BAT RESEARCH NEWS

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BAT RESEARCH NEWS

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BAT RESEARCH NEWS

Table of Contents for Volume 21, 1980

STATE UNIVERSITY COLLEGE
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August 13, 1980

Dear Subscriber to BRN:

As Brock pointed out in his editorial, we have indeed experienced some production difficulties. Our administration questioned the appropriatness of using "their" institutional facilities to reproduce a non-university document. After a protracted discussion our publication was approved. Shortly thereafter our local post office challenged our bulk-mailing status which was subsequently approved. After this minor delay, BRN was challenged by I.R.S. on its non-profit nature, but even I.R.S. was embarrassed when they saw how "non-profit" we really were. This, of course, alerted the New York tax authorities to our existance, and they were in turn chagrined at having "bothered" us. So after 2 tax audits and review, the mailing problem and the local delay we are back in business. It must be added that everyone involved was most helpful and kind but collectively these delays have set us back about six months. So, now you have February 1980 Volume 21:1 of Bat Research News. Perhaps that issue should be called Bat Research History.

We have not sent out any notices of dues, etc., until all the above was settled, but a statement of your account will be included with the next issue. Volume 21:2 (May) is currently being bound, and Volume 21:3 (August) is being typeset. By mid-September they will all have been mailed.

Please forgive our long silence and the delay. One would think that at our editorial salaries, we would me more efficient! Please forward your subscription dues (if they are due) as soon as convenient. We're broke and we all like to get letters.

Sincerely yours,

Roy Horst
Managing Editor

RH/bv

TABLE OF CONTENTS

EDITORIAL

Volume 21 marks the fourth volume of **Bat Research News** which Roy Horst and I have prepared, and now that we seem to be on the other side of some production problems, things should appear more regularly. However, there are several points which the readers should consider.

First of all, are you finding this newsletter useful? Compared to other newsletters it appears to be a good bargain, at least as far as capital output is concerned. However, even a minimal capital output is pointless if the return is not appropriate. From this end, the new literature and occasional article is probably the most valuable contribution that **BRN** makes. Is there something else you would like to see here? Should we consider raising the cost and subscribing to a computer search system for new literature which would enhance the coverage? The current system relies on willing volunteers and makes no pretense at being comprehensive.

Should we consider encouraging people to submit outlines of what kinds of work is going on in different places (similar to the Society of Vertebrate Paleontologists newsletter)?

Because of the interruption in production and mailing it is difficult to sense the responses of readers to **BRN** as it now stands.

The next point for contemplation is that Roy and I do not anticipate producing **BRN** forever. From the beginning (volume 18, for us) we planned to work on this for five years. We presume that there is someone in the wings who would like to see the operation continued. We will raise this point for discussion at the North Americaa Bat symposium in California (University of California, Fullerton) this fall to see what sort of response we receive, but there is no assurance that the next editor would be in the audience.

We serve notice that Volume 22 will be our last, and suggest that the next editor(s) work with us through that series of issues to make the transition a smooth one.

Naturally, we anticipate a flood of volunteers . . . .ho ho ho.

NEWS

I have just received number XVI (1978) of **Myotis** which includes the following:

Fledermausbeobachtungen in Gebieten des sud-lichen West-Deutschland 1945-1979, by Heinz Felten and Dieter Kock, pp. 3 - 83.
Kurzberichte aus dem Mitar[illegible]erkreis, pp. 83-94
Fledermausschut[illegible], pp. 95 - 102
Tagungen, pp. 103-106
Neue Literatur, pp. 107-115

Information about this newsletter may be obtained from Dr. H. Roer, Zooloisches Forschungsinstitut un Museum Alexander Koenig, 5300 Bonn 1, Adenauerallee 150-164, BRD. They are requesting a contribution of at least DM 20, — to keep one's name on the mailing list; money orders should be made out to 'Contribution for **Myotis**'.

Another recently arrived newsletter is 'Australian Bat Research News, number 14 (October 1979). The editor is G. C. Richards, Division of Wildlife Research CSIRO, P.O. Box 84, Lyneham, ACT, 2602, Australia. It includes an editorial, notes on regional news, and several articles:

Threatened bat populations in Queensland and New South Wales, by Glenn Pure, pp. 3-5
The throat pouch of the yellow-bellied bat, **Taphozous flaviventris**, by Leslie S. Hall and Greg Gordon, pp. 5-6
New information on the little pied bat, **Chalinolobus pictus**, by Greg Richards, pp. 6-7

There is also a request for photographs of Australian bats, and a section on Australian bat literature.

Tom Griffiths has written and reported that the University of Kentucky Press at Lexington is reissued "Bats of America" by Barbour and Davis. The cost is apparently $22.50 U. S. and the book may be ordered directly from the Press.

Ed Gould has sent in some information about a recent book 'Aerobiology: the ecological systems approach' edited by Robert L. Edmonds, US/IBP Synthesis Series, 10 Dowden, Hutchinson and Ross, Inc., Stroudsburg PA. A literature citation therein refers to studies between 1937 and 1945 that established the summer densities of insects over a few square kilometers, up to 100 m or so, contain populations of millions of insects representing many species.

I have also received volume 2, number 3 of Night Flyer, the newsletter of the NSS Bat Subcommittee; the editor is Thomas Lera (729 Nora Lane DeSoto, Texas 75115).

The 1976 Bulletin of the Nigerian Ornithological Society, volume 12, page 42 contains an article by Antony Pettet about 'Shikra **Accipiter badius** taking bats. The birds were taking bats as they left their roosts in roofs in the dry season or pre-rains period.

Some readers may also be interested in the 'African Small Mammal Newsletter' which is carrying on very well; number 4 (November 1979) has just been produced. The latest issue contains no particular reference to bats, but this is somewhat exceptional, since most issues to date have included some information about bats. The editor is Erik Van der Stratten (Universiteit Antwerpen, Laboratorium voor Algemene Dierkunde, Groenenborgerlaan 171, B - 2020 Antwerpen, Belgium).

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Table of Contents

The Recent Literature which might have been included here will appear in the August issue, which will also contain information about the annual meeting scheduled for Los Angeles in November 1980.

The article by Kunwar Bhatnagar was invited by me in the hopes that those of us who occasionally collect bats in the field might make the specimens more generally useful to others.

ANNOUNCEMENT OF THE ELEVENTH ANNUAL NORTH AMERICAN SYMPOSIUM ON BAT RESEARCH

NOVEMBER 20-22, 1980

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Notes on preserving bats in the field

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During Field trips it is a common practice to preserve bats either in formalin or alcohol. The sacrificed animals are simply dropped into the fixative in which they remain for a long time. Whereas this method may be flawless from a taxonomist's point of view, nevertheless, for any subsequent purposes (such as histological examination of tissues) this valuable material proves highly unsuitable. Numerous specimens, which could otherwise be used profitably, thus remain unutilized. These notes are intended for a field chiropterologist who might find them useful for collecting and preserving quality specimens not only for his own use but with the idea that the specimens prove equally useful for other purposes also. The author does not claim any originality for the methods discussed since these are traditionally and routinely followed in most all laboratories. To a field biologist, however, these procedures are expected to provide some useful and additional information.

Whereas there could be scores of other methods of fixation and preservation of the entire animal, the following have been considered here in their order of suitability and practicability:

1. Vascular perfusion. Excellent. Highly recommended;
2. Injection method. Unsatisfactory, yet better than the one following;
3. Whole body immersion. Poor. Not recommended for histological procedures.

Vascular Perfusion

Apparatus

Tuberculin syringe, 1 ml for anesthesia

Two 10 ml glass syringes (Luer-lok tip)

B.D. Stainless steel needles (Gauge nos. 24, 26)

Dissecting instruments

Cork board and pins

Labels

Storage bags

Solutions

(Also see Appendix A)

Flusing solution: Saline in nitrite or physiological saline

Fixative: 10% neutral buffered formalin or any other fixative of choice

Nembutal for anesthesia

Chemicals

Sodium chloride
Sodium nitrite
Formalin (37-40%)
Acid sodium phosphate, monohydrate
Anhydrous disodium phosphate
Nembutal sodium

Procedure

Vascular perfusion is carried out only in a live specimen with the aim that the fixative reaches all the tissues through vasculature. Keep ready the two syringes filled with the flushing solution and the fixative. Anesthetize the animal by injecting diluted Nembutal (about 0.07mg/gm body weight, intraperitoneally) in the abdomen. As soon as the anesthetic takes effect (5 to 10 min), pin the bat on a cork board. Make a midline skin incision close to the genitals and extend it up to the neck. Reflect and pin the skin. Next, cut open the abdominal cavity and then cut parallel

to but slightly lateral to the sternum on the left side of the animal (to avoid the internal thoracic vessels). Also cut the diaphragm laterally on both sides. The heart will now be exposed. Using fine forceps remove or reflect the pericardium. With a steady hand insert the needle (Syringe with flushing solution) into the apex of the left ventricle taking care not to push the needle too far (Fig. 1). With the other hand make a tiny cut in the right atrium. Very gently force the fluid into the circulation. In less than a minute, clear fluid will be seen escaping through the opening in the right atrium, the liver will change to a light color and blood vessels will appear empty. Without pulling the needle from the heart, if possible, replace the syringe with the one containing the fixative and continue perfusing without stopping. Uniform and slow but gradual pressure has to be maintained. The animal will now appear to relax. With emptying of the syringe the perfusion should be complete (approximately 1 min for flushing out the blood, 2-3 min for circulating the fixative). Excellent perfusion is indicated by observing the following signs in the perfused body: rigidness of the entire animal, especially in the neck region; colored fixatives, such as Bouin's fluid are easily noticed in the blood vessels, palate etc.

The whole animal is then immersed in the fixative for 1-4 days. It should then be transferred to 70% alcohol when convenient. Vascular perfusion, if performed correctly, will provide excellent preservation of all tissues.

There are numerous variants of this method, but they all require more sophisticated instrumentation, space and time. With some practice one could hand perfuse a bath within 10 minutes. For **Eptesicus**, 10 ml of each solution is sufficient. Bigger animals will require proportionatley larger volumes of both solutions. After perfusion, if desired, various tissues can be dissected and saved in the fixative.

For perfusing larger sized animals it may be necessary to use gravity method which utilizes two separatory funnels (one each for the flushing and the fixing solutions) hung about 2 meters above the working bench. A Y-connector carries a thin polyethylene tubing to which a blunt needle is attached. The procedure is similar as described except that in this case the needle is pushed through the left ventricle into the ascending aorta where it is held secure with sutures. A cut is made into the right atrium as before. The two fluids are allowed to run one after the other.

Injection Method

Only one syringe for the fixative, and an anesthetic are required. Sacrifice the animal using an overdose of Nembutal (either or Chloroform). Using the syringe introduce the fixative in the thoracic and abdominal cavities as well as under the skin at several places, expecially in the head and neck region. Also introduce some fluid through both nostrils and the mouth. The animal is then immersed in the fixative and treated further as described above.

Appendix A

(Ref: Lillie, R.D. 1965 Histopathologic technic and practical Histochemistry. McGraw Hill.)

Saline in Nitrite

*Distilled Water	500 ml
Sodium Chloride	4.5 gm
Sodium nitrite	2.5 gm

Physiological saline

Distilled water	1000 ml
Sodium chloride	9 gm

Neutral buffered formalin (pH 7.0)

37-40% Formaldehyde solution	100 ml
Distilled water	900 ml
Acid sodium phosphate, monohydrate	4 gm
Anhydrous disodium phosphate	6.5 gm

Aqueous Bouin's

Picric acid (saturated aqueous solution)	75 ml
Formalin (37-40%)	25 ml
Glacial acetic acid	5 ml

*Distilled water can be substituted with the one available in the field. Most of the chemicals could be preweighed and packaged ready for mixing in the field.

Nembutal Sodium (Sodium pentobarbital)

Nembutal (50-60 mg/ml)	3 ml
0.9% Physiological saline	27 ml

Of this dilution use only about 0.10 ml per 10 gm body weight of the bat for light anesthesia. If failure occurs, a second small dose may be necessary.

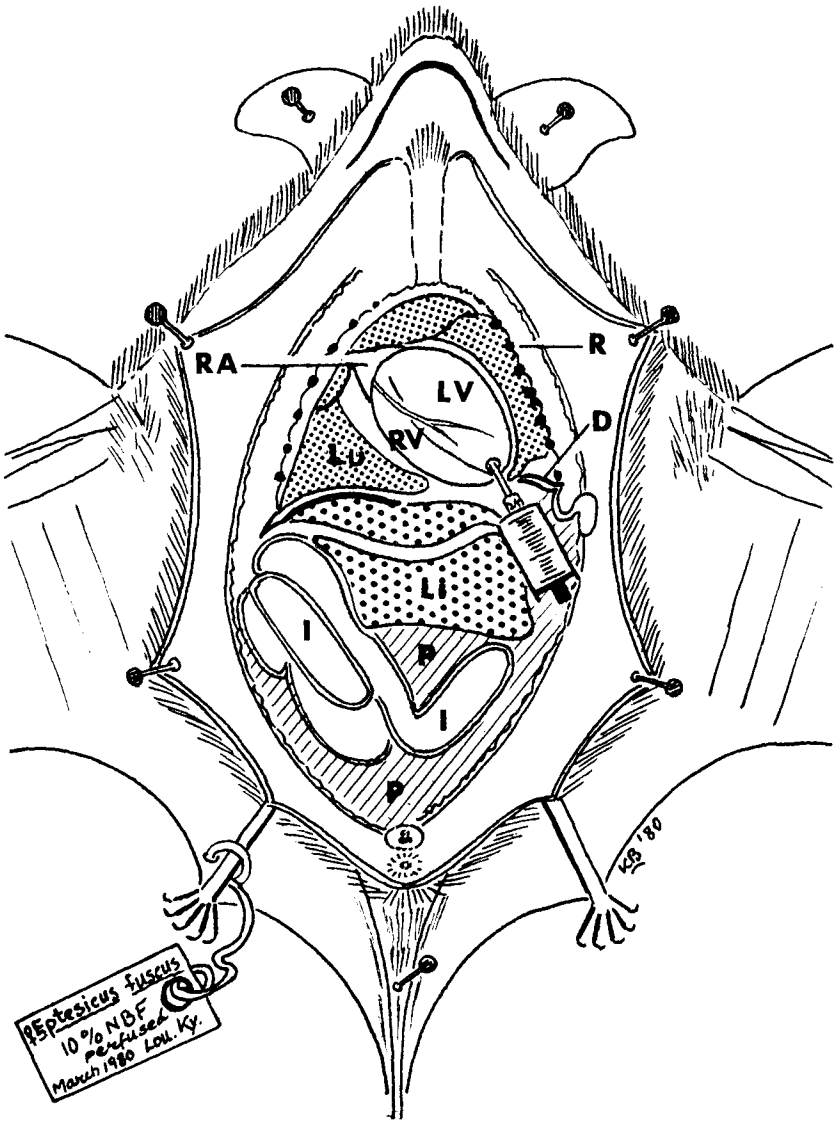

Fig. 1. **Eptesicus fuscus.** In this diagramatic sketch the thoracic and abdominal cavities are exposed in preparation for vascular perfusion. A syringe needle is shown entering the apex of the heart. The right atrium (RA) has been punctured to allow the fluids to escape. D, diaphragm; I, intestines; Li, liver; Lu, lung; LV, left ventricle; P, peritoneal (abdominal) cavity; R, cut ends of the ribs; RV, right ventricle

TWO CASES OF HAWK PREDATION ON BATS

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On 22 September 1975, Andrew Williams and I were photographing a live **Scotophilus dinganii** (= **nigrita**) at Nairobi, Kenya. The captive bat had been chilled by the coolness of the previous night and was clinging to the trunk of a tree. The bat suddenly took flight, but before it had flown 15 meters an African goshawk (**Accipiter tachiro**) darted out of the nearby shrubbery, rolled onto one side and deftly snatched the bat from the air with both feet. The hawk took the bat to the ground, from where we flushed the bird (in obtaining a better look) into a tree. The hawk again took the bat to the ground, was flushed and then flew with the bat out of our vision. Gillette and Kimbrough (1970. **In** About Bats, A Chiropteran Biology Symposium, Southern Methodist University Press; 262-283) listed several species of hawks known to capture bats. But they listed a single species of **Accipiter** (the sharp-shinned hawk, **A. striatus**) as a bat predator. They had no record of **Scotophilus** being taken by a hawk or owl. Fenton, Cumming, and Oxley (1977: Condor, 79:495-7), however, found significant numbers of **Scotophilus** spp. remains in the pellets of the bat hawk (**Macheiramphus alcinus**) in Rhodesia.

The second instance of bats being captured by hawks was related to me by Charles M. Kirkpatrick. On 13 October 1967, Kirkpatrick was with some Australian biologists observing the bulldozing of some dead trees near Metchell, Queensland, Australia. As some of the rees were pushed over, numerous small bats emerged from tree holes and began flying about. Soon several black kites (**Milvus migrans**) appeared and began chasing and catching the bats in flight. A bat might successfully avoid one kite, only to be captured by a second kite. The twelve bats obtained by Kirkpatrick from the trees were the small **Tadarida planiceps**.

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TABLE OF CONTENTS

NEWS

E.D. KITZKE (616 Aspen, South Milwaukee, WI 53172) sent along a copy of an article from the ***Milwaukee Journal*** of Monday 23 June 1980 that included a spiffy picture of Merlin Tuttle feeding frogs to ***Trachops***. The article was well written and Merlin looked to have been in fine form.

Arthur G. CLEVELAND (Department of Biology, Texas Wesleyan College, Fort Worth, Texas 76105) sent an article from the ***Arlington Urbanite*** of Sunday 8 June 1980 that presented a great deal of information about bats, with suitable reference to a number of our esteemed colleagues.

Kunwar BHATNAGAR (Department of Anatomy, University of Louisville, P.O. Box 35260 Louisville, Kentucky 40232) sent a less positive article from ***The Courier-Journal*** of Wednesday 21 May 1980 concerning bats and rabies.

Thomas H. KUNZ (Department of Biology, Boston University, Boston, MA 02215) sent a couple of interesting articles. One from the March 1980 issue of ***Transmission and Distribution*** which reported (article by Ron Taylor) that a 'bat jammer' successfully chased bats away from a project site in Central Arizona. The article suggests that the bats left because their navigation systems were jammed, but there is no indication of the output of the 'jammer'. The other article, by Ingemar AHLEN in ***Biophon*** volume VII no. 2 is a discussion of identifying bats by their calls.

The most recent issue of ***Australian Bat Research News*** (number 15, April 1980) contains a number of interesting bits of information and news, along with some articles:

Moorehouse, D.E. 1980. A nematode worm of fruit bats as a possible human pathogen. Aust. B.R.N. no. 15: 4-5.

McKenzie, N.L. 1980. Taxonomy of *Nycticeius greyii* and *N. balstoni* in western Australia. Aust. B.R.N. no. 15: 5-6.

Tedman, R. and L. Hall. 1980. The myology and osteology of some Australian bats. Aust. B.R.N. no. 15: 7-9.

There is also an article on commercially available bat detectors, and some book reviews, notably a useful review of ***Bats of Eastern Australia*** by L.S. Hall and G.C. Richards (Queensland Museum booklet no. 12).

Yves TUPINIER (5-B rue Claude Baudrand F. 69300 Caluire (Rhone) FRANCE) mentioned in a recent letter that there will be a symposium on bats in Europe in Bonn (West Germany) from 16 to 20 March.

Speleological Abstracts no. 18 has been issued by the Union Internationale de Speleologie and Societe Helvetique des sciences naturelles, Commission de Speleologie.

The Sociedad de Ciencias Naturales La Salle Memoria Tomo XXXVII no. 108 (September-December 1977) contains some articles which may be of interest to some readers: none deals directly with bats.

ANNOUNCEMENTS

The Eleventh North American Symposium on Bat Research will begin its meeting in Los Angeles at 7:30 P.M. November 20, 1980, with an informal no-host social gathering. The formal program will begin at 8:30 A.M. on Friday, November 21 and will end on Saturday, November 22 in the late afternoon or evening, depending on the number of papers to be presented.

Persons planning to attend should make their reservations at the University Hilton (area code 213-748-4141) before October 20th. Be sure that you request the rate for the Bat Symposium. All individuals who plan to present a paper contact Roy Horst at the earliest possible time. Questions concerning local transportation or travel directions should be addressed to Jim Smith, Department of Biology, California State University at Fullerton, Fullerton, CA. His number is 714-773-2143. All other questions or communication should be addressed to Roy Horst.

Dr. Eyo E. Okon, who is the Chairman of the Local Organizing Committee of the Sixth International Conference has asked that we publicize the following:

> We hereby formally announce the Sixth International Bat Research Conference (SIBRC) and have the honour in inviting you to attend and participate. As agreed at the FIBRC in Albuquerque, U.S.A., the Sixth Conference will take place at the University of Ife, Nigeria, and the Local Organizing Committee has decided to hold it from Saturday, August 29th to Thursday, September 3rd, 1981. It is being jointly organized by the Faculties of Science, Pharmacy and Health Sciences.

Any persons interested in attending should contact Dr. Okon at the earliest opportunity at the Zoology Department, University of Ife, Ile-Ife, Nigeria. The port of arrival is Lagos, Nigeria; the language of communication is English. There is a $50.00 (U.S. funds) registration fee. Housing arrangements can be obtained from Dr. Okon.

Emily Davis Mobley of Wilbraham, Massachusetts announces that she has the following chiropteranalia available for sale to bat biologists:

The Lives of Bats by D.W. Yalden and P.A. Morris	$10.95
The World of the Bat by Charles E. Mohr	8.95
Silently By Night by Russell Peterson	7.95
Cave Life of Oklahoma by Jeffery Black	3.00
The Bat by Nina Leen	6.95
The World of Bats by Alvin Novick and Nina Leen	23.95
OUT OF PRINT AND RARE ITEMS	
Allen, H., ***Bats of North America***, Smithsonian No. 165 June 1864. Disbound but complete	$35.00
Same, leather and marble paper binding, very good	45.00
Allen, H., ***Monograph of the Bats of North America***, Bulletin 343 of the National Museum, 1893, Rebound.	45.00
Bailey, Vernon. ***Animal Life of the Carlsbad Caverns***, Monograph No. 3 of the American Society of Mammalogists.	30.00
Allen, H. ***Description of a New Species of Bat, Atalapha Semota.*** Smithsonian publication offprint, 1890, more than one available. (3 pp)	1.00

She also has a large selection of beautiful bat prints in stock, some dating from 1737! Her address is: Speleobooks, Box 333, Wilbraham, MA 01095. (413) 596-9516.

RECENT LITERATURE

The volume of recent literature is large this time due to the fact that none was included in the last issue. As usual Harlan Walley, Jackie Belwood, Pat Brown, Kunwar Bhatnagar and Eleanor Fenton helped to ferret out appropriate titles.

Activity

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Swift, S.M. 1980. Activity patterns of pipistrelle bats (***Pipistrellus pipistrellus***) in north-east Scotland. J. Zool. Lond. 190: 285-295.

Anatomy

Baron, G. and P. Jolicoeur. 1980. Brain structure in Chiroptera: some multivariate trends. Evolution 34: 386-393.

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TABLE OF CONTENTS

BAT RESEARCH NEWS

By coming into my office just after Christmas I can get this issue out of my hair before the New Year so that it is at least prepared in 1980, albeit a month or two late.

REMINDER . . . that as of this time next year I will stop being the Editor of ***Bat Research News*** so I hope that by then someone else will be ready to assume this task. To date nobody has expressed any interest in it at all. **mbf**

NEWS

In the past while I have received several publications which you might find of interest:

Richard L. Clawson (Wildlife Research Biologist, Missouri Department of Conservation, Fish and Wildlife Research Center, 1110 College Avenue, Columbia, Missouri 65201) sent along a report covering 5 years of bat research there by Richard and Meg LaVal. The report is available free of charge from the above address:

> LaVal, R.K. and M.L. LaVal. 1980. Ecological studies and management of Missouri bats, with emphasis on cave-dwelling species. Terrestrial Series No. 8, Missouri Department of Conservation.

R.L. Peterson (Department of Mammalogy, Royal Ontario Museum, Toronto, Ontario M5S 2C6) sent me a copy of a manual on collecting mammals which includes a considerable amount of information on bats (copies available from the Sales Desk, Royal Ontario Museum, for $6.50 each, Canadian):

> Nagorsen, D.W. and R.L. Peterson. 1980. Mammal collector's manual. Life Sciences Miscellaneous Publications, Royal Ontario Museum 79pp.

S.B. Lall (2-GH-6, Machlamagri Scheme, Udaipur – 313001, India) wrote to report some of the work they have been doing on bats in his laboratory. Included in this list of accomplishments is a Ph.D. thesis recently completed by one of his students ("Histo-enzymology and histochemistry of ovary and uterus of ***Taphozous melanopogon melanopogon*** Temminck and ***Pteropus giganteus***").

A.M. Voute (De Hoofdafdeling Natuur – en Landschapsbescherming heeft het genoegen U) has sent a special issue of LUTRA (volume 22, nos 1–3) which is a compilation of bat population studies conducted in Holland. It includes an English summary, and a wealth of information on populations of bats.

> Dean, S., G.H. Glas, A.M. Voute, et al. 1980. Long term changes in bat populations in the Netherlands. Lutra 22: 1–118.

Antonio S. Quitugua (Director of Agriculture, Animal and Plant Industries, Agana, Guam 96910) has sent a copy of the Annual Report of the Division of Aquatic and Wildlife Resources of the Department of Agriculture which includes considerable information on ***Pteropus mariannus mariannus***, and some observations on ***Emballonura semicaudata.***

ANNOUNCEMENTS

For the first time in recent memory, ***Bat Research News*** is fiscally solvent. The response to renewal notices was encouraging even though many subscribers have not yet found time to return their dues statements. We currently mail 541 copies, 15 of these are on an exchange basis or courtesy copies, and about 200 remain unpaid. In early 1981 you will again receive a statement of your subscription status. If you have already paid, we are grateful; if not, we would appreciate your early attention to this small matter. If there is a mistake, please call it to my attention. With a staff as large as Brock and I have to help us, it is easy to make errors. Thank you for helping keep ***Bat Research News*** alive and reasonably healthy.

G. Roy Horst
Managing Editor

The Twelfth Annual North American Symposium on Bat Research will be held at Cornell University in Ithaca, New York on October 15–17, 1981. The Sheraton Inn has set aside a block of rooms for our use. The estimated price per room will be $38.00 single occupancy and $22.00 (per person) double occupancy. Dr. William A. Wimsatt will be our host and will chair the local arrangements committee. I will chair the program committee.

It has been our policy in the past to accept titles (to be included on the program) up to only 3 or 4 weeks prior to the meeting date. This large amount of freedom for the contributors was gained at the expense of a very tight schedule for the planners. This past year we had to set some meeting dates before we knew how many papers we would actually have. The result was that some of us had an extra day to spend in golden (in more ways than one) California.

The deadline for receipt of a title this year will be August 15, 1981 (just 60 days prior to the meeting). The formal call for papers will appear in the next issue of ***Bat Research News*** and ***Journal of Mammalogy and Bioscience. B.R.N.*** will also include a title transmission form for your convenience.

Both the Program Committee and the Local Committee are very interested in a special session or two with longer papers on a specific theme, similar to those held at the World Conference in Albuquerque in 1978. Please contact me (Horst) if you are interested in organizing and/or participating in a contribution of this sort.

Travel arrangements, etc., will be detailed in a later issue, but you will be relieved to know that the hotel is one mile from the airport and one mile from campus!

G. Roy Horst

SIXTH INTERNATIONAL BAT RESEARCH CONFERENCE

29 August to 3 September 1981

University of Ife, Nigeria

Registration fee – $50.00 U.S.

Registration by December 1980
(late registrations will be accepted)

For more details contact:

Dr. Eyo E. Okon
Zoology Department
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Ife-Ife, Nigeria

* * * * * * * * * *

Recent Literature held for next issue

TRIAENOPS PERSICUS AFER (HIPPOSIDERIDAE) AND CONDITIONS OF ANOXIA

INTRODUCTION

Little appears to be known about the biology of *Triaenops persicus* (Brosset 1966; Kingdon 1974). According to Hayman and Hill (1971), the species is distributed as follows: *T. p. afer* is known from Somalia, Ethiopia, Kenya, mainland Tanzania (and possibly Zanzibar Island), Uganda and Mozambique. *T. p. majusculus* Allen and Brosset has been found in Congo Brazzaville and the nominate subspecies is found in Arabia and Iran. Matthews (1942) described the reproductive system of *T. p. afer*, which is seasonal in its breeding pattern at Kisarawe, Tanzania, with young born in December (Howell 1976; 1977). Mainoya and Howell (1977) described the structure of the glandular frontal sac and Mainoya (1979; in press) studied the fine structure of the frontal sac and examined the relationship between spermatogenic and frontal sac gland activity in *T. p. afer*. Howell (1980) briefly noted pelage colour abnormalities in this subspecies.

The purpose of this report is to record large influxes of *T. p. afer* into an abandoned mine in coastal Tanzania and the presence of this species under conditions of anoxia at the roost.

METHODS AND STUDY AREA

As part of a study (Howell 1976) of the reproductive biology of *Hipposideros ruber ruber* (Noack), *T. p. afer* Peters (Hipposideridae) and *Nycteris thebaica* E. Geoffroy (Nycteridae), I collected samples at approximately monthly intervals from 1971–1973 and intermittently from then until January 1980. The diurnal roost where bats were collected with a hand net was an abandoned kaolin mine in the Pugu forest near Kisarawe, Kisarawe District, Coast Region, Tanzania (app. 6°53'S, 39°05'E). Although there was a strong air flow in most passages of the mine, relative humidity measured by paper hygrometer was high (80–85%) in these areas, and temperature measured by mercury thermometer varied from 23° to 27°C. In one dead-end tunnel 75 m long, air circulation was poor and maximum humidity and temperatures were higher (90% and 30°C) than in the main passages. The atmosphere in this passage was oppressive but there was sufficient oxygen to support the flame of a "Labogaz" gas lamp.

RESULTS

In early 1971 about 300 *N. thebaica* roosted in short side passages in the twilight areas of the entrances, while about 500,000 *H. ruber* tended to remain deep inside the mine in areas of darkness, including the dead-end side tunnel mentioned above, in densities of 25 to 144 bats/m^2. Both species hung from the roof and walls in such a way that they did not come into contact with neighbouring bats.

No *T. persicus* were observed until August 1971, when one male and one female were captured in the dead-end side tunnel. But from September 1971 to April 1972, none of this species was observed or captured. From May to October 1972 small groups of up to 14 *T. persicus* were observed and captured in the same area. Despite intensive searching of the entire passage system of the mine, *T. persicus* was not observed again until February 1973, when a single individual was captured. None was seen again until May 1973, when thousands

were present. The numbers of *T. persicus* continued to fluctuate until June 1974, from which time thousands have occupied the dead-end tunnel. The species roosts in close contact with one another and occasionally moves into tightly packed, dense clusters, making estimation of densities very difficult. However, to obtain at least a minimum estimate of the numbers of *T. persicus* present in August 1973, I used the maximum density figure for *H. ruber*, 144 bats/m^2, and estimated that a minimum of 172,000 *T. persicus* occupied the dead-end tunnel.

As early as May 1972, I noticed that *H. ruber* no longer occupied as much of the dead-end side tunnel and appeared to be abandoning this area for other roosts in the mine. In June of the same year, *T. persicus* occupied almost the entire roosting space available in the dead-end side tunnel, and only a few *H. ruber* were seen at the periphery. By 22 November 1975, *T. persicus*, in addition to having occupied the dead-end side tunnel, had moved out into the main passage of the mine, further displacing *H. ruber*, and by July 1976, *T. persicus* had occupied even more of the main tunnel system. As *H. ruber* extended into new roosting areas, *N. thebaica* roosted closer to the entrances of the mine and in greater densities than observed previously.

With the presence of large numbers of *T. persicus* in the dead-end side tunnel, I noticed an increase in humidity and temperature and a lack of fresh air, but was still with effort able to reach the end. In August 1973, when the temperature reached 30°C, I experienced severe difficulty in breathing, with gasping and dizziness, and had to leave the tunnel. On 14 June 1974 there was not sufficient oxygen in the atmosphere of the side tunnel to support the flame of a gas lamp and it was no longer possible to reach the end of the tunnel because of difficulty in breathing. Thousands of *T. persicus* were densely packed along the first 25 m, as far as I was able to go before being forced to turn back. Since 1974 conditions of anoxia have prevailed in this tunnel, and although I have not measured humidity, temperatures have ranged from 32° to 41°C (mean 35°C).

In July 1978, a visit to the mine revealed that a portion of it had collapsed due to very heavy rainfall during the long rainy season in April. Microclimate conditions had been altered, with a noticeable increase in humidity and a decrease in air circulation even in the main passages. In parts of these, temperature had increased to 30°C. In this same area, the number of *H. ruber* was greatly reduced (Howell, 1979). *T. persicus*, however, continued to be abundant in the dead-end side tunnel as well as in the other passages of the mine previously occupied by *H. ruber*.

DISCUSSION

No exact explanation is available as to why a small number of *T. persicus*, a species originally absent from the abandoned mine, came to occupy it. Nor is there any known reason for the relatively sudden influx of thousands of this same species, or their original irregular occurrence. The kaolin mine which serves as a roost was begun in 1941 and abandoned in 1949. I first visited the mine in January 1971, at which time it had already been occupied by hundreds of thousands of *H. ruber*, but as noted above, no *T. persicus* were present. I have never found *T. persicus* in small caves and fissures in the corraline cliffs along the coast near Dar es Salaam, but the species is recorded from Amboni caves near Tanga 220 km north of Kisarawe (Matthews 1942), and from Mikindani 400 km south (Swynnerton and Hayman, 1951).

Fenton (1970, 1972) noted a case in which a mine was occupied by a colony of over 1,000 ***Myotis lucifugus***, ***M. leibii*** and ***Eptesicus fuscus*** in less than 10 years, and commented that the rapidity with which bats exploit new roost sites remains unexplained. Fenton (1980) reported that the calls of bats, including echolocating calls, may be important factors in determining locations of roosts by conspecifics.

None of the 252 ***T. persicus*** I banded has been recaptured to date and banded ***H. ruber*** showed no movement among the several mines in the area. Whether ***T. persicus*** as a species undergoes regular or irregular movements is not yet known, but my observations of fluctuations in population at Kisarawe suggest this might be so. This species has never been found in other mines in the area, which are inhabited by ***H. ruber.***

T. persicus is not unique among bats in its ability to roost under conditions of anoxia. Constantine (1970) reported that ***Myotis velifer*** roosted under conditions that caused apprehension and gasping in humans. He also noted studies by Britton and Kline (1945) on ***Myotis*** which demonstrate "an extraordinary resistance to anoxia," and cites a report by Dwyer and Hamilton-Smith (1965) that ***Miniopterus schreibersii*** occurred in large colonies which man was unable to enter due to conditions of anoxia.

The physiological responses of bats with a high tolerance to conditions of anoxia obviously merit more attention, as the available data do not explain the high tolerance observed in several species. Riedesel (1977), citing the work of Mitchell (1963), noted that exposure of bats to an atmosphere of 5% carbon dioxide resulted in a 200% increase in respiration rate, but a 2% concentration of carbon dioxide caused no increase. Burke (1953) found that the carrying capacity of bat blood with regard to oxygen was within the range of most mammals. Certainly other physiological responses must be at work in these bats which are able to roost and reproduce under conditions of anoxia.

Some bats are known to be resistant to high concentrations of ammonia in the atmosphere (Studier 1969), but no evidence is available on this point from the present study. Although there was sufficient ammonia present to bleach the pelage of both ***H. ruber*** and ***T. persicus*** (Howell 1976) only a slight odour of ammonia was noticed, and I experienced none of the extreme reactions such as glottis spasm, etc. noted by Constantine (1970) under high ammonia concentrations.

From these limited observations at only one locality, it would appear that large numbers of ***T. persicus*** roosting in dense clusters in areas of poor air circulation produce, through their own respiration, as well as the decomposition of guano, conditions of low oxygen concentration intolerable to other species such as ***H. ruber***, which may be forced to use other areas of the roost. At Kisarawe, this trend was further enhanced when a portion of the main tunnel system collapsed, increasing conditions of humidity and further reducing air circulation.

A tolerance for conditions of anoxia, high temperatures and high humidity allows a species to occur in large numbers in very limited space and in a roost where air circulation is poor. The presence of both high temperature and humidity in a roost may be advantageous for the early survival and growth of the young, which would not have to expend as much energy for heat production and temperature regulation as they would under less favourable conditions; cutaneous water loss would also be greatly reduced. Adults too would similarly benefit from such conditions.

The selective pressures which favoured the development of such a tolerance are not known, but the evolutionary histories of the two hipposiderids *H. ruber* and *T. persicus* must have differed considerably since the former is unable to adapt to these same conditions.

The help of many students and colleagues, but especially that of Mr. C.A. Msuya, who accompanied me on almost every visit to the mine, is gratefully acknowledged. M.B. Fenton offered useful criticism of an earlier version of this note.

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A SUMMARY OF STATE BAT LEGISLATION

The purpose of this table is to provide a summary of states and territories of the United States which have laws or regulations applying to bats, and the agency within the state that governs the laws. Information for this summary was obtained primarily through correspondence, between 1972 and 1980, with state agencies that regulate or are concerned with bat legislation. While some states have laws specifically mentioning bats, either providing or denying protection, many states have legislation applying to bats only by interpretation. Under such laws bats may be viewed as nongame wildlife or indigenous state mammals. In some cases the legislation is so nonspecific that its meaning depends on the interpretation. Some states have regulations which offer protection for bats, apparently in the interest of public health, and they treat bats as vectors of disease rather than mammals needing protection. Although some states presently do not have any legislation concerning bats they anticipate developing bat protection legislation. Some bat species have state protection through endangered species laws, as either federal or state endangered species, but the same state may offer no protection for other bats. Funding for legislation, interpretations, and federal legislation may change; and the impact of changes may cause state bat legislation to appear, disappear, or to be reinterpreted. Without enforcement or public awareness programs the legislation may not protect bats. Omissions from this table could be due to lack of response of state agencies, changes in legislation, misinterpretation, or accidental deletion. I thank Dr. Robert L. Martin (University of Maine at Farmington), who originated this project, for all his help and support.

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	Pesticide Board Laws	Public Health Dept.	State Land Laws	Habitat Access Laws	Conservation Laws	Dept. of Nat. Resources	Collection Laws	Hunting Laws	Endangered Species Laws	Cave Laws
Alabama	–	–	–	P	P,I	P,I	–	–	F	–
Alaska	–	–	P,I	–	–	–	I	NP,S	–	–
Arizona	–	–	–	–	–	–	I	NP,I	–	P
Arkansas	–	–	–	–	–	–	I	P, I	F	–
California	–	L	–	–	–	–	I	P, I	–	–
Colorado	–	L	–	–	–	–	I	P, S	–	–
Connecticut	L	–	–	–	–	–	–	–	F	–
Delaware	–	L	–	–	–	–	–	–	–	–
District of Columbia	–	L	–	–	–	–	–	–	–	–
Florida	–	–	–	–	–	–	–	–	F	–
Georgia	–	–	–	–	–	–	–	–	F	P
Guam	–	–	–	–	–	–	S	P, S	A	–
Hawaii	–	–	–	–	–	P,S	–	–	St	–

	Pesticide Board Laws	Public Health Dept.	State Land Laws	Habitat Access Laws	Conservation Laws	Dept. of Nat. Resources	Collection Laws	Hunting Laws	Endangered Species Laws	Cave Laws
Idaho	–	–	–	–	–	–	–	NP,I	–	–
Illinois	L	–	–	–	A	–	–	–	F	–
Indiana	–	–	–	–	–	P,S	–	–	St	–
Iowa	L	–	–	A	–	–	–	NP,I	St	–
Kansas	–	–	–	–	–	–	–	–	–	P
Kentucky	–	–	–	–	–	–	–	–	St	–
Louisiana	–	–	–	–	–	–	I	NP,I	F	–
Maine	L	–	–	–	–	–	I	P,I	A	–
Maryland	–	–	P,I	–	–	A	–	–	F,St	P
Massachusetts	L	–	P	P	–	–	–	P,I	F	–
Michigan	L	–	–	–	–	–	I	–	F	–
Minnesota	–	–	–	–	–	–	–	NP,I	–	–
Mississippi	–	–	–	–	–	–	I	–	P	–
Missouri	–	–	–	P	P,S	–	I	–	F	A
Montana	–	–	–	P	–	–	–	–	A	–
Nebraska	–	–	–	–	–	–	I	NP,I	–	–
Nevada	–	–	–	–	–	–	–	–	–	–
New Hampshire	L	–	–	–	–	–	–	NP,I	A	–
New Jersey	–	L	–	–	–	–	–	P,I	F	–
New Mexico	–	–	–	–	–	–	–	A	St	–
New York	L	L	–	–	–	–	–	NP,I	F	–
North Carolina	L	–	–	–	A	–	I	P,I	F	–
North Dakota	–	–	–	–	–	–	–	NP,I	–	–
Ohio	–	–	–	–	–	P,I	–	–	St	–
Oklahoma	–	–	–	–	–	–	–	–	–	P
Oregon	–	L	–	–	–	–	–	–	–	–
Pennsylvania	–	–	–	–	–	–	–	NP,I	F	–
Puerto Rico	–	–	–	–	–	–	–	–	–	A
Rhode Island	–	–	–	–	–	–	–	–	–	–
South Carolina	–	–	–	–	–	–	–	NP,I	F	–
South Dakota	–	–	–	–	–	–	I	P,I	–	–
Tennessee	–	–	–	P	–	–	I	P,I	F	A
Utah	–	–	–	–	–	P,I	–	–	–	–
Vermont	–	–	–	A	–	–	–	NP,I	A	–
Virginia	–	–	–	–	–	–	–	–	F	–
Washington	–	–	–	–	–	–	–	P,A	–	–
West Virginia	–	–	–	–	–	–	I	P,I	–	P
Wisconsin	–	–	–	–	–	–	–	–	F	–
Wyoming	–	–	–	–	–	–	–	NP,S	–	–

KEY

P–protected, A–anticipated protection, F–federally endangered species, NP–not protected, I–bats by interpretation, St–state endangered species, L–laws for bats, S–bats mentioned

BIOLOGY OF BATS OF THE NEW WORLD FAMILY PHYLLOSTOMATIDAE PARTS II AND III

Edited by R.J. Baker, J.K. Jones, Jr., and D.C. Carter

These two volumes follow faithfully in the footsteps of Part I of this three-part series. The original concept behind the series was to "bring...together (a tremendous wealth of information on phyllostomatids which has accumulated) in order to assess what is now known about the family and to provide a departure point for future studies." While some authors took to their tasks well, faithfully summarizing, and in some cases supplementing, the variable array of information on this fascinating and much neglected family, others organized their topics poorly, or used the opportunity to present hordes of previously unpublished data.

Volume II contains chapters on Endoparasites, Ectoparasites, Oral Biology, Echolocation and Communication, Thermoregulation, Feeding Habits, and Movements and Behaviour. Endoparasites (Ubelaker, Specian and Duszynski), Ectoparasites (Webb and Loomis) and Thermoregulation (McManus) are all excellent reviews. The parasite papers provide association lists and summarize the little available information on the biology of the parasites associated with these bats. The indication is that much work remains to be done in this area. The thermoregulation chapter is well synthesized and reveals some rather interesting patterns, while providing an excellent base for future work.

Fenton and Kunz's review of Movements and Behaviour is adequate, considering how little is known about the subject, however much of their material is covered in other sections in the three volumes. This chapter, and the chapter by Gould on Echolocation and Communication suffer immeasurably by the long delay in bringing these volumes to press. So much has been learned since these manuscripts were prepared (1974) that they are now virtually obsolete. Gould provides information on mother-young interactions not published elsewhere, but a lack of consistency in treating call intensity measures makes comparisons difficult. There is no indication of what conditions recordings were made under (i.e. field, lab, handheld, etc.) and no discussion of how sounds were analyzed.

Oral Biology (Phillips, Grimes and Forman) is an exhaustive, descriptive work, the bulk of which was previously unpublished. There is little discussion or comparison; most of the text is anatomical description. Feeding Habits (Gardner) is poorly organized, consisting of long species accounts and awkward tables. I found it difficult to extract much of the valuable information it contained. Much of this information would have been better conveyed in table form.

Volume III, with chapters on Systematic and Distributional Notes, Morphometrics, Karyology, Biochemical Genetics, Sperm Morphology, Alimentary Tract, Morphometric Analysis of Chiropteran Wings, Reproductive Patterns, and Population and Community Ecology, provides a similar mosaic of excellent and less than excellent reviews. The first chapter, inserted by the editors to update the systematics and distribution of the family, reminds us how quickly such reviews become outdated.

Two chapters stand out as excellent reviews: Karyology (Baker) and Biochemical Genetics (Straney, Smith, Greenbaum and Baker). The former provides karyotypes for 60 species of phyllostomatids, and includes a fascinating discussion of chromosomal races in

Uroderma bilobatum. Despite a heavy reliance upon new data, the authors of Biochemical Genetics provide an excellent review of a timely topic, which offers an alternative view of phylogenetic relationships. It serves as an excellent base for future work.

Bleier's chapter on Embryology is clear, concise and well-organized, with no excesses of speculation such as taint many other contributions. Humphrey and Bonaccorso's review of Population and Community Ecology is well organized, but they often make unwarranted generalizations (for example: all species of ***Micronycteris*** are assumed to be gleaners; optimal foraging and resource partitioning are assumed with little or no data). They provide a good review of diversity patterns but fail to discuss actual foraging strategies. Several important references are left out, again probably a function of the length of time taken in bringing these volumes to press.

Wilson's review of Reproductive Patterns is exhaustive but poorly organized. I was disappointed by the lengthy tables that showed no obvious effort to summarize and interpret the data. This criticism also applies to Morphometrics (Swanepoel and Genoways). Their lengthy lists of measurements of individual bats lack means or variances or any other attempt at summarizing.

The chapters on Sperm Morphology (Forman and Genoways) and Alimentary Tract (Forman, Phillips and Rouk) were not well summarized. The former could have been condensed to a one page table of measurements of sperm heads. The latter is a weak synthesis of unpublished data, containing much anatomical description and little discussion.

Kleiman and Davis's chapter on Maternal Care relies almost entirely on new data from a single species (***Carollia perspicillata***) but provides useful baseline data on development of dentition, flight and mother-young interactions, albeit all lab observations. Burn's chapter on General Physiology is hampered by a lack of material to review.

Finally, Smith and Starrett's Morphometric Analysis of Chiropteran Wings is a manuscript totally out of place. It is a long, exhaustive work covering the whole Order Chiroptera, with only token concentration on the phyllostomatids.

In summary, I feel cheated by the quantity of poorly written, poorly organized and poorly edited material in the three volumes. A much shorter (perhaps a single volume) collection, better organized, better edited and more quickly brought to press would have better served the bat research community. It is this long delay in publishing that mars many of the fine contributions in the series (as much as a five year delay between submission and publication). The length of time between publication and review does not improve things (three years in the case of Part II). Much of the material in the three volumes is of immeasurable value (the Annotated Checklist and keys in Volume I alone must be worth the price of the set to anyone working with bats in the neotropics. Despite its shortcomings, for only $42 (U.S.) the set supplies an incredible volume of information, and a valuable tool to anyone working in any area of bat biology.

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