool. Univ. Mich. 50:1-38; 1988. pers. comm.). Partially fills distributional hiatus between Southern Rocky Mountains and Sacramento Highlands. We thank A.B. Grobman for assistance.

Submitted by **JAMES N. STUART**, Environmental Section, U.S. Army Corps of Engineers, P.O. Box 1580, Albuquerque, NM 87103, and **WILLIAM G. DEGENHARDT**, Museum of Southwestern Biology, Department of Biology, University of New Mexico, Albuquerque, NM 87131, USA

PSAMMOPHIS CONDANARUS (Asian Sand Snake). BALI: West Bali; north of Mount Merbuk, on a forest road near the seashore. 25 July 1985. Yvan Gradis. Verified by Ivan Ineich and Jean Deuve. Paris Natural History Museum (MNHN 1989-49). First record from Bali, Indonesia. Known before only from West Java, locality Gresik (Mertens, R. 1957. Senckenb. Biol. 38(1/2):23-31).

Submitted by **IVAN INEICH** and **JEAN DEUVE**, Museum national d'Histoire naturelle, Laboratoire des Reptiles et Amphibiens, 25 rue Cuvier 75005 PARIS, FRANCE

RHADINAEA MONTANA. (Nuevo Leon Yellow-lipped Snake). MEXICO: NUEVO LEON. 4.3 km N Las Adjuntas (by road), 792.5 m elev. 17 July 1985. Ernest A. Liner and Allan H. Chaney. Verified by Ernest A. Liner. E.A. Liner private collection (EAL 5002). Seventh known specimen of this species and extends the range eastward from the previous known localities ca. 34 km airline NNE of Ojo de Agua nr. Galeana (the type locality), and 55

km airline ESE La Huasteca (21 km W Monterrey) (Myers 1974. Bull. Amer. Mus. Nat. Hist. 153(1):1-262).

Submitted by **ALLAN H. CHANEY**, Department of Biology, Texas A & I University, Kingsville, TX 79363 and **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, LA 70364-2598, USA

TANTILLA NIGRICEPS NIGRICEPS (Plains Black-headed Snake). USA: WYOMING: Platte Co: Guernsey. 29 August 1987. Bradley Carl Wichman. Verified by W.K. Hayes, D. Duvall, G.T. Baxter. University of Wyoming Museum of Zoology (H-0619). First state record. Another unpreserved specimen reported from Glendo State Park, Platte Co. (Baxter and Stone. 1985. Amphibians and Reptiles of Wyoming, 2nd ed. Wyoming Game and Fish Department, Cheyenne, 137 pp.), suggests the presence of a viable population along the North Platte River in eastern Wyoming.

Submitted by **WILLIAM K. HAYES**, **DAVID DUVALL**, **WILLIAM A. GERN** and **GEORGE T. BAXTER**, Department of Zoology and Physiology, University of Wyoming, Laramie, WY 82071, USA

THAMNOPHIS SIRTALIS (Common Garter Snake). USA: WISCONSIN: Calumet Co: Brillion Nature Center (T20N, R20E, Sec 34). 21 July 1987. Mary Sobota. Verified by P.A. Cochran. Photograph on file at University of Wisconsin-Green Bay Richter Collection (1485). New county record (Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Pub. Mus. 205 pp.).

Submitted by **MARY SOBOTA**, Division of Natural Sciences, St. Norbert College, De Pere, WI 54115, USA

THAMNOPHIS SIRTALIS ANNECTANS (Texas Garter Snake). USA: TEXAS: Johnson Co.: 8.9 km SW Cleburne at junction Park Rd. 21 and US 67. 11 June 1989. C.T. McAllister. Verified by S.E. Trauth. Arkansas State University Museum of Zoology (ASUMZ 13237). New county record (Dixon 1987. Amphibians and Reptiles of Texas, Texas A&M University Press, College Station, TX, 434 pp.).

Submitted by **CHRIS T. MCALLISTER**, Renal Metabolic Lab (151-G), Veterans Administration Medical Center, 4500 S. Lancaster Rd., Dallas, TX 75216, USA

TESTUDINES

CHELONOIDIS CHILENSIS (Chaco Tortoise). ARGENTINA: FORMOSA: Patiño Department: Estancia Sawicki, Los Immigrantes, Ruta Nacional No. 81 (km 1386), 8 km W of Ibarreta (25° 13' S, 59° 51' W). 7 March 1988. P. Fidalgo and G. Scrocchi. Verified by E. Richard. Herpetological Collection, Fundación Miguel Lillo (FML, Chelonii 031: Adult, skeleton). First record for the Department. The species was previously recorded from Formosa Departments of Pirané and Ramón Lista (Waller, T. 1986. FVSA—Amp. y Rept. (Cons.) 1(2):36-48).

Submitted by **ENRIQUE RICHARD**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000-Tucumán, República Argentina and Proyecto Herpetofauna (FVSA), Sección NOA, Rivadavia 105, 5 to "G", 4000 - Tucumán, República Argentina

CHELONOIDIS CHILENSIS (Chaco Tortoise). ARGENTINA: SANTIAGO DEL ESTERO: Pellegrini Department: Algarrobal Viejo (25° 43'S, 64° 02'W). 10 October 1988. E. Richard and J.M. Gómez. Verified by E. Richard. Herpetological Collection, Fundación Miguel Lillo (FML, Chelonii 030: adult male); Figueroa Department: Ruta Provincial no. 5, 32 km before Caspi Corral (between La Banda and Caspi Corral). 27 October 1985. M. Fabrezi, J. Langone, E. Lavilla, R. Montero and G. Scrocchi. Verified by E. Richard. (FML, Chelonii 008: adult male). First records for the departments. The species was previously recorded from Santiago del Estero departments of General Toboada, Jiménez, Quebracho, La Banda, Ojo de Auga, Río Hondo, and Alberdi (Waller, T. 1986. FVSA—Amp. y Rept. (Cons.), 1(2):36-48). The Pellegrini Dept. record is a contribution of the "Proyecto Tortugas" (Proyecto Herpetofauna -FVSA), supported by the Kantonaler Zürcher Tierschutzverein (Switzerland).

Submitted by **ENRIQUE RICHARD**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 - Tucumán, República Argentina, and Proyecto Herpetofauna (FVSA), Sección NOA, Rivadavia 105-5to "G", 4000 - Tucumán, República Argentina

CHELONIA MYDAS (Green Sea Turtle). ARGENTINA: CHUBUT PROVINCE: Fondeadero Sarmiento shore (42° 15'S, 64° 04'W). 13 July 1988. G. Venegas. Verified by J.A. Scolaro. Centro Nacional Patagónico, Colección Herpetológica (CNP-H #0331). This is the most southerly record for the species on the Atlantic coast and the first to be recorded on Valdes Peninsula, near Puerto Madryn city (Frazier 1984. Las tortugas marinas en el Océano Atlántico sur occidental. Asoc. Herpetol. Argentina. S. Divulg. 2. La Plata. 22 pp.). The specimen (carapace length 39.5 cm; mass 5.7 kg) was collected dying at shore.

Submitted by **JOSÉ ALEJANDRO SCOLARO**, Centro Nacional Patagónico, Consejo Nacional de Investigaciones Científicas y Técnicas, Casilla Correo 69, (9120) Puerto Madryn, ARGENTINA

CHELYDRA SERPENTINA (Snapping Turtle). USA: WISCONSIN: Kewaunee Co: in School Creek near bridge along Hwy. 54, 1 km east of County Hwy. H (T24N, R22E, Sec 17). 11 June 1988. Dreux J. Watermolen. Verified by P.A. Cochran. University of Wisconsin-Green Bay Richter Collection (0318). Adult. New county record (Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Pub. Mus. 205 pp.).

Submitted by **DREUX J. WATERMOLEN**, Division of Natural Sciences, St. Norbert College, De Pere, WI 54115, USA

CHRYSEMYS PICTA (Painted Turtle). USA: WISCONSIN: Calumet Co: Brillion Nature Center (T20N, R20E, Sec 34). 15 September 1987. Mary Sobota. Verified by P.A. Cochran. Photographs on file at University of Wisconsin-Green Bay Richter Collection (1483, 1484). New county record (Vogt. 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Publ. Mus. 205 pp.).

Submitted by **MARY SOBOTA**, Division of Natural Sciences, St. Norbert College, De Pere, WI 54115, USA

Computerize Your Field Notes

GECKO is very powerful, yet uses simple screen menus. It will allow you to:

Record genus, species, subspecies, number, locality, county, state, collector or observer, collection number and comments. Family, order and class are entered automatically.

Extract data for viewing, editing or printing by any combination of the above, e.g. iguanid lizard localities for Inyo Co., California or all herps seen in Texas from June through September.

List, edit or print data by order of entry, by date or phylogenetically in a variety of formats from simple species lists to complete records.

Copy selected records to files for use with data base programs, spreadsheets, or word processors.

Count the number of species for all or part of the data base, e.g. number of species for 1989 or number of species of *Hyla*.

GECKO incorporates a master species list of U.S. and Canadian herps. Lists of other vertebrates are available and can be merged for more comprehensive coverage. The master list can also be edited to accommodate taxonomic changes or new species. **Version 4.0** is now available. It offers the option to enter scientific names with simple, intuitive codes for fast, accurate data entry.

GECKO runs on IBM PCs and compatibles with 320K RAM and DOS 2.0 or later. \$65 + \$3 shipping. California residents add 6.25% tax.

Sandpiper Software

153 Michele Circle, Novato, CA 94947



SELECTED HERP BOOKS FROM -

ZOO BOOK

SALES

P.O. Box 349
Sanibel Island, Fla. 33957
Phone (813) 472-5490

REPTILES:

COR-757s

CATALOGUE OF THE NEOTROPICAL SQUAMATA - PART 1 SNAKES, by James A. Peters and Roberto Donoso-Barros -- PART 2 LIZARDS AND AMPHISBAENIANS, by James A. Peters and Braulio Orejas-Miranda - Reprint with new material by P.E. Vanzolini (1986) The checklist of Central and South American snakes and lizards. The only work to cover the continent. Primary synonymies and keys in both English and Spanish. The update brings all the taxonomic nomenclature current through early 1986. 148 b&w illustrations, 672 pp., 8½ X 11" Softcover . \$29.95

COR-059H

THE VENOMOUS REPTILES OF LATIN AMERICA, by Jonathan A. Campbell and William W. Lamar (1989) Provides the first comprehensive coverage of all the dangerously venomous reptiles in Latin America. Detailed descriptions of 145 species of snakes and 2 species of lizard with discussions of their coloration, scutellation, distribution and habitat. 504 color photos, 62 line drawings, 115 maps, 6 color maps, Hardbound, \$ 59.50

STE-865H

KEEPING AND BREEDING SNAKES, By Chris Mattison (1988) The author brings together every aspect of snake husbandry necessary to keep and breed just about every species that the hobbyist is likely to encounter. Details everything from basic principles to environment, health, feeding, breeding and with individual chapters on the main genera. 184 pp. illus. with color and b/w photos. Hardcover \$24.95

MPM-158s

SYSTEMATICS AND NATURAL HISTORY OF THE AMERICAN MILK SNAKE (*Lampropeltis triangulum*) 2nd Revised Edition - By Dr. Kenneth L. Williams (1989) Softcover 192 pages. Each of the 25 sub-species fully illustrated in color. Keys to identification, new maps, line drawings. \$ 34.95

TFH-125H

KINGSNAKES AND MILKSNAKES, By Ronald G. Markel. All the species and subspecies of *Lampropeltis* are treated in detail and fully illustrated in color. Detailed information on the care and captive breeding of kingsnakes. Over 200 color photos, 144pp., 8½ X 11" Hardcover \$29.95

COR-414H

TURTLES OF THE WORLD, by Carl Ernst and Roger Barbour (1989) The first modern reference book on turtles summarizing the classification and biology of all 257 species of turtles. The authors provide clear descriptions and keys for identification to family, genus and species as well as comments on range, ecology, reproductive biology, and other topics. The introductory chapter includes description and illustration of turtle anatomy and a discussion of turtle evolution. 50 color and 143 b&w illus., 5 tables, 21 line drawings, 290 pp., 8½ X 11" Hardcover \$45.00

FOF-174H

CROCODILES AND ALLIGATORS, Edited by Charles A. Ross A complete introduction to the 22 species of the world's crocodylians. Text written by over 25 experts with a full treatment of all species with three major sections: biology and evolution; natural history; and relations with humans. 250 photos and illustrations, most in full color 240 pages. 9½ X 12¼" Hard. \$35.00

DAY-007H

CROCODILES, by Rodney Steele (1989) Covers the crocodylian family including the alligators, caimans and gavials, with species accounts and drawings of the heads from the top and side views. Chapter on conservation and farming. 19 color photos, detailed range maps Taxonomic coverage. 7½ X 9-3/4", 198 pages, HC \$ 34.95

FOF-900H

LIZARDS OF THE WORLD, by Chris Mattison (1989) The latest of this series of books, now completing the herpetological group- (Frogs & Toads; Turtles & Tortoises; Snakes of the World- which are also available at \$24.95 ea.) 62 color and 46 b. & w. photos, 17 figs., Environment, food and feeding, reproduction, Distribution, Captivity, 6 X 9" Hardcover. 192 pages . \$ 24.95

RAN-824H

THE AUDUBON SOCIETY FIELD GUIDE TO NORTH AMERICAN REPTILES & AMPHIBIANS, BY JOHN BEHLER & F. WAYNE KING (1979-88) Description, Breeding, Habitat, Range - The Photographic Field Guide, with 657 full-color photographs. Easy to use, Easily carried in the field. Soft leatherette cover. 743 pages \$ 14.95

RCB-FRNZ

COLLIN'S HANDGUIDE TO THE FROGS AND REPTILES OF NEW ZEALAND, By Brian Gill (1986) This concise and fully color illustrated handbook describes the 43 species of frogs and reptiles found in New Zealand., 6 frogs, the tuatara, 9 geckos, 21 skinks, 2 sea-snakes and 4 marine turtles. 112 pages, Soft Vinyl cover. 4½ X 7½" \$ 19.95

FOF-233H

BITES & STINGS: The World of Venomous Animals, by John Nichol (1989) An insight into the venomous animals (Toads, snakes, fish, spiders, frogs) and their relationship with man. Covers antivenoms, religion, myths, snake charmers, snake bite, keeping venomous animals, conservation etc. Well illus. with color and b & w photos. Appendix lists suppliers of antivenoms, their addresses and type of antivenom produced. 6 X 9" Hardcover, 208 pages \$ 19.95

SPECIAL CLEARANCE **BIG DISCOUNTS**

HO-286H

SNAKES "Struik Pocket Guides for Southern Africa" By Rod Patterson (1986) Illustrates in color 50 species of southern Africa's snakes. Habits, habitat and distribution. 64 pages, range maps, 4½ X 7" Boardcover \$ 11.95 NOW REDUCED 20% FOR THIS SPECIAL SALE . . ONLY . \$ 9.55

RCB-RESA

REPTILES OF SOUTHERN AFRICA, by Rod Patterson, Photography by Anthony Bannister (1987) A handsomely illustrated guide to 90 of Southern Africa's most fascinating reptile species. 238 excellent color photos compliment the text describing the various species. A chapter on snake bite covers prevention, first aid and treatment. There is a rather extensive illustrated chapter on keeping reptiles in captivity, breeding, diet and caging. 8½ X 11" Hardboard cover. 128pp. \$39.50 NOW PRICE REDUCED 25% - NEW SALE PRICE - ONLY \$ 29.50

RCB-SUSN

SURINAAMSE SLAGENINKLEUR "SURINAM SNAKES IN COLOR" By Joep Moonen, W. Eriks & K. Van Deursen 119 Pages with 66 Color Photos. Softcover. Text in Dutch with brief English summary on each page. Excellent color photos showing 45 of the more common species of snake from this important South American country. English and scientific names are given. One of the few books on So. Amer. snakes. Reg. \$29.95. SALE -20% OFF-ONLY \$ 23.95

WRITE FOR OUR FREE LISTING OF WILDLIFE BOOKS: Mammals, Birds, & Over 85 Reptile Titles.

TERMS: Payment with order except for public institutions. Add For Postage \$2.00 for first book, 1.00 for each additional book. Fla. residents add 6% for state sales tax.

CHRYSEMYS PICTA (Painted Turtle). USA: WISCONSIN: Manitowoc Co: County Hwy Z 1.5 km east of County Hwy T (T21N, R22E, Sec 23). 22 May 1988. Dreux J. Watermolen. Verified by P.A. Cochran. University of Wisconsin-Green Bay Richter Collection (0319). Door Co: boat launch parking area in Potawatomi State Park, Sturgeon Bay (T27N, R24E, Sec 26). 28 May 1988. Dreux J. Watermolen. Verified by P.A. Cochran, University of Wisconsin-Green Bay Richter Collection (0320). Shell fragments and body parts of road-killed adults. New county records (Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Pub. Mus. 205 pp.).

Submitted by **DREUX J. WATERMOLEN**, Division of Natural Sciences, St. Norbert College, De Pere, WI 54115, USA ●

CLEMMYS GUTATTA (Spotted Turtle). USA: GEORGIA: Sumter Co: 6 km S. of Americus. 6 March 1989. Bob Herrington. Verified by Bob Herrington. Georgia Southwestern College Vertebrate Collection (#1651). New county record, extends the range 37 km NW in the Muckalee Creek drainage and substantiates the presence of a small population in this drainage (Camp and Powder. 1980. SSAR Herp. Review 11(3):80).

Submitted by **BOB HERRINGTON**, Department of Biology, Georgia Southwestern College, Americus, GA 31709, USA ●

CLEMMYS MARMORATA (Western Pond Turtle). USA: CALIFORNIA: Amador County: Sutter Creek, 5 km W Volcano. Sewage treatment pond, Amador City. Jackson Creek, 150 m N Hwy 88. 23 June 1987. Buskirk and Kinji Hayashi. Twelve turtles seen, 6 photographed, 1 captured. Calaveras County: North Fork Calaveras Creek above Highway 12, 3 km NW San Andreas. Pond, Jesus Maria Rd 10 km W Railroad Flat Rd. 4 June 1988. Buskirk. Seven turtles seen, 3 photographed, 1 captured. Eldorado County: Pond, Hwy 49 3 km N Pilot Hill. 16 June 1987. Buskirk and Hayashi. Four turtles seen, 2 photographed. Lassen County: Pit River at Pittville. 3 October 1988. Buskirk. Six turtles seen, 3 photographed. Nevada County: Pond, Hwy 49 0.5 km N Limekiln Rd. Pond, Auburn Rd 0.3 km N Hwy 49, 12 March 1988. Buskirk. Four turtles seen, three photographed. Placer County: Secret Ravine near China Garden Rd, 2 km E Rocklin. 16 June 1987. Buskirk and Hayashi. Four turtles seen, one photographed. Yuba County: Backwater of Dry Creek above Hwy 20. 12 March 1988. Buskirk. One turtle seen and photographed. All specimens verified by Harry Greene and documented by photographs deposited in Museum of Vertebrate Zoology. All represent new county records.

The records for Amador, Calaveras, Eldorado, Nevada, Placer, and Yuba Counties fill in some of the gaps in the known distribution of *Clemmys marmorata* in the Sierra Nevada foothills between Tuolumne County (MVZ 78788) and Butte County (Hayes and Cliff 1982. A checklist of the herpetofauna of Butte County, the Butte Sink and Sutter Buttes, California. Herp. Review 13(3):85-87). Two localities in Eldorado County with inadequate supporting information are listed in Appendix B of Brattstrom and Messer (1988. Current

status of the southwestern pond turtle *Clemmys marmorata pallida*, in southern California. Final report for CA Dept. Fish and Game Contract C-2044. 47 pp.) The Lassen County record is the first for this turtle between Fall River Mills, Shasta County (Pope 1939. Turtles of the United States and Canada. Alfred A. Knopf. 343 pp.) and Ash Creek, Modoc County (Buskirk 1985. SSAR Herp. Review 14(4):116).

Submitted by **JAMES R. BUSKIRK**, 4131 Terrace Street, Oakland, California 94611, USA ●

KINOSTERNON SCORPIOIDES SERIEI (Argentina Mud Turtle). ARGENTINA: FORMOSA: Patiño Department: Las Lomitas. 9 December 1987. J. Braunstein. Verified by E. Richard. Herpetological Collection, Fundación Miguel Lillo (FML, Chelonii 029, Adult male). First record for the Department. Extends range 160 km SE of nearest record: Ing. Guillermo N. Juárez, Matacos Department (Freiberg, M.A. 1967. Ciencia e Investigación, 23(8):351-363).

Submitted by **ENRIQUE RICHARD**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 - Tucumán, República Argentina and Proyecto Herpetofauna (FVSA), Sección NOA, Rivadavia 105-5to "G", 4000 - Tucumán, República Argentina ●

KINOSTERNON SCORPIOIDES SERIEI (Argentina Mud Turtle). ARGENTINA: SALTA: Rivadavia Department: Los Blancos (23° 36'S, 62° 36'W). 13 November 1985. M. Fabrezi, J. Langone, E. Lavilla, R. Montero and G. Scrocchi. Verified by E. Richard. Herpetological Collection, Fundación Miguel Lillo (FML, Chelonii 007: Adult). First record for the Department. The species was previously recorded from Salta Departments of General San Martín, Orán and Anta (Freiberg, M.A. 1967. Ciencia e Investigación, 23(8):351-363).

Submitted by **ENRIQUE RICHARD**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 - Tucumán, República Argentina and Proyecto Herpetofauna (FVSA), Sección NOA, Rivadavia 105-5to "G", 4000 - Tucumán, República Argentina ●

PHRYNOPS WILLIAMSII (Williams' toad-headed Turtle). ARGENTINA: MISIONES: Departamento Iguazú: Arroyo Uruguayo, 30 km E Puerto Bemberg. Museo Argentino de Ciencias Naturales (MACN 12589-95). October 1949. J. Cranwell. Departamento Guaraní: Arroyo Paraiso (trib. of Uruguay R.). Unnumbered, undated MACN specimen collected by J. Hintz. Verified by A.G.J. Rhodin. First records for Argentina. Material available to Rhodin and Mittermeier (1983. Rhodin and Miyata [eds.] Advances in herpetology and evolutionary biology. Mus. Compl. Zool. Harvard: 58-72) before describing *Phrynops williamsii* did not include the MACN specimens. Live specimens have been captured and photographed since 1985 in the Iguazú River below Dos Hermanas Falls, Iguazú National Park and the Arroyo Uruzú, Depto. Iguazú.

Submitted by **JAMES R. BUSKIRK**, 4131 Terrace St., Oakland, CA 94611, USA ●

BOOK REVIEWS

Banglar Bonnyoprani. Vol. I. (In Bangla), by Mohammed Ali Reza Khan. 1987. Bangla Academy, Dhaka. 1-16, 1-169. 44 pl., 1 map. Price taka 125 (US \$4).

Bangla or Bengali is spoken by an estimated 200 million people in Bangladesh and eastern India. Khan's volume is the first in a series of three that attempts to describe, in Bangla, the vertebrates (excluding fish) of the Republic of Bangladesh. The series is an expanded version of Khan's (1982) checklist: Volume I deals with the wildlife habitats and the herpetofauna, and volumes II and III (recently published) deal with the birds and mammals, respectively.

Dr. Mohammed Ali Reza Khan was until recently Associate Professor of Zoology at Dhaka University and is presently Curator of the Al Ain Zoo and Aquarium at Abu Dhabi, U.A.E. A member of the IUCN/SSC Commission on Education and of several of IUCN's Survival Specialist Groups, Khan is recognized as an authority on the wildlife of Bangladesh and is a prolific author.

The volume is divided into three chapters following an introduction: a definition of wildlife and a description of the various forest types of Bangladesh, a rather short account of the amphibians, and a longer one of the reptiles. The herpetofauna of this little country includes some 143 species (Khan 1982) and shows an admixture of both Indian- and Indo-Malayan elements. Geographic data of the country, considered to be the most densely populated by humans, are naturally of interest to wildlife biologists. According to Khan, Bangladesh has a total area of ca. 143,998 km², of which 8,300 km² consists of streams, rivers and estuaries and a mere 21,950 km² of various categories of forests. The last figure, Khan admits, is a government statistic, and the actual forested area is much less.

The chapter on amphibians is only 12 pages, a reflection of how little is known about this group. Earlier, Khan (1982) listed 19 species of amphibians that may occur in Bangladesh, but field work in some of the more inaccessible, frog-rich regions, such as the Chittagong Hill Tracts and Sylhet, should increase this tally. Most of the frog and toad species dealt with are widespread throughout the Indian subcontinent. Mention is made of the tree toad (*Nectophryne kempfi*), which the author suspects is found in Sylhet district. The chapter closes with an account of the country's trade in frogs.

The last and longest (99 printed pages excluding illustrations) chapter concentrates on the reptiles. It commences, after a brief account on reptiles in general, with chelonians, a group well represented in Bangladesh (25 out of the 33 species found on the subcontinent). This is also a resource heavily exploited; between July 1989 and June 1982, the equivalent of Taka 30-40 million was earned by the country through turtle export. This legal trade, Khan writes, is a tiny proportion of the country's turtle trade, as very large numbers of these animals are smuggled across the border to India.

Of the 850 or so species of amphibians, reptiles, birds and mammals thought to occur

in Bangladesh, only two, according to the author, can be considered endemic. These are the black softshell turtle (*Trionyx nigricans*) which is known to be restricted to a tank attached to the shrine reportedly of Byazid Bostami at Chittagong and in nearby ponds, and the Indian eyed turtle (*Morenia petersi*), widespread in Bangladesh. Khan did suspect the occurrence of the latter within Indian limits, and the species has been found in recent years in the Indian state of Bihar (Das 1985; Moll and Vijaya 1986).

Each species account of chelonians consists of a brief description, with natural history and status notes, often of considerable interest. Khan deserves to be commended for the first records of numerous turtle and tortoise species from his country, including *Batagur baska*, *Kachuga tentoria*, *K. dhongoka*, *Melanochelys tricarinata*, *Cuora amboinensis*, *Indotestudo elongata* and *Manouria emys*. The section following the species accounts deals with various issues, including the turtle trade, the resultant decline in wild populations and ways to stem this.

Compared to the chelonians, the lizard fauna seems impoverished, with only some 17 species recorded (Khan 1982) and the present volume describes only the commoner or more interesting forms. One of these, the flying lizard, is reported from the country by the author, from the Chittagong forests, based on a sight record: Khan assumes this to be *Draco maculatus*. The locality of the present specimen, however, more closely approaches the distribution of *Draco blanfordii norvilli*, known from the nearby Indian state of Assam as well as northern Burma (see Musters 1983).

There are other interesting snippets of information on the lizard species. According to this book, the tokay gecko (*Gekko gekko*), the largest of the geckos, is used in folk medicine in Bangladesh as a substitute for the once available spiny-tailed lizard (*Uromastix hardwickii*), which is found in Pakistan and north-western India. Khan restricts the water monitor (*Varanus salvator*) to the salt-water regions in the country. This species is widespread, though often very rare at present, in non-coastal regions in southeast Asia and in north-eastern India, and thus may be found (or was in the past) in Sylhet, Mymensingh and the three Chittagong Hill Tracts districts of Bangladesh. There is an example of this species in the Indian National Zoological Collection, maintained by the Zoological Survey of India (Reg. No. 2126) with data indicating that it was collected from Rangpore in northern Bangladesh.

Seventy-nine snake species are known to occur in Bangladesh (Khan 1988). The present volume describes, once again, the commoner or the more interesting forms, among which are the two python species, the rock python (*Python molurus*), now largely restricted to the Sunderbans, and the reticulated python (*P. reticulatus*), distributed over Sylhet and the Chittagong Hill Tracts. Of the Indian egg-eating snake (*Elachistodon westermanni*), the author has no information, apart from an old specimen, now at the British Museum, collected from Rangpore. Following the brief descriptions of snakes are (often too lengthy) accounts of the various superstitions associated with these reptiles.

All three crocodilian species of the subcontinent occur in this small country. The gharial

(*Gavialis gangeticus*) is present only in the northern district of Rajshahi; the saltwater crocodile (*Crocodylus porosus*) in the Sunderbans; and the rarest, the once ubiquitous mugger or marsh crocodile (*C. pelustris*), restricted to a tank at Bagerhat. The status of all crocodilians is thus alarming and governments of nearby countries, such as India and Nepal could start 'croc diplomacy' by providing surplus animals from their rearing centres for a well-designed management programme for crocodiles in Bangladesh.

Creation of common names for the different species is the first step towards public education, and the author has been bold in this venture. He calls *Lepidochelys olivacea*, jalpaironger kachim; *Cuora amboinensis*, diba kachim; and *Elachistodon westermanni*, dimkhor shap, all literal translations of their respective English common names.

There are, however, numerous typos in the book, and names of two taxa have been misspelled throughout — *Cuora amboinensis* and *Varanus flavescens*. These mistakes have been repeated from the earlier checklist.

For illustrations, the volume relies heavily on Daniel (1983) from which line-drawings, black-and-white photographs, and color photographs and paintings have been borrowed. Quality of reproduction, however, is poor. There are several other problems with the illustrations: p. 50 (fig. 3.4) illustrates a low-shelled, keel-less emydid which cannot be *Kachuga tentoria* as its caption identifies it. Captions of *Eretmochelys imbricata* and *Dermochelys coriacea* have been interchanged on p. 66. On p. 70, the three monitor

species found in Bangladesh are shown, but the caption provides no identification to the species.

A bibliography of 15 herpetological books and papers, 11 in English, 4 in Bangla, round out this interesting book. Published by the Bangla Academy, the book is not widely available. I had to make a trip to Dhaka to buy my copy.

LITERATURE CITED

- Daniel, J.C. 1983. The Book of Indian Reptiles. Bombay Natural History Society, Bombay. 141 pp.
- Das, I. 1985. Indian turtles: A Field Guide. World Wildlife Fund-India (Eastern Region), Calcutta. 119 pp.
- Khan, M.A.R. 1982. Wildlife of Bangladesh: A Checklist. University of Dhaka, Dhaka. 174 pp. + corrigenda.
- Khan, M.A.R. 1988. An updated list of snakes of Bangladesh. Hamadryad 13(1):5-7.
- Moll, E.O. & J. Vijaya. 1986. Distributional records for some Indian turtles. *J. Bombay Nat. Hist. Soc.* 83 (1):57-62.
- Musters, C.J.M. 1983. Taxonomy of the genus *Draco* L. (Agamidae, Lacertilia, Reptilia). *Zool. Verh.* (199):1-120.

INDRANEIL DAS

Madras Crocodile Bank Trust,
Vadanemmel, Perur Post,
Mahabalipuram Road,
Madras 603 104,
India

Proceedings of a Workshop on Neotropical Distribution Patterns, by P.E. Vanzolini and W.R. Heyer, eds. 1988. Academia Brasileira de Ciencias: Rio de Janeiro: 1-488.

This volume is based on a workshop held in January 1987 in Rio de Janeiro, Brazil, that brought together a diverse group of botanists, entomologists and vertebrate biologists to examine *pattern* in the distribution of Neotropical organisms. The volume is refreshing in avoiding the facile explanation of current distribution provided by reference to hypothetical Pleistocene refuges that change location and extent depending upon the groups analyzed and the imagination of the investigator. Not surprisingly in such a volume the approaches are diverse and depth of coverage uneven since the aim was to inform the participants of on-going research by others. Five of the papers in the proceedings are of particular interest to readers of *Herpetological Review* and illustrate and emphasize this uneven treatment. For herpetologists interested in South America this forms a useful update and corrective for some of the extreme refugial positions taken in the *South American Herpetofauna* volume edited by Duellman (1979).

John E. Cadle and J.L. Patton discuss the distribution of amphibians and reptiles (and mammals) along the eastern slope of the southern Peruvian Andes. Their treatment is very useful in detailing the altitudinal extent of species distributions for the region and the difference in pattern between mammals (greater diversity and finer vertical partitioning of the forested slopes) and herps. In addition

they provide a cladistic basis for determining if the distributions of related taxa are the product of vicariant (allopatric) or gradient (parapatric) speciation models. They conclude that the former is the dominant one, without providing concrete analyses of relationships to support that conclusion. The interpretation of the origin of the fauna of the region is strictly dispersalist. Apparently the authors believe that the Andean slopes of southern Peru were a *tabla blanca* invaded from the north, south and east. Is it not possible that a substantial portion of the fauna is autochthonous and has been more or less evolving *in situ* from a time prior to any Andean uplift? This would certainly be in keeping with their conclusion that Pleistocene events are not the principal influence on differentiation of the fauna of this region.

In a second paper W.R. Heyer undertakes a detailed examination of the adequacy of the anuran data base as a basis for determining patterns and evaluating their significance east of the Andes. He concludes that even though the data base has dramatically increased in the last 10 years, it remains inadequate for reasoned discussion of pattern (too much missing data) or historical causes (too many possibilities for *ad hoc* hypothesis construction). Nevertheless, Heyer is willing to highlight certain features of Neotropical frog distribution, which based upon his broad knowledge and experience, provide a context for future study. These include an emphasis on the morphoclimatic domains of Ab'Sáber (1977) as correlates of distributions, the significance of open versus forest formations

and the tendency for forest species to have smaller areal ranges than those in other formations.

In another paper M.T. Rodrigues reviews the distribution of the lizard genus *Tropidurus* in Brazil with particular regard for broad ecological determinants. Although he emphasizes the importance of the morphoclimatic domains in this treatment, one is impressed by the fact that most of the figured species distributions show low fidelity in terms of restriction to a particular domain. More impressive is the essential absence of this genus from the Amazonian forest region while it occurs in all other open and forest formations. An interesting conclusion is that the caatinga area has an endemic component rather than simply being invaded by species from adjacent open formations during the drying trend of the current interglacial.

In a more general paper on lizard distribution P.E. Vanzolini provides an excellent and detailed review of species occurrence in Amazonian and Atlantic Forests and the principal open-formations (caatinga, cerrado and Chaco). Other major areas are covered in less detail. This minor flaw is far outweighed by the opportunity to have in one place a summary of the thoughts of the leading authority on South America's lizard biogeography. Vanzolini concludes that the basic patterns were established during Tertiary (Mio-Pliocene) and many species date from that period (others however are products of Quaternary climatic cycles), that wide-ranging taxa are the exception and that *in situ* speciation within major domains is the rule.

The final paper in the proceedings, *A New Look at the Iguania* by E. E. Williams, encompasses a much wider range than any of the others, forming an attempt to analyze the phylogeny, biogeography and evolutionary processes responsible for differentiation in a major clade of lizards. While this effort seems somewhat far afield from the central issues of the workshop, it is of considerable value to

have this summary of Williams' ideas on these subjects. After all, he has been deeply immersed in the study of one of the largest components of this group (the anoles and their allies) for over 30 years. Because of the space limits for this review only a few of the most important features of the *New Look* are touched upon here. Williams' phylogenetic analysis is based upon 13 features (out of 49) utilized by Etheridge and de Queiroz (1988) and two additional scale features. He concludes that the Iguania are comprised of a Gondwanan clade (morunosaur *Polychrus*, anoloids, oplurines and chameleons) and a Laurasian one (all other iguaninians, including agamids). He regards anoloids as being the sister group to chameleons and oplurines, which are in turn sister taxa. These proposed relations are based primarily on post-xiphisternal inscriptional rib conditions, sensory scale organ similarities and ulnar nerve position. These views are now placed in considerable doubt by the more recent rigorous, cladistic analysis (67 characters) of Frost and Etheridge (1989), who conclude that "agamids" and chameleons are sister taxa and not particularly closely allied to oplurines or anoles.

Williams found, as did Frost and Etheridge (1989) that numerous apparent homoplasies make resolution of relationships among the major subdivisions in the Iguania difficult. He argues that a rule of Geographic Contiguity may be "at least" as valuable as parsimony (or compatibility) in evaluating homoplasy, i.e. homoplasy may be rejected as an explanation of character incongruity when evidence suggests that the clades in question have been contiguous or sympatric at or near their time of origin. It is partially this rule that led Williams to propose the anoloid, oplurine and chameleon relationship. In light of the work of Frost and Etheridge (1989), this idea seems to have little merit in explaining character distributions in higher taxa. It also appears, in the example given by Williams, that his

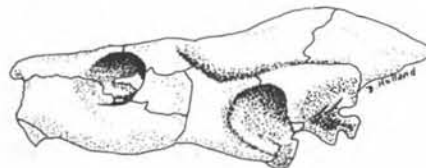
choice from among several possible homoplasies as to which are indicative of relationships is subjective. Nevertheless the concept that the geographic distribution of character states may be important to phylogenetic analysis needs to be explored on a wider basis.

LITERATURE CITED

- Ab'Saber, A.N. 1977. Os domínios morfoclimáticos na América do Sul. Primeira aproximação. Geomorph. (Inst. Geogr. Univ. S. Paulo) 52:1-21.
- Duellman, W.E., ed. 1979. The South American Herpetofauna. Univ. Kansas Mus. Nat. Hist. Mono. 7:1-485.
- Etheridge, R.E. and K. DeQueiroz. 1988. A phylogeny of Iguanidae. In: R. Estes and G. Pregill, eds. Phylogenetic Relationships of the Lizard Families, Stanford: Stanford Univ. Press:283-367.
- Frost, D.R. and R.E. Etheridge. 1989. A Phylogenetic Analysis and Taxonomy of Iguanian Lizards (Reptilia: Squamata). Misc. Publ. Univ. Kansas Mus. Nat. Hist. 81:1-65.

JAY M. SAVAGE

Department of Biology
University of Miami
P.O. Box 249118
Coral Gables
Florida 33124, USA



STEVEN SIMPSON NATURAL HISTORY BOOKS

P.O. BOX 853, BRIGHTON BN1 5DY, ENGLAND

Tel: 0273 — 727328

SPECIALISTS IN REPTILE AND AMPHIBIAN BOOKS

New, Out of Print and Antiquarian Books for the Herpetologist

Conservationist and Collector.

Catalogue on request. Credit card facilities available.

Books Bought. Offers of good single items, small private collections
or complete libraries are always welcome and receive prompt attention.

SSAR Committee Chairpersons and Coordinators

CHAIR PERSONS

Conservation

Dale Jackson
Florida Natural Areas Inventory
254 East Sixth Avenue
Tallahassee, FL 32303, USA

Grants-in-Herpetology

Darrel Frost
Museum of Natural History
The University of Kansas
Lawrence, KS 66045, USA

Kennedy Student Award

J. Eric Juterbock
Department of Zoology
Ohio State University
Lima, OH 45804, USA

Long Range Planning

James L. Christiansen
Department of Biology
Drake University
Des Moines, IA 50311, USA

Meetings (Joint Comm., SSAR/HL)

Joseph T. Collins
Museum of Natural History
The University of Kansas
Lawrence, KS 66045

Local Committee (1990)

Harold A. Dundee
Department of Biology
Tulane University
New Orleans, LA 70118

Nominating

Carl Gans
Department of Biological
Sciences
The University of Michigan
Ann Arbor, MI 48109

Regional Society Liaison

Stephen H. Hammack
Reptile Department
Fort Worth Zoo
Fort Worth, TX 76110, USA

Resolutions (Joint Comm., SSAR/HL)

George R. Pisani
Division of Biological Sciences
The University of Kansas
Lawrence, KS 66045, USA

Zoo Liaison

Donal Boyer
Reptile Department, Dallas Zoo
621 East Clarendon Drive
Dallas, TX 75203, USA

COORDINATORS

Common and Scientific Names

Joseph T. Collins, Editor
Museum of Natural History
The University of Kansas
Lawrence, KS 66045, USA

Translations

Robert D. Aldridge
Department of Biology
Saint Louis University
St. Louis, MO 63103, USA

HERPETOLOGICAL REVIEW EDITORIAL POLICY

The following statement-of-purpose appeared in the Introduction to the first issue of *Herpetological Review* in 1967 (Corson Hirschfeld, Editor):

"*Herpetological Review* incorporates the Ohio Herpetological Society Newsletter. Its primary function, as the name states, will be to review herpetology, past and present, in terms of the individuals, institutions, literature and other components of the field. Perhaps equally important, the *Review* will provide a unique means of communication among persons interested in amphibians and reptiles. We believe it will be of interest to all persons in herpetology, and we hope all members will find it informative and entertaining."

Herpetological Review still remains true to that purpose. We will continue to publish semi- and non-technical articles (original research should be submitted to the *Journal of Herpetology*—see inside front cover for address), book reviews, institutional and regional society news, research requests of SSAR members, letters from readers directed to the field of herpetology, illustrations and photographs. Manuscripts submitted must be typed, double spaced, on 8.5X11 inch paper, and should be sent in duplicate. We encourage submissions on Macintosh disks, though we can also work with TEXT (ASCII) files submitted on IBM and compatible floppies. *Herpetological Review* is composed on a Macintosh SE using Microsoft Word, which accepts files from several other word processor applications. Format your documents full-page width; we will fit to HR format. Unpublished photographs of an unusual nature or of uncommon amphibians or reptiles may also be submitted. These should be 8X10 inches black and white, glossy prints, and should be accompanied by a descriptive caption. The name and address of the contributor should be taped or penciled lightly on the back of each print. Return of unsolicited photographs cannot be guaranteed unless adequate return postage is provided. Unused photographs solicited by the Editor will be returned at our cost.

Reprints of contributions cannot be supplied. Contributors may reproduce up to 200 copies of pages containing their own articles for private distribution only. No reproduction for sale purposes is permitted. *Herpetological Review* will accept commercial advertising. Rates and copy information are available from the advertising manager. Fully formatted ads may be provided on Macintosh disks in several Draw or Paint formats. Contact the Managing Editor for details. All ads are accepted at the Editor's discretion.

MJR

SSAR CATALOGUE OF AMERICAN AMPHIBIANS AND REPTILES

| | |
|--|---------|
| THE CATALOGUE: Imprinted binder, taxonomic tabs, Accounts 1-50..... | \$50.00 |
| IMPRINTED POST BINDER ONLY..... | \$20.00 |
| SYSTEMATIC TABS ONLY (Ten tabs to fit binder. "Class Amphibia," "Order Caudata," etc.)..... | \$4.00 |
| INDIVIDUAL ACCOUNTS (Photocopies only; please request by number)...each... | \$1.50 |
| CATALOGUE ACCOUNTS 1-25..... | \$25.00 |
| CATALOGUE ACCOUNTS 26-50..... | \$25.00 |
| CATALOGUE ACCOUNTS 51-100..... | \$25.00 |
| CATALOGUE ACCOUNTS 101-125..... | \$25.00 |
| CATALOGUE ACCOUNTS 126-150..... | \$25.00 |
| CATALOGUE ACCOUNTS 151-175..... | \$25.00 |
| CATALOGUE ACCOUNTS 176-190..... | \$25.00 |
| CATALOGUE ACCOUNTS 191-205..... | \$25.00 |
| CATALOGUE ACCOUNTS 206-220..... | \$25.00 |
| CATALOGUE ACCOUNTS 221-245..... | \$25.00 |
| CATALOGUE ACCOUNTS 246-279..... | \$25.00 |
| CATALOGUE ACCOUNTS 271-295..... | \$25.00 |
| CATALOGUE ACCOUNTS 296-320..... | \$25.00 |
| CATALOGUE ACCOUNTS 321-345..... | \$25.00 |
| CATALOGUE ACCOUNTS 346-370..... | \$25.00 |
| CATALOGUE ACCOUNTS 371-390..... | \$25.00 |
| CATALOGUE ACCOUNTS 391-410..... | \$25.00 |
| CATALOGUE ACCOUNTS 411-430..... | \$25.00 |

Make checks payable to: "Cat. Amer. Amphib. Rept." or to "SSAR" and mail to:

for subscriptions
Douglas H. Taylor
Department of Zoology
Miami University
Oxford, OH 45056, USA

for back orders
Robert D. Aldridge
Department of Biology
Saint Louis University
Saint Louis, MO 63103, USA

Contents

| | |
|--|----|
| SSAR BUSINESS | 1 |
| NEWSNOTES | 11 |
| SOCIETIES | 11 |
| FEATURES | |
| Sexual selection and communication in amphibians and reptiles, by P.A. Verrell | 11 |
| Phorid fly larvae as predators of turtle eggs, by R.A. Acuna-Mesen and P.E. Hanson | 13 |
| Geographic variation in the egg-laying strategy of the mole salamander, <i>Ambystoma talpoideum</i> , by R.D. Semlitsch and S.C. Wells | 14 |
| TECHNIQUES | |
| A new procedure for dermestid beetle preparation of skeletons from formalin-fixed specimens, by P. Gritis and S.A. Brunner | 15 |
| HERPETOLOGICAL HUSBANDRY | |
| Reproduction in the pancake tortoise, <i>Malacochersus tornieri</i> , in captive collections, by A.R. Darlington and R.B. Davis | 16 |
| LIFE HISTORY NOTES | 18 |
| GEOGRAPHIC DISTRIBUTION | 21 |
| BOOK REVIEWS | |
| Banglar Bonnyoprani. Vol. I., reviewed by I. Das .. | 26 |
| Proceedings of a Workshop on Neotropical Distribution Patterns, reviewed by J.M. Savage .. | 27 |