

BAT RESEARCH NEWS

Volume 13 No. 1

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# BAT RESEARCH NEWS

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Original Issues Compiled by Dr. Robert L. Martin, Publisher and Editor, of *Bat Research News* (1972).

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## Table of Contents for Volume 13, 1972

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### Volume 13: Number 1, January 1972

The Cover .....	1
Editor's Comments .....	1
Here and There .....	1
Reproduction of the Bats <i>Myotis keenii</i> and <i>Pipistrellus subflavus</i> in Indiana by James B. Cope and Stephen R. Humphrey .....	9
Recent Literature .....	10

### Volume 13: Number 2, April 1972

The Cover .....	13
Here and There .....	13
Improved Tools for Bat Banders by William H. Elder and Wilbur J. Gunier .....	14
Adaptations of Refuging Free-tailed Bats by Stephen R. Humphrey .....	19
More Here and There .....	26
Recent Literature .....	27

### Volume 13: Number 3, July 1972

The Cover .....	34
Editor's Notes .....	34
Here and There .....	34
Recent Literature .....	36
More Here and There .....	59

### Volume 13: Number 4, October 1972

Errata for <i>Bat Research News</i> , Vol. 13, no. 4 .....	ii
The Cover .....	60
Here and There .....	60
Adaptive Morphology of the Tongue of Nectar-feeding Bats by Donna J. Howell .....	64
Recent Literature .....	65

## THE COVER

The cover photo shows a vampire bat (Desmodus rotundus) preparing to feed from the ground on the hoof of a standing cow. The bite was made earlier and can be seen above the vampire bat's head. The photo was provided by Dr. G. Clay Mitchell of the USAID/BSFW Vampire Bat Control Project in Latin America.

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## EDITOR'S COMMENTS

By mailing the October 1971 issue with the January 1972 issue, the financial deficit incurred in producing Bat Research News was minimized, and by raising the subscription rate to two dollars for two years, the publication is assured of survival in spite of the lack of institutional support. The rate is set for a two year period rather than one dollar per year to minimize bookkeeping time expenditure. With a two year subscription period, less time is required than would be in sending out expiration notices each year. I will accept a limited number of new foreign subscriptions at the old rate for a time in order to boost the international coverage of BRN, but the cost of cover printing and postage alone still exceeds the subscription rate. As long as the deficit is slight, there will be no problems, so library subscriptions are still solicited as well as foreign listings.

## HERE AND THERE

For those researchers planning to attend the Third International Bat Research Conference in Yugoslavia from September 5-10, 1972, contact should be made with the Croatian Society for Natural Sciences as noted in an earlier BRN issue. For those of you who wish to request National Science Foundation travel funds, send to National Science Foundation, Office of Science Information Service, Washington, D.C. 20550, and request NSF Form 192, Application for International Travel Grant. Those wishing more complete information immediately may call area code 202-632-5850 for professional assistance from the Information Services Program. Only eight researchers signed my list for such information at the Albuquerque meeting in November, but others may also be interested.

## Several address changes:

Dr. Iyad A. Nader, College of Education, University of Riyadh, P.O. Box 2458, Riyadh, Saudi Arabia

Dr. Josefina C. Rauch, Department of Zoology, University of Manitoba, Winnipeg R3T 2N2, Manitoba, Canada

Hugh C. Smith, 8613-157 Street, Edmonton 52, Alberta, Canada

## New Subscribers:

Ted Bulthaup, 2508 Wolfe Drive, Woodridge, Illinois 60515

Christopher Love, 1614 Hampden Boulevard, Reading, Pennsylvania 19604

Gordon B. Thompson, 56 Beaumont Road, Cambridge CB1 4PY, England

Warren Kerr, Box 2890, Linfield College, McMinnville, Oregon 97128  
 Timothy McDonnell, 743 Poplar Street, Ramona, California 92065  
 Cherrie D. Bramwell, Department of Applied Physical Sciences, Building  
 3, Earley Gate, Whiteknights, Reading RG6 2AL, England  
 Dr. Andrew Starrett, Department of Biology, San Fernando State College,  
 Northridge, California 91324

Dr. Michael Petit, Department of Microbiology, Colorado State University,  
 Fort Collins, Colorado 80521

Walter R. Gusciora, Veterinary Public Health, Department of Health,  
 P.O. Box 1540, Trenton, New Jersey 08625

Gary Banowetz, Box 671, Hudson, Iowa 50643

Shereen Greenberg, 30 Buckman Street, Woburn, Massachusetts 01801

Dr. Allen H. Benton, 40 Norton Place, Fredonia, New York 14063

Mr. T. Cartmell, 2 Hillhurst Boulevard, Toronto 310, Ontario, Canada

Dr. James F. Scudday, Box 6011, Sul Ross State University, Alpine,  
 Texas 79830

Eugene D. Kitzke, 616 Aspen Street, South Milwaukee, Wisconsin 53172

Jim Roberts, Department of Biology, University of Southwestern Louisiana,  
 Lafayette, Louisiana 70501

Francis J. Gramlich, State Supervisor, Division of Wildlife Services,  
 P.O. Box 800, 280 State Street, Augusta, Maine 04330

Dr. W. J. Bowman, 15 Elm Street, Skowhegan, Maine 04976

Owen D. Buck, Box 60, Bates College, Lewiston, Maine 04240

Dr. Warren C. Lewis, 119 North Church Street, Rockford, Illinois 61101

W. Cal Welbourn, 5309 7th Court NW, Albuquerque, New Mexico 87107

Stephen Brady, 232 Springdale Drive, Belleville, Illinois 62223

John Thomas Andrew Pawluk, 22 High Gate Drive, Smithtown, New York 11787

Back issues of Bat Research News are not available at this time. I will provide information on which numbers and issues are available when and if they become available. Those wishing back issues may then contact me for them.

SIGURD SZERLIP writes, "During some invertebrate work last summer, I came across the remains of a banded bat. Very little was left, just a few wing bones and the band. The specimen was in the Main Passage of Fort Stanton Cave, Lincoln Co., New Mexico. The band number was: 25

190389

Any information other BRN readers could supply would be useful. The specimen was collected 25 July 1971 and is in my possession. The band has been sent to the Fish and Wildlife Service. I would appreciate any other information any of the BRN readers might have on the bats in Fort Stanton Cave or past banding programs, collecting records, etc. in Fort Stanton Cave."

PATRICIA BROWN writes, "For my doctoral research I am studying vocal communication in the pallid bat (Antrozous pallidus pacificus) with special emphasis on mother-young interactions. I have made a number of field observations on a colony near Santa Maria, California. However, these bats are somewhat inaccessible, and I would appreciate any information from your subscribers on roosts in the Southern California area either of Antrozous p. pallidus or pacificus. I have also been banding Macrotus, Myotis, and Plecotus in the Colorado and Mojave Deserts as part of a long term study on their populations." At the Albuquerque meeting, Mrs. Brown played recordings illustrating the vocal signatures by which mothers recognize their young as part of a paper she presented on the subject.

It finally happened: a gas station attendant looked at my license plate and asked, "Fill it up, Mr. Myotis?" DILFORD CARTER says his EUMOPS plate has resulted in the same kind of recognition. MACROGLOSSUS, anyone?

Added to the subscriber list is: Library, University of Dar es Salaam, P.O. Box 35092, Dar es Salaam, Tanzania.

In response to an article in *Krasnaya Zvesda*, the publication of the Soviet Defense Ministry, in which it was claimed that the U.S. Government carried out an attempt in World War II to utilize bats as carriers for incendiary bombs, a spokesman for the U.S. Navy stated that as far as he knew the only research on bats was on echolocation done in colleges with some Navy research funds. News media frequently do misquote and do on occasion make mistakes, but if the Navy man was not misquoted, he should have checked Navy records for the Navy funding of "Project X-Ray", in which Tadarida were tested for carrying such incendiary devices. The project was successful enough for some of the bats to escape and set fire to portions of the base where the work was being carried out. The project was terminated in 1944, and thus should not alarm even a pacifist, but it would be nice to see accurate responses to such interesting statements instead of ridicule. The bat information in the article was essentially correct, but any inference that bats are now being contemplated for such use is open to question.

In response to NIXON WILSON's comment on finding a clump of 138 Eptesicus fuscus in an Iowa cave as reported in the April 1971 issue of ERN, HARLAN WALLEY writes: "On February 12, 1963, Dr. Edward Keiser and I banded 251 Eptesicus fuscus taken from one overhanging ledge in south Blackball Mine, LaSalle Co., Illinois. At least 150 additional Eptesicus were clearly visible, but inaccessible with our equipment on hand. This is the largest concentration of Eptesicus I've ever seen in hibernation, and have failed to find such sizable numbers in the mine since that time. This ledge was located within the twilight zone."

CARLETON PHILLIPS is interested in hearing from students who want to study systematics and evolution of bats in the master's program at Hofstra University. He is currently doing some comparative histological and histochemical studies of the dentition of bats.

MICHAEL PETIT is working under a Rockefeller Foundation grant to determine, if possible, the level of mercury occurring naturally in the environment each year for a 250 year period by studying the layers of bat guano in selected bat nursery caves. Establishing a stratigraphic dating system is the first step, and he reported on his progress in this direction at the Albuquerque meeting in November.

JOHN SEALANDER notes that he is willing to accept students at either the M.S. or Ph.D. level to conduct research on bats. He notes that opportunities are good for research on bats in his area (Arkansas); his own interests are in the area of physiological ecology, but he is also interested in life history phenomena and behavior of bats.

An older letter from ROBERT A. MARTIN notes that five species of bats, Plecotus townsendii, Myotis volans, M. lucifugus, M. leibii, and M. thysanodes, hibernate in appreciable numbers in Jewel Cave, Custer County, South Dakota. He notes that an individual Plecotus townsendii banded in Jewel Cave in 1959 was discovered in 1970, and the record forwarded to CLYDE JONES at the Bird and Mammal Laboratories in Washington. He has netted M. keenii at Jewel Cave, but it does not hibernate there.

CHERRIE BRANWELL sent a nice photo of a Pteropus giganteus, the first of a proposed colony of twelve for her studies in bat bioengineering; her earlier work has been on Cretaceous pterosaurs. According to the Newsletter of the Mammal

Society of the British Isles, there was such a bat at the Bat Group meeting in October, so the source seems pretty obvious. At the Bat Group meeting members were tested for allergies to bats and mites, and discussions included a survey on bat persecution by local authorities, ideas on maintaining bats in National Forests, and information on distribution and status of bats. R. E. STEBBINGS is "accepting" bats in all stages of disrepair, apparently; it seems too bad to have any carcass discarded when it might provide some information, and on this premise, he has acquired 666 specimens with data.

MERLIN TUTTLE writes, "I have been working on the movements of Myotis grisescens from Kentucky and Virginia to Florida since 1960 and have spent 21 months in the field since 1963. Most recently I have worked extensively on factors which limit distribution and population density. Detailed data have been recorded from hundreds of roosting sites used by more than 80 summer colonies which range in size from a few hundred to a quarter of a million. Roughly 45,000 bats have been banded (mostly as newly flying juveniles), and about 15,000 movements have been recorded. Comparative mortality rates are being computed from winter recoveries in four hibernating caves which contain the following numbers of bats: 1,500,000, 500,000; 100,000, 100,000. I have been very careful not to disturb the bats unduly and have not noted the frequently reported declines in the populations. Fortunately, two of the wintering sites are known only to me, and all are extremely difficult to reach. It certainly would be a worthwhile project if the largest of these wintering populations could be protected before it is seriously endangered. I know of two wintering caves, which probably housed more than 1,000,000 M. grisescens within the past 20 years, where all of the bats were killed or forced to leave."

Over the Christmas vacation, I visited Carter Caves State Park in Kentucky, where I asked the Park Naturalist the status of the gate a number of concerned bat research workers had paid to have installed years ago after an especially bad case of bat killing by vandals. The gate washed out several years ago, but a chain link fence has been installed, which helps to control access to the cave where the main hibernating colony of Myotis sodalis is located.

Also over the vacation period, I visited a graphite mine in northern New York State where I did some banding in 1963. The main openings had been bulldozed in to prevent entrance, but I found an old entrance under three feet of snow and found a good population of pipistrelles and Myotis lucifugus, many with my bands. This mine and another abandoned mine in northern New York would be nice to have set aside strictly for bat use, but I am sure that the owners would be convinced that precious minerals were present if approached and the resultant price out of reason. This seems to have been the pattern in the past for bat workers with similar ideas.

GORDON THOMPSON writes that his particular interests are with ectoparasites of bats.

RON PINE writes concerning Carollia: "It now appears as if my revision of the genus Carollia should finally be appearing early this spring. I've heard from various sources that some people may be conducting non-taxonomic studies on captive colonies of supposed Carollia perspicillata. As true C. perspicillata is quite difficult to tell from at least one other species of Carollia, workers who have been studying captive animals might wish to send me specimens for a positive identification. I'll be happy to take a look at them; specimens prepared as skins and skulls are best. Send to: Dr. Ronald Pine, Mammal Identification Service, Division of Mammals, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560"

TIMOTHY McDONNELL, at United States International University at San Diego, is conducting research on Antrozous pallidus pacificus.

CHARLES MOHR, long concerned with cave bat population fluctuations, has sent out to more than 100 National Speleological Society grottoes a paper entitled: "An Urgent Request for Support from NSS Grottoes for Better Understanding and Protection of Cave Bats". With it he included a form for each grotto to fill in, entitled: "Acceptance of Grotto Responsibility for Bat Protection", which is to my way of thinking an excellent means of making the average cave explorer aware of the dangers to bat populations. Knowing that just keeping the records this request will produce will become a major task makes me even more admiring of the efforts of such people as CHARLES MOHR. I look forward to hearing what the response is to this request. Included on the form was notification that information was available on request on subscriptions to Bat Research News.

PETER DWYER, writing from Queensland, states, "I will be away from here through next year as sabbatical has turned up and I am heading for the hills of New Guinea to try and find a nice set of caves, near rainforest and a comfortable (i.e., isolated) village, where I can catch bats and think about species diversity for 12 months. At present I have no address for New Guinea but will probably acquire a post office box number somewhere and pick up forwarded correspondence from time to time." I was pleased to get a nice set of reprints from him recently.

GLEN KOEHLER writes that he is designing and producing a key which could probably be used by public health departments as mentioned by STEVE HUMPHREY in the April 1971 ERN. When it is completed, he will send it to anyone who would like a copy. It will consist of a family key and successive keys arranged by families, a basis pictorial reconstruction of that in ROGER BARBOUR and WAYNE DAVIS' Bats of America. I personally would like to see state health departments set up an arrangement with a reputable mammalogist for positive identification of mammalian specimens rather than to rely on keys, no matter how good the keys may be. The State Health Department here identified a short-tailed shrew as a mole, and has identified bats involved in rabies cases as simply "bat". This is my cue to get after them here to contact me, I guess, following my own suggestions.

RICHARD LAVAL makes some pertinent comments regarding bat movements and records, as follows: "...regarding the movement of the banded Myotis grisescens from Missouri to South Dakota, RON TURNER, in his dissertation "Mammals of the Black Hills of South Dakota and Wyoming" discussed this incident in some detail, and concluded that the identification of the bat recovered in the Black Hills remains suspect, that M. grisescens is not a part of the normal fauna of the Black Hills, and that 'At best, the record represents abnormal wandering of a displaced mammal that was liberated in strange surroundings.' Since we know (thanks to millions of bird-watchers) that birds may wander as far or much farther from their normal range and habitat, there is no reason to believe bats might not do the same thing. The scarcity of "bat-watchers" would guarantee that few such wandering individuals would ever be detected." My additional commentary on this is that while it is useful to have information on strays from normal range and habitat, those persons producing range maps, for bat species especially, should not include the localities of such strays within the distribution area unless the maps are for use with keys for layman use; for this usage, it is perhaps well to have ranges extended beyond the actual limits of the species' distribution so that any specimen of that species will be checked with the key. I know of many cases where specimens have not been identified to the correct species because, "that species isn't found that far north" or, "that species isn't found in this state".

Just got the September 1971 list of British Government Publications, this time noting that orders must be sent to Pendragon House, 899 Broadway Avenue, Redwood City, California 94063.



K. M. HOWELL writes from Tanzania to add the library at the University of Dar es Salaam to the subscriber list: Library, University of Dar es Salaam, P.O. Box 35092, Dar es Salaam, Tanzania. He also notes a reference for the recent literature section: Cunningham-van Someren. 1972. Pollination of Kigelia flowers by bats. East African Nat. Hist. Soc. Bull., January: 9-12; part II will appear in the February issue.

DAVID BELITSKY, who has a B.S. from Ohio State University in Wildlife Management, is now in the U.S. Coast Guard and is willing to help anyone in southeastern Texas who would like assistance in bat work. His new address is:

David W. Belitsky, 411 Lozand Building 2, Apartment 5, Harlingen, Texas 78550

DAVID YOUNG, a graduate student at Sul Ross State University, is working on bats in an irrigation tunnel. His address is:

David B. Young, Box 205, Sul Ross Village, Alpine, Texas 79830

JOHN FARNEY is currently marketing his aluminum frame wire bat trap as shown at the Albuquerque meeting; his address is now: John P. Farney, 8 Tabor Place, Kearney, Nebraska 68847. After hearing MERLIN TUTTLE's comments on its use, I knew I had to have one - need only now to obtain the finances. Those interested in the possibility of purchasing a steel wired 5' x 6' frame bat trap (like those used by DENNY CONSTANTINE, but smaller and portable), contact John at the above address.

RALPH RASCHIG writes from his Wisconsin home: "After receiving the article from you entitled, "Bat Control with High Frequency Sound" (Hill, 1970), I accumulated the materials and built a unit to eradicate bats from our Washington Town Hall. As the buildings mentioned in the article were huge and under construction, I reasoned that the town hall was approximately 1% of the cubic foot air space. With this in mind I used four adjustable, high frequency dog whistles connected to a small air compressor, each whistle having its own valve to control air flow to obtain proper operation of the sound. The unit was placed in the building at 3:30 PM with transom open to where the bats were quietly roosting behind the inside walls between the studding. The sound was disturbing to a dog a block away as well as a very high pitch ringing in my ears 200 feet away from the building with the doors closed. Nothing happened. At 8:30 PM the first bat emerged and ten minutes later the exodus began and thousands of bats (pipistrelles) left the roost. At 4:00 AM the following morning (July 21, 1971) the bats returned and apparently the sound made no difference as they entered the building by the thousands and by 5:15 AM all had entered, and at 6:00 AM all was quiet except for the whistles. So after 16 hours of continuous operation, the motor compressor was turned off and the experiment considered a failure. Therefore I believe the bats' removal from a building under construction with high frequency sound was not due to the sound." Editor's note: The whistles used by Hill ranged from 4,000 to 18,000 vibrations per second; I don't know what frequencies might or might not have been the most effective, if any. The Hill paper, incidentally, was: Hill, E. P. III. 1970. Bat Control with High Frequency Sound. Pest Control Magazine, 38(9): 18. No word has come from the Pest Control Association, to whom I sent the original paper and Mr. Raschig's letter, although I know the PCA's research director is interested. Mr. Raschig has since sent me an electrocardiogram of a pipistrelle which I will be happy to send on to anyone interested, as he requests.

JOHN GUNSON, wildlife biologist at Edmonton, Alberta, is a new subscriber. His address: John R. Gunson, Department of Lands and Forests, Province of Alberta, O. S. Longman Building, 6909 - 116 Street, Edmonton, Alberta, Canada.

A letter from EDWIN GOULD is interesting enough to print here in its entirety: "I have just returned from Tucson, Arizona, where I have been the guest of Dr. Howard Baldwin at the Sensory Systems Laboratory in Tucson and Dr. E. Lendell Cockrum of the Department of Biology at the University of Arizona. Our primary interests were to examine the various facets of the development of vocalization in bats. We are interested in mother-infant communication and the way in which these sounds may develop into sonar signals. I have also been collecting data on the development of respiration in known age bats and the concomitant vocal emission as the bat coordinates his ultrasonic output. Here in Baltimore a graduate student, Nigel Woolf, has been removing the malleus and breaking the tympanum of very young bats at different ages and following the development of their ultrasonics into adult life. He now has 5 such operated animals and their sibling controls using Eptesicus twins.

"My studies of maternal-infant behavior included observations of Antrozous, Macrotus, Myotis velifer, Leptonycteris and Molossus ator. (The last species was studied at the Laboratory of Dr. Roy Horst at the University of Arizona Medical School.) Chris Dietz, an undergraduate in mammalogy at UCLA (just transferred from Johns Hopkins) did a superlative job in maintaining these bats and their babies from weaning onwards in the laboratory.. When Chris left Tucson he had with him an Artibeus that Dr. Horst had given us. This fruit bat was only a couple of weeks old or so and was doing well on diluted milk and fruit juice. We are very anxious to hand raise bats to see what effects maternal deprivation has and we are going to attempt a number of approaches this next spring. These studies are also leading us to experiments that deal with learned behavior in bats and in particular what baby bats learn from their mother during foraging. This may be particularly relevant to the vampire bat problem. I hope next spring to go to Mexico and perhaps to Trinidad to obtain various species of bats that might be pregnant and bring them back to the laboratory. Dennis Turner has been studying the ability of mother bats to distinguish their infant from other infants by ultrasonics. He has also been mist netting in Costa Rica where he studied the use of flight lanes by bats along stream beds and other passages through the forests.

"I cannot resist relating an observation that Chris, Dennis and I made one evening when we were photographing with 16 mm color using synchronized electronic flashes of the retrieval of infant Macrotus by its mother. Two baby Macrotus, one about 7 days old and the other just one day old were placed 6 inches apart on a vertical fence post. The mother circled near both of the bats in about a 10 inch diameter and then landed next to the older infant which was not her own and guided it to her nipple and then went to the newborn baby that was her own and guided it to her other nipple. She then flew away with both babies hanging to the nipples. I am eagerly waiting for the development of the film and looking forward to testing some new hypothesis about individual recognition of bats. I can think of a number of explanations of what happened but most interesting of all is that it does permit us to test new hypotheses."

Then a letter from DENNIS TURNER arrived after Dr. Gould's: "In April, May and June of this year I participated in an Organization for Tropical Studies field ecology course in Costa Rica. We netted over 1500 bats, including several "rare" specimens. I have just submitted a ms to Ecology (with a co-author) on the use of flyways by neotropical bats. (Editor's note: FRANK BONACCORSO gave an account of the vertical stratification of bats in neotropical forests for himself and for Dennis at the Albuquerque meeting.) I'll send a complete reference if it is accepted. Then, this summer I returned to Arizona to meet Ed Gould and study maternal-infant communication in the beasts. I am currently planning on a return to Costa Rica in March for dissertation research on vampire foraging strategies - a radio telemetry study."

It's letters such as these that inspire future graduate students to go on.

WILBUR GUNIER spent several weeks this summer travelling about 2300 miles to search out new colonies of Nyctotis grisescens in Oklahoma and Arkansas, and Missouri. He included a copy of, "An Essay on the Caves of the Cherokee Nation" by Donald R. Russell. It is a well-printed, non-technical booklet of 50 pages available for \$2.50 from Donald R. Russell, 2017 Archdale, Broken Arrow, Oklahoma 74012. Although not of bat interest, it might be helpful for those looking for cave localities.

Listed among the Sigma Xi Grants-in-Aid of Research Awards for 1971-1972 is one to VAN RICK McDANIEL, Texas Tech University, for "Evolutionary implications of the comparative anatomy of brains of American leaf-nosed bats." One is listed for DENNIS M. SKAGGS, Western Illinois University, for "Ecology of bat populations in natural and man-made caverns of west-central Illinois." One is also listed for BERNICE R. TANNENBAUM, Cornell University, for "The adaptive significance of social behavior in neotropical bats."

G. CLAY MITCHELL writes, "To briefly outline your request of our research activities. Our work on Desmodus rotundus is ecology and control oriented. Ecology studies include:

- a) The use of radio tracking to gather behavioral data. (A manuscript is being prepared with some interesting results.)
- b) Local movement studies by capture-recapture methods.
- c) Observing the feeding behavior of Desmodus rotundus under natural conditions. This study was recently completed and by using night vision equipment (Starlight on loan from U.S. Army) we observed 75 vampires feeding under field conditions. (A manuscript is being prepared.)

Control studies include:

- a) Evaluation of presently used control methods and improvement. The only chemical control for vampire bats is poisoning by treating old bites. We evaluated this approach and have improved it by replacing the strychnine with a safer compound for handler and cattle. (A manuscript is being written on this method.)
- b) Evaluating systemic insecticides as vampiricidal agents. Our work is not complete at this time, but we have some interesting results.

Other control and behavioral studies are being conducted by our back-up team at the Denver Wildlife Research Center. Basically our objective is to find a species specific control for vampire bats to use in areas where vampires have become a pest species. The conventional methods used for some 35 years have done more damage than good and we hope to improve the methods."

ARTHUR GREENHALL sent a good photo of a Desmodus standing to feed on a bite on the chin of a rabbit, very similar to the position shown by the vampire bat on the cover of this issue of BRN, but not quite as sharp.

STEPHEN BRADY, new subscriber just listed, has changed his address already: Stephen J. Brady, 629 West Jackson Street, Macomb, Illinois 61455.

A new subscriber is BORIS LYZAK, Assistant Director of the Turtle Back Zoo, who is interested in establishing a live bat exhibit. His address is: Boris Lyzak, Turtle Back Zoo, Essex County Park Commission, 560 Northfield Avenue, West Orange, New Jersey 07052.

ROY HORST and I discussed the possibility of having the abstracts of the papers presented at the Albuquerque bat research meeting printed in BPN, and the invitation was given at the meeting. Only four abstracts from 35 papers

have arrived to date; I strongly suspect that the fear of printing in BRN as prior publication may have been the major reason. One of the four abstracts received noted publication of the full paper elsewhere, for that matter. I am withholding the printing of the remaining three, as the authors may wish to either publish elsewhere or even have the work printed in BRN.

XX

#### SHORT NOTE SECTION

#### REPRODUCTION OF THE BATS MYOTIS KEENII AND PIPISTRELLUS SUBFLAVUS IN INDIANA

Keen's bat, Myotis keenii, and the eastern pipistrelle, Pipistrellus subflavus, are distributed over large areas of central and eastern North America. The latter species is quite abundant in the southern part of its range, while the former is seldom abundant (Mills, 1971). Little is known about the reproductive biology of either species (Parbour and Davis, 1969).

Hamilton (1943) found that an unspecified number of female M. keenii in New York each had single embryos. He concluded from the size of the embryos taken from 21 June to 9 July that parturition occurred in July. Brandon (1961) captured two immature M. keenii which had fallen from their nursery roost, as well as an adult female which had apparently come to suckle her offspring. In two days of captivity, one immature did not nurse at all while the other did frequently. On 5 June in Missouri, Easterla (1968) mist-netted a M. keenii which was attached to a newborn young by the umbilicus. We sampled a nursery population of M. keenii in a window sash of a barn near Brownstown, Jackson Co., Indiana, on 22 June 1966, capturing 24 adult females, 12 immature females, and 18 immature males. Ten other adults and no young escaped. One adult was pregnant and the other 23 were lactating. The presence of about the same number of adults and young and participation of virtually all adult females in reproduction indicates that a litter size of one is normal. The smallest and largest immature males from this sample had forearms 18 and 32 mm long and weighed 2.0 and 4.2 grams, respectively. We conclude that parturition of this species in Indiana spans several weeks in early and mid-June.

Wimsatt (1945) reviewed published data on litter size of P. subflavus and examined females in all stages of pregnancy, including ten which each had two very large embryos. He concluded that several zygotes implant but only two mature. Lindsay (1956) collected a female containing four small embryos and one with two large embryos. Davis and Mumford (1962) reported a female with two young. On 30 June 1961 in the Pike County State Forest, Indiana, Cope and W. Wilson Baker mist-netted a P. subflavus which bore two young in a cage overnight. Cope (in Mumford and Cope, 1964) observed about 30 adults and 30 volant young P. subflavus on 30 July 1958 at a nursery near Brownstown, Jackson Co., Indiana. Following bat-proofing of this roost, on 30 June 1960 he found six adults and from six to ten young in a nearby barn (the one used by the M. keenii). On 22 June 1966 we observed a loose cluster of torpid P. subflavus hanging from the eaves of the barn. We captured all 17. All were adult females in late pregnancy, and the shapes of their distended abdomens clearly showed that each contained two embryos. We concur with Wimsatt that the normal litter size in this species is two. In southern Indiana, near the northern edge of the species' range, parturition occurs in the last week of June and the first week of July, much later than in M. keenii in the same area.

James B. Cope and Stephen R. Kumphrey, Joseph Moore Museum, Earlham College, Richmond, Indiana 47374, and Florida State Museum, University of Florida, Gainesville, Florida 32601.

## Literature Cited:

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## THE COVER

The cover photos, courtesy of Horacio Delpietro, are of Macrophyllum macrophyllum, only recently described from Argentina and Paraguay. The bat photographed here was taken near Posadas, Misiones Province, Argentina. It is the only photograph I have ever seen of this species, and John Paradiso

has already indicated that it would be a nice addition to the next edition of Walker's Mammals of the World, which John edits. Dr. Delpietro has submitted other photographs to be used as cover material for Bat Research News, two of which will grace the cover of Volume 14, No. 1.

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Bat Research News appears quarterly: January, April, July, and October. The subscription rate is \$2.00 for two years. Address all correspondence to Robert L. Martin, Department of Biology, Preble Hall, University of Maine, Farmington, Maine 04938.

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## HERE AND THERE

A Partial Bibliography of the Vampire Bats (Desmodus, Diphylla, Diaemus) 1971, compiled by SAMUEL B. LINHART, has been printed, and he indicates that he has a number of reprints available for distribution. Each reference has a subject index number or numbers following, allowing the papers to be placed in alphabetical order of author, while providing the added value of indicating subject coverage. 626 citations are listed.

The news released by the U.S. Department of the Interior's Fish and Wildlife Research Center in Denver regarding vampire bat control has stirred up quite a bit of interest. Science, on 5 May 1972, had an article entitled: Doom Spelled for Vampires; Newsweek and other magazines also picked up the news and spread it. Diphenadione, an anticoagulant, has been used with petroleum jelly on captured vampire bats, killing them and those who groom and lick them in shared roosts; also injected into cattle stomachs, the resulting anticoagulant in the cattles' blood, while not enough to harm the cattle due to their bulk, caused death in vampire bats feeding on the cattle. The reports are well-written and not overly sensational in Science, volume 176, p. 495, and Newsweek, 15 May 1972, p. 105.

Some new subscribers are:

Donald R. Patten, Los Angeles County Museum of Natural History, Exposition Park, 900 Exposition Boulevard, Los Angeles, California 90007

Edith G. Bragg, Department of Biology, Idaho State University, Pocatello, Idaho 83201

Timothy C. Kaspar, Department of Biology, Midwestern University, Wichita Falls, Texas 76308

Dr. Gerhard Neuweiler, Arbeitsgruppe Elektrophysiologie, 74 Tübingen, Köllestr. 23, West Germany

Dr. F. Dusbábek, Czechoslovak Academy of Sciences, Institute of Parasitology, Prague 6, Flemingovo Nám. 2, Czechoslovakia

John R. Gunson, Department of Lands and Forests, O. S. Longman Building, 6909 116th Street, Edmonton, Alberta, Canada

Dr. Roland Beschel of Queens University, Kingston, Ontario, has been reported as deceased.

## SHORT NOTES

## IMPROVED TOOLS FOR BAT BANDERS

Most bat banders have found banded bats suffering from some irritation, wing membrane puncture or tearing of the alar membrane (Bels 1952, Hitchcock 1957, Purchase and Hiscox 1960, Dwyer 1965). Many of these chronic irritations induce biting and chewing of the band so that it becomes overgrown with skin and connective tissue and sometimes bone as well (Hitchcock 1941, Trapido and Crow 1948, Cockrum 1956, Herreid et al. 1960, Perry and Beckett 1966). This necessitates expenditure of considerable time by the bander or anyone trying to remove this excess growth in order to read the band. In addition many bands are rendered illegible by the extensive chewing by the bat. Furthermore, the effects on the bat's flight ability or seasonal movements may influence survival rates and longevity of the banded cohort of the population. We are sure that all bat banders would like to see a reduction in this problem and welcome any suggestion for improvement. We should like to make three such suggestions.

1. Bat bands should be made from standardized hardened aluminum alloy providing uniform wear and loss rates. This problem has long plagued bird banders. The differential wear and band loss rates from one decade to another result from unknown variations in the metal from which bands are constructed. This

makes interpretation of long-term trends in population turnover rates and determination of maximum longevity either difficult or impossible. It seems reasonable that the U. S. Bureau of Standards could be asked to measure and pass judgment on the uniformity of the aluminum alloy before each contract is let by the USFWS for band construction. Present "lip type" bat bands are much too soft, and even the #2 size is so malleable that even an initial bite or two by the bat could cause closure, resulting in irritation and overgrowth.

2. Bat bands would best be supplied opened, with machine uniformity. But until then bat bands should be uniformly opened in order to make possible, and actually help assure, their proper closure. As Davis (1961) pointed out, an unevenly opened band cannot be closed evenly. Perhaps the greatest hazard in bat banding is the pinching of the skin of the alar membrane as first shown by Trapido and Crow (1948). This causes irritation and thereby induces chewing by the bat, often resulting in a tightening of the band and worsening of the condition until excess chewing may make the band illegible.

Smith (1964) illustrated a modified pliers for opening bat bands, but the type action of his pliers nearly assures that the bands will be opened unevenly.

Various methods for opening bat bands so that they may be prepared ahead of entering the cave have been proposed. Hitchcock (1941) was first to devise such a method, but it was very slow.

A more rapid scheme was designed by Beck (1961) who suggested pushing the bands onto a steel knitting needle. Later, Bell (1961) and Myers (1964) used an ice pick or modified probe onto which the band was forced. Both they and Davis (1961) saw the need for using an instrument with very gentle taper to prevent one side of the opened band from being wider than the other. We have examined many bands so opened and used such a tool ourselves, but it became apparent that any band opened on a tapered tool was likely to have one side slightly wider than the other. To correct this we have tried turning the opened band around and again pushing it onto the tapered opener. This does provide uniform opening but is a slow and tedious procedure.

We propose the universal use of a tool (Fig. 1) which can be simply and cheaply made and which will give absolutely correct and uniform opening of every band. It is made from a valve lifter (cost 75¢) by making two additions: (1) Brazing tips at right angles so that the movement causes parallel opening of the bands and (2) addition of a set screw permitting ready adjustment of the degree of opening, thus allowing one band opening tool to be used with several band sizes.

A similar tool with identical function is shown in Fig. 2. This was made from a cheap, light weight pair of Waldes Truarc retaining pliers available to federal employees from the GSA catalog. Heating of the tips permitted them to be bent at right angles after which the sides were ground down slightly to make them parallel as shown. A still finer tool can be made from 8.5 inch Craftsman snap-ring pliers by merely grinding down the tips and adding a set screw. These are sold by Sears Roebuck (9KT4735) for \$3.00.

We made tests of the speed of preparing bands with these opening devices and found that, without practice, a string of 100 bands can be opened in 9 minutes. As each band is opened it is strung on a 1/8 inch filler welding rod, 32 inches long (cost 5¢). Several may be stored and carried in an aluminum or plastic fishing rod case (cost \$1.50). Better still is a section of plastic pipe with plastic couplings fitted on both ends. This case is nearly indestructible and will float--a useful feature when bat colonies must be approached by canoe or wading in deep water.

3. Bat bands must be as carefully and uniformly closed as they are opened. This requires use of a tool. In their haste and devotion to mass banding too many banders have applied bands carelessly, inducing irritation, overgrowth or band chewing. We believe that all bat banders should be equipped with a proper band closing device as shown in Fig. 3 in order to do precision work and remove one more variable from their research.

Any long-nosed pliers can be adapted for this purpose by making three modifications: (1) Grind out a pocket to hold the band. Make this exactly 0.225 inch so that a #2 band when closed by it will be properly spaced so as to provide free movement on the forearm. (2) Insert or adjust a pin in the axis of the pliers so that a stop is provided preventing the pliers from opening farther than is necessary to accept the band that has been opened with the opening tool described above. (3) If pliers are not

available with a spring to keep them open this should be added as shown. A similar tool was suggested by Smith (1964) but it had no spring and made work much too slow. With our closing pliers each of us can band 190 bats per hour and we believe that all closures are perfect.

With the application of these three suggestions, we believe that bat banding can be elevated to the precision of bird banding and that the results obtained will then be more reliable and meaningful.

Banders not used to bothering with tools while banding will find pliers clumsy at first. But no trouble is too great to get a good job done. We recommend (at least for those working with small bats) that workers take their rabies shots, get rid of gloves while working and develop skill with the closing pliers. We believe our speed great enough for any banding operation. And the value of the extra time required for opening bands perfectly cannot be measured; it is time spent before entering the cave and is justified in order to do more precision work leading to more meaningful results.

William H. Elder and Wilbur J. Gunier, Department of Zoology, University of Missouri, Columbia, Missouri 65201.

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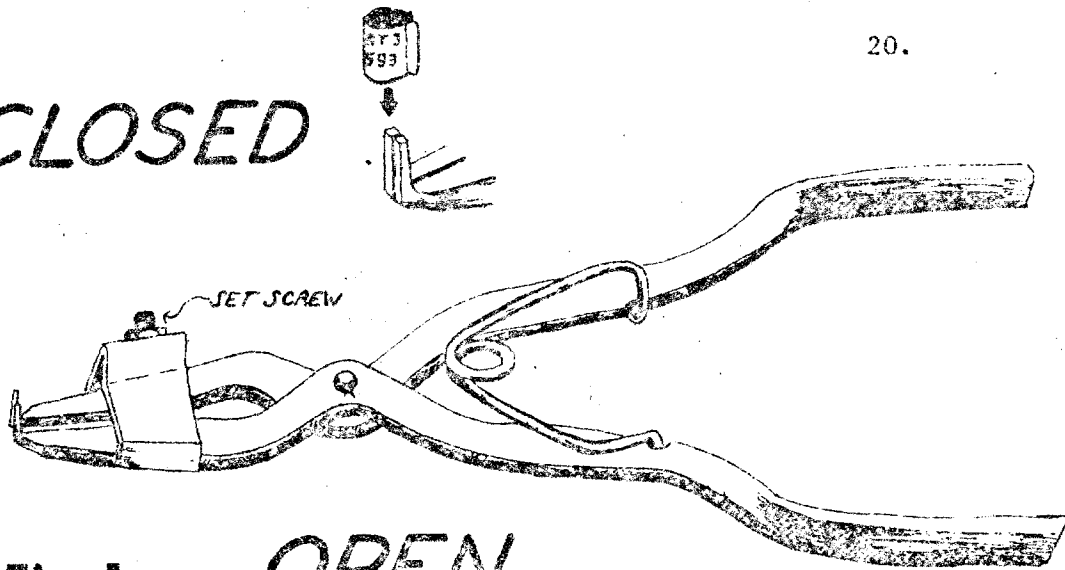
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#### ADAPTATIONS OF REFUGING FREETAILED BATS

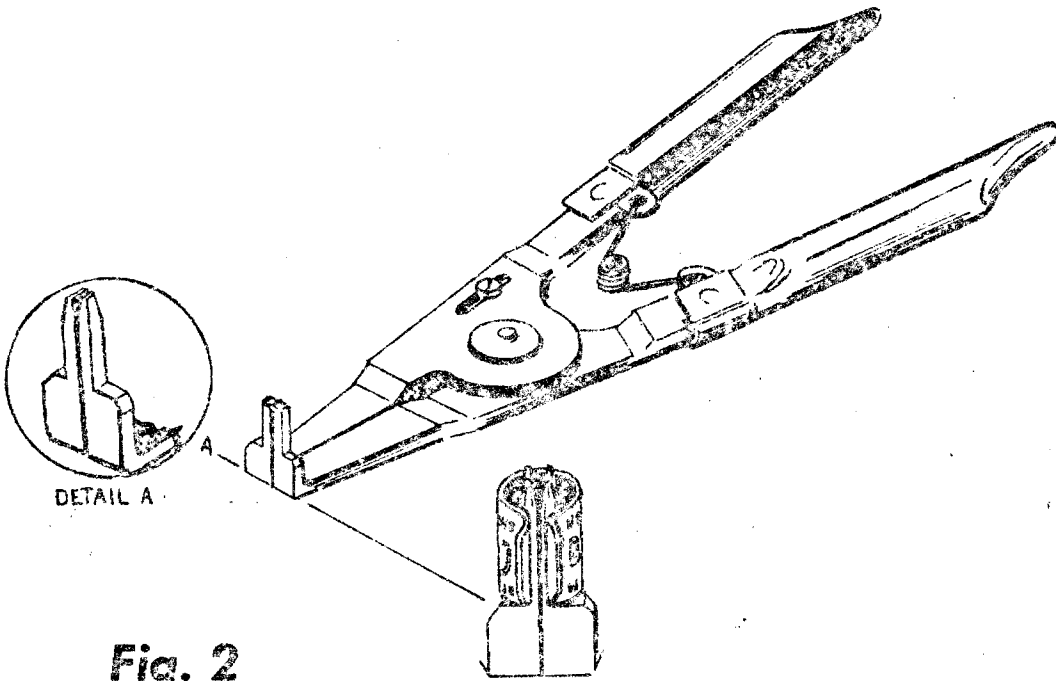
Hamilton and Watt (1970) recently reviewed characteristics of refuging animals, and Kunz (1971) has thoughtfully applied refuging theory to the cave bat, *Myotis vellifer*, and discussed refuging of bats in general. A well-known refuging species is the Mexican freetailed bat, *Tadarida brasiliensis mexicana*,

**CLOSED**



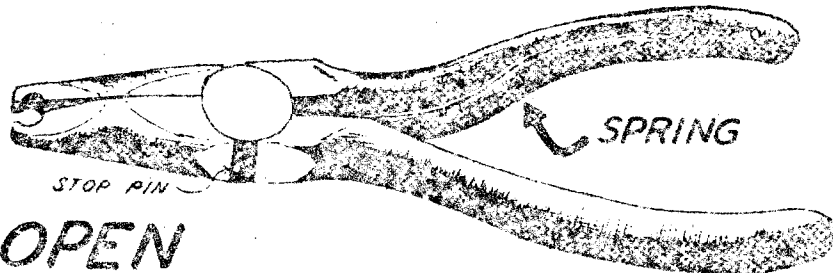
**Fig. 1**

**OPEN**



**Fig. 2**

**CLOSED**



**Fig. 3**

**OPEN**



which forms large nursery populations and disperses great distances to secure food. Several populations of 20 million adults and young are known; these apparently are the largest bat refuges in the world. This note reports some new behaviors exhibited by freetail and discusses adaptations that contribute to the species' refuging strategy. Observations were made at Vickery Cave, Major Co., Oklahoma and Stillwater, Payne Co., Oklahoma; 9X wide-angle binoculars assisted visual observations.

The freetail nursery at Vickery Cave is of moderate size, consisting of about 500,000 adult females or 1 million adults and young (Humphrey, 1971). During the warm season of 1969 I periodically observed the evening flight of these bats and noted the emergence behavior described by Allison (1937), Davis et al. (1962), and Herreid and Davis (1966). The bats often flew when considerable light was available for observation, particularly in August and September when volant young caused the population to peak. On several occasions the flight began when direct sunlight was still on the ground; the earliest flight began at 7:10 p.m. The bats flew horizontally in a continuous serpentine column for about 1000 m and then began to gain altitude and break up into groups. The groups continued to climb and soon disappeared from unaided sight. On all six occasions when binoculars were used I observed a peculiar behavior. The ascending groups climbed to an elevation estimated at 700 m; there they stopped climbing and resumed horizontal flight away from the cave, gliding instead of flapping. On nearly every summer evening in western Oklahoma there is a strong, steady, southerly wind resulting from the Bermuda High. The freetails used this wind to disperse from the cave area; only those going south flapped their wings steadily to make progress. Those going east and west glided with their bodies quartered into the wind and progressing sideways, flapping only to alter direction slightly. Bats flying north did not flap

at all. After several hundred thousand bats had exited, I could see an unbroken monolayer of freetail in any direction as far as binoculars allowed me to discern them. On 29 August I watched this behavior for 30 minutes and then drove east 4.8 km and north 12.9 km, stopping at intervals to scan the sky above. As I moved away from the high density of bats at the cave, the small groups of bats were again apparent. The groups ranged from a few hundred to 1,000 bats, were still in a monolayer at the same altitude, and from below appeared oval in shape, longer than wide. When I quit the chase to prepare for a flight count of another species, at a point 14.8 km from the cave entrance, several discrete groups had just passed overhead and continued to glide NNE. These observations expand knowledge of freetail group movement to include routine dispersal to feeding areas and document for the first time extensive use of gliding locomotion by a bat. It is probable that feeding areas can be located by careful following of groups.

On 19 March 1971 a torpid female and male freetail were found in a garage 13 km E of Stillwater. This apparently is the earliest spring record of freetail at this latitude in the Great Plains (Glass, 1959). At 6:00 am on 22 April 1971, 4 female freetails flew in an open dormitory window in Stillwater. Stillwater is in north-central Oklahoma, about 160 km E of the nearest freetail nursery site. On this date an atmospheric low pressure area was centered over northwestern Oklahoma and a line of violent storms occurred along a front extending through western Oklahoma and central Texas. On 28 April, at 12:30 am, another freetail entered the same window. Only one bat of the previous four was in the room, in a shoebox in a closet. If the new visitor had not witnessed the first visit, probably it was attracted to this transient roost by sound and not by sight or smell. These records illustrate the frequency with which "extra-limital" movements of freetails occur during migration, implicate weather patterns in their occurrence, and suggest that sound may be used in group establishment.

Hamilton and Watt (1970) emphasized that as the number of individuals in a refuging system increases a higher value is placed on complex communication systems and cooperative behavior patterns and a higher time and energy cost accrues from resource gathering. Freetails have a number of adaptations that enable their refuging system to function properly.

Freetails have colonized a roost habitat used by no other bat - the long, wide, flat ceilings of large caves. These sites are quite variable in temperature and humidity (Twente, 1956). Large populations may be able to use body heat and evaporative water loss to increase ambient temperature and humidity; certainly large occupied nurseries are very hot and humid. High nursery temperature reduces the need of each individual to maintain its own body temperature at all times and thus frees energy for gestation and growth. Possibly the daytime circling flight in caves (Twente, 1956; Davis et al., 1962) circulates air through the cave and brings in fresh air; this would prevent overheating, supply oxygen, and reduce concentrations of carbon dioxide and ammonia. Another cooperative behavior in nurseries deals with the difficulty of maintaining the mother-young bond among so many individuals. While other species care only for their own young, freetail mothers returning to the roost form a community food source by nursing any young (Davis et al., 1962). Weakening of the family bond has the seemingly maladaptive effect of eliminating the parental retrieval of fallen young; fallen young either crawl up the wall to the nursery cluster or die. The number of fallen young seems high but in fact is relatively low. Herreid (1967) found that about 13,000 nonvolant young dying in a cave amounted to only 1.3% of the young born there. Similarly the mortality attributable to predators drawn to the refuging freetails may be less significant than thought by Twente (1956). Such predation has not been quantified.

The importance of communication is indicated by the freetail's pervasive pattern of group movement. Freetails clearly move in groups when orientation is critical, as when artificially displaced (Davis et al., 1962) or when migrating (Davis et al., 1962; Constantine, 1967). They also move in groups in the vicinity of cave exits (Allison, 1937; Davis et al., 1962; Herreid and Davis, 1966) and when dispersing to feeding areas. Capture of two discrete, small groups of freetails in a mist net led Ross (1967) to conclude that the species feeds in groups. Group dispersal to forage may both aid orientation and increase the probability of finding insect swarms; for discussion of the advantages of group foraging see Morse (1971) and Schoener (1971). Davis et al., (1962) raised questions about the mode of communication used by freetail groups, but subsequent research has not resolved these questions. My observations implicate the use of sound in finding a new transient roost but may not extend to groups in flight. Suthers (1970) has indicated the probable importance of vision in bat orientation.

The use of gliding must greatly reduce the energetic cost of nightly dispersal to feeding areas. In some cases foraging grounds are thought to be as far as 97 km away from nurseries (Davis et al., 1962). Perhaps gliding permits dispersal to greater distances than does direct flight. If so, gliding places a larger food resource within reach of a refuge and increases the maximum population size attainable before time or energy expenditure makes further dispersal unprofitable. Application of refuging theory in this way assumes that freetails have encountered intraspecific competition for food in both current and evolutionary time. Such competition has not been demonstrated for any bat. Nonetheless, this line of reasoning satisfactorily explains our present understanding of the freetail refuging system.

The Mexican freetail thus possesses several characteristics to be expected of a refuging species - cooperative behavior patterns and some sort of communication system, plus a mechanism (gliding) for reducing the energetic cost of routine dispersal. Additional research, particularly on communication, modification of roost microclimate, and foraging behavior and dynamics, is needed to fully explicate the importance of these adaptations. Davis et al., (1962) argued that even the largest freetail populations are limited by roost space. If this is true it is ample proof of the success of this species' refuging strategy.

Stephen R. Humphrey, Florida State Museum, University of Florida,  
Gainesville, Florida 32601.

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#### MORE HERE AND THERE

JAMES HEDGES sent in a clipping from Changing Times of March 1972 in which the question of prevention of bats' roosting in attics is answered with the suggestions of using moth repellents and sealing all openings. It's good to see this instead of the frequent response that, "The best way to kill bats is..." Jim also sent a page from the February 1972 Organic Gardening and Farming magazine in which a woman from Texas writes that bats should not be touched due to the danger of rabies, but then overstates the case with the statement that bats spread rabies by biting wild animals such as squirrels, opossums, raccoons, foxes, badgers, etc., also attacking cows, horses and domestic animals such as dogs and cats.

LARRY WATKINS, recently returned from duties at the Organization for Tropical Studies in Costa Rica, has taken over the recent literature section of Bat Research News, beginning with this issue. We discussed this at an American Society of Mammalogists meeting and then Larry indicated a willingness to take it at the Albuquerque meeting last November; it is a major job in itself for anyone. Reprints of your papers are solicited to be sent to Larry.

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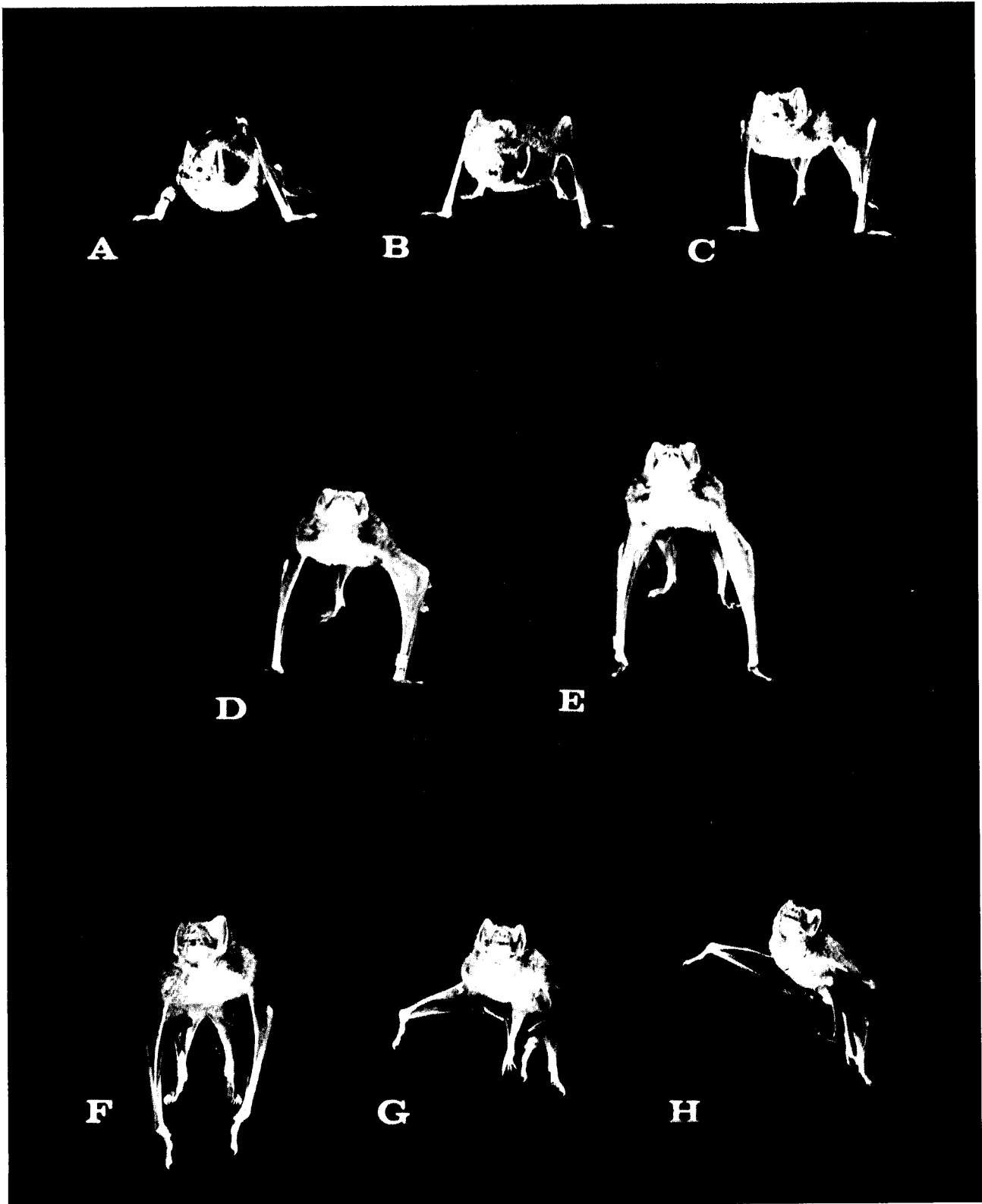
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reprints to ↓ for BRN

Compiled by Larry C. Watkins, Museum of Natural History, University of Kansas, Lawrence 66044. 26 May 1972.

( — denotes previous listing in BRN)

Larry whipped up this recent literature section at a moment's notice, and we both have much more in piles, so the next issue's recent literature section should be massive and quite up-to-date. Having this section of BRN completely up-to-date should enhance the value of BRN considerably, and the best way to ensure this is to have subscribers and other bat research workers send in reprints of their papers as soon as they get them. While I would still like very much to receive such reprints, I earnestly solicit your help in providing Larry with your recent papers (note his address above). I have been sent many reprints which have not yet been listed in BRN; with Larry handling this section, I can assure you that such papers will be listed in the following issue of BRN.



## THE COVER

The cover photograph sequence is that of Desmodus rotundus jumping, at 1/15,000 second exposure, taken by Dr. J. Scott Altenbach of the Department of Microbiology, Colorado State University, Fort Collins, Colorado. It was photographs such as these which ensured an appreciative audience at his presentation on the mechanisms of jumping and initial flight in the common vampire bat at the American Society of Mammalogists annual meeting in 1971, held in Vancouver, British Columbia.

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Bat Research News appears quarterly: January, April, July, and October. The subscription rate is \$2.00 for two years. Address all correspondence to Robert L. Martin, Department of Biology, Preble Hall, University of Maine, Farmington, Maine 04938, U.S.A.

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## EDITOR'S NOTE

In recently sending out notices of overdue subscription fees, after having been generous enough to extend the subscriptions of those who had not kept up in their fees, I found that many recipients of this notice were quite taken aback at the information of their apparent delinquency. When subscriptions expire, I have in the past placed a red-printed notice of such expiration in the issue, but have not attached the notice to the issue. This slip has been obviously subject to being overlooked or even lost, and I apologize for not having been aware of this possibility; in the future, I will take the time to attach the notice to the January issue of expiration. With over 30 letters a week, on the average, concerning bat research, I admit to having taken short-cuts such as not attaching the notices, but I've learned my lesson. If any issue reaches you in poor condition, please drop me a note requesting a replacement, which I will happily provide free of charge.

## HERE AND THERE

G. A. CASEY writes that, with a co-worker, W. A. WEBSTER, he has been doing some work on the intestinal parasites of bats which are submitted to the laboratory for rabies testing, and they are in the process of preparing a manuscript on some of their findings.

JAMES HEDGES sent a newspaper clipping from The Evening Star of Washington, D.C. of May 3, 1972, reporting a rabid bat killed in the Hyattsville area, the first case of rabies reported in Prince Georges County, Maryland, since 1970. The bat was killed with a shovel by a woman who observed it acting peculiarly in her backyard. Quote: "The health department plans to check if there is a colony of bats in the area." An Associated Press wire release I picked up and which Jim also sent along reports that in March at Worcester, Massachusetts, during a concert by pianist Richard Casper, a bat accompanied his rendition of a Beethoven sonata, but did not accompany him when he went on to a piece by Chopin. I prefer Beethoven myself, bat.

PHILIP J. SPEAK, Director of Technical Research of the National Pest Control Association, writes that the association still has interest in the subject of bat control with sound, but inquiry so far has failed to yield information that bats are repelled by high frequency sound, other than the report by Hill mentioned in earlier BRN notes.

B. V. PETERSON of the Diptera Section, Entomology Research Institute, Ottawa, Ontario, K1A 0C6, is currently working on two large papers on the bat

flies of Cuba and the West Indies, and would like to see specimens from these regions if any readers of BRN has such in their possession.

New subscribers and addresses:

- David W. Beebe, D.D.S., 109 East Way, Canillus, New York 13031
- John F. Douglass, Lowell House, Harvard College, Cambridge, Massachusetts 02138
- Dr. F. Dusbábek, Czechoslovak Academy of Sciences, Institute of Parasitology, Prague 6, Flemingovo Nám. 2, Czechoslovakia
- A. L. Gardner, Drawer MU, Louisiana State University, Baton Rouge, Louisiana 70803
- Robert A. Gonya, 68 Connecticut Avenue, Millinocket, Maine 04462
- John R. Gunson, Alberta Department of Lands and Forests, O. S. Longman Building, 6909 - 116th Street, Edmonton, Alberta, Canada
- Henry Hilton, Weld, Maine 04285
- Robert A. Joy, R.F.D. 1, Canaan, Maine 04924
- Dr. Jiří Krátký, Museum of Šumava Mts., Kašperské Hory, Klatovy district, Czechoslovakia
- Lee W. McGeorge, Department of Zoology, Duke University, Durham, North Carolina 27706
- Julie L. Moore, Librarian, Biological Information Service, 3050 West 7th Street, Room 102, Los Angeles, California 90005
- Nick Noe, Secretary, Central Indiana Grotto, P.O. Box 153, Indianapolis, Indiana 46206
- William L. Overal, Department of Entomology, The University of Kansas, Lawrence, Kansas 66044
- Jesús H. Pérez R., Director, Asociacion de Estudiantes de Ciencias "Luis Pasteur", Caracas, Venezuela - Apartado de Correos No. 14.191 Caracas 101
- Richard Pitcher, 57 Amberley Gardens, Stoneleigh, Epsom, Surrey, England
- Mark Pokras, Apartment 39A, Glendale Manor, Pleasantville, New Jersey 08232
- Charles Seymour III, 413 East 71st, Apartment 4, New York, New York 10021
- Sharon E. Stedman, R.F.D. 1, Hartland, Maine 04943
- John N. Stallone, 3711 Arnold Avenue, San Diego, California 92104
- Lloyd R. Wingate, Department of Zoology, University of Natal, P.O. Box 375, Pietermaritzburg, South Africa
- The University Librarian, Smt. Hansa Mehta Library (University Library), M.S. University of Baroda, Station Road, Baroda 2, India
- Winthrop U. Ford, Jr., 656 Holly Circle, Aberdeen, Maryland 21001

Changes of address:

- Gary Banowetz, 944 S.W. 11th Street, Apartment 2, Corvallis, Oregon 97330
- Kunwar Bhatnagar, Ph.D., University of Louisville, Health Sciences Center, School of Medicine, Department of Anatomy, Louisville, Kentucky 40202
- Owen D. Buck, Box 154, Westminster, Vermont 05158
- Thomas R. Cowland, Gerrish Island, Kittery Point, Maine 03905
- Dr. David A. Easterla, Department of Biology, Northwest Missouri State University, Maryville, Missouri 64468



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Compiled by Larry C. Watkins, Museum of Natural History, The University of Kansas, Lawrence, Kansas 66044.

#### MORE HERE AND THERE

The recent literature survey by LARRY WATKINS is so great in volume, I will leave the majority of further research news until the October issue. It is nice to have such a complete coverage of the literature as Larry is now carrying out.

#### More address changes:

Dr. Carl H. Ernst, Department of Biology, George Mason University, Fairfax, Virginia 22030

William G. Ewing, King Ranch, Route 2, Box 14A, Sapello, New Mexico 87745

George G. Harrington, 1626 South Elwood Avenue, Apartment L-20, Tulsa, Oklahoma 74119

Delbert L. Kilgore, Jr., Department of Zoology, Duke University, Durham, North Carolina 27706

Dr. Matthew J. Kluger, Department of Physiology, University of Michigan Medical School, Ann Arbor, Michigan 48104

Carol L. Koenig, 403E - E Bayett, College Station, Texas 77840

Thomas W. Landrum, P.O. Box 63-, Muscatatuck National Wildlife Refuge, Seymour, Indiana 47274

Anthony W. Lewis, Mountain View College, Malaybalay, Bukidnon, Philippines

V. Rick McDaniel, Division of Biological Sciences, Arkansas State University, State University, Arkansas 72467

Dr. C. J. Marinkelle, Director, Microbiological and Parasitological Centre (M.P.C.), c/o Embajada de los Paises Bajos, Apartado Aereo 4385, Bogota, Colombia

Bernd Martens, 908 Pensdale Crescent S.E., Calgary 23, Alberta, Canada

Dr. Robert A. Martin, Department of Biology, Fairleigh Dickinson University, Madison, New Jersey 07940

Richard S. Mills, c/o Post Office, College Corner, Ohio 45003

Dr. George R. Mount, Mountain View College, 4849 West Illinois, Dallas, Texas 75211

Gerald S. A. Perez, Director, Land Management, Government of Guam, Agana, Guam 96910

Dr. Robert O. Ramsden, R.R. #5, Rockwood, Ontario, Canada

Dr. John J. Rasweiler IV, College of Physicians and Surgeons of Columbia University, 630 West 168th Street, New York, New York 10032

Dr. James A. Simmons, Department of Psychology, Washington University, St. Louis, Missouri 63130



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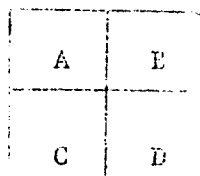
Errata for Bat Research News, Vol. 13, No. 4.

- p. 60: 21 lines up from bottom of page, "benevolence"  
7 lines up from bottom of page, "Thailand"
- p. 62: 10 lines down from top of page, "Jiri"  
15 lines down from top of page, "unused"  
26 lines down from top of page, "information"
- p. 63: 3 lines up from bottom of page, "corner"  
3 lines up from bottom of page, "suggests"  
2 lines up from bottom of page, "had"
- p. 64: 3rd paragraph down, "tongue"
- p. 67: 4th reference down, "Gardner"
- p. 71: 3rd reference down, "ochrogaster"

Sorry for the above typographical errors; at least none of them could be considered misleading. Have reprimanded my typewriter, and it will do a better job next time. - R.L.M.

## THE COVER

The cover photos by Donna Howell and Norman Hodgkins are described in the note on the tongues of nectar-feeding bats



in this issue. The magnifications are

20X for photo "A", 100X for photo "B",

200X for photo "C", and 1000X for photo "D".

The 20X photo is approximately the anterior half of the bat's tongue. The tongue is from Leptonycteris sanborni.

Jim Simmons read Donna's paper on physiological adaptations of bat pollinators and their hosts at the Third International Bat Research Conference in Yugoslavia this September, including these photos. The increase in surface area is rather dramatic in spite of the small size of the papillae; studies of ciliary structures in olfactory and respiratory areas by P. P. C. Graziadei of Florida State University indicate that increase in bare receptor surface may possibly be the only function of cilia in olfactory mucosa. His photos (non-bat) are shown in the May 1972 issue of The Sciences, 12(4): 14-15. It's all a far cry from the gross anatomy of the past, and I can almost see a Stereoscan edition of F. A. Benedict's 1957 classic, "Hair structure as a generic character in bats" (U. Calif. Pub. Zool., 59(8): 285-548.)!

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Bat Research News appears quarterly: January, April, July, and October. The subscription rate is \$2.00 for two years. Address all correspondence to Robert L. Martin, Department of Biology, Preble Hall, University of Maine, Farmington, Maine 04933, U.S.A.

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## HERE AND THERE

With this issue I am including some material on the origin of the use of the bat as the registered trademark of Bacardi. It's such a well-written booklet, and rather good image-producing for bats, I decided to see if I could obtain a copy for each subscriber, the enclosure attests to my success and the benevolence of the Bacardi Imports, Inc. I am not trying to advertise for them, but think the booklet good enough advertising for bats to offset any criticism that might be directed at me for indicating approval of Bacardi rum (though I'll be happy to drink to that criticism, too).

A. W. GUSTAFSON writes: "On behalf of Dr. W. A. Wimsatt and myself, I would greatly appreciate your making note ...that we are marking bats by means of "punch-marking" the left wing (Donaccorso, F. J. and N. Smythe. 1972. Punch-marking bats, an alternative to banding. J. Mamm., 53(2): 389-390). The codes we are using are AWG1, AWG2, etc. and WAW1, WAW2, etc. Reports of finding any of these marked bats can be made to either of us at the following address: Section of Gen., Dev. and Physiology, Plant Science Building, Cornell University, Ithaca, New York 14850.

In this country, the British Museum (Natural History) Bulletin, Zoology, No. 6, Bats from Thailand and Cambodia, by J. E. Hill and Kitti Thonglongya, issues March 29, 1972, pp. 173-196, is available from Pendragon House Inc., 899, Broadway Avenue, Redwood City, California 94063, for \$4.00 U.S.

ROLLIN BAKER writes that in August he and Cornelia Sanchez Hernández, biologist for the Instituto de Biología of the Universidad Nacional Autónoma de México, banded a large number of fruit bats at the Estación Chamela, six kilometers east of Chamela in coastal Jalisco, Mexico, hoping to continue the program for two more

summers.

The Biosciences Information Service of Biological Abstracts has notified me that they believe that reports from Bat Research News should be made available internationally to bioscientists and are including it in their world-wide coverage. Thus materials included in BRN will be abstracted and indexed. Since BRN is not refereed, and since I have no intention of changing BRN into a "Journal of Chiroptology", though such might be needed, it is up to the writers of notes for inclusion in BRN to make the choice for themselves as to whether or not to consider such notes as "publications". Elery Hamilton-Smith, of Australian Bat Research News, feels that the regional newsletter fills a definite need, and I agree, but also wish to fill an international need as well. Should enough bat research workers decide that a journal devoted entirely to chiropteran studies should be brought into existence, I hope and expect that the newsletter form of BRN will still fill a much-needed role in communication, and that it will continue.

HARRY H. GOEHRING has officially retired, but not before publishing his 20 years of study of Eptesicus fuscus in Minnesota in the Journal of Mammalogy, with an eight-page article on "Minnesota Bats" for The Minnesota Volunteer of July-August 1971. It is good to see such articles in the popular conservation literature, and a rather nice gesture on Dr. Goehring's part. If you see a 28 foot Airstream trailer whipping by you, you may be seeing the passing of another of the "good bat guys".

RICHARD K. LAVAL sent me some information on the use of the modified harp trap (sold by John Farney) as displayed at the Albuquerque bat research meeting, and after talking with him at the Tampa American Society of Mammalogists meeting in June, wrote the following for note here: "This winter I had the opportunity to spend a couple of weeks testing the modified harp trap on Barro Colorado Island, Panama. I erected the trap in a variety of locations, mainly over water and over trails at ground level. I usually set nets nearby for comparative purposes. The trap proved disappointing. At low wire tension settings it caught small bats, mostly emballonurids and vespertilionids, in low numbers. Saccopteryx leptura, Rhynchonycteris, and Myotis were pleasant surprises. At high wire tensions it caught nothing. However, figs in the bag indicated that fruit bats had hit the wires, dropped their fruit, and escaped. Bats caught in nets and placed in the bag were unable to escape, however, so it seemed evident that the phyllostomatids just weren't getting caught. Finally I placed it in front of a culvert housing a thousand or so Pteronotus parnellii, a fair-sized bat. At first they flew through or bounced off, but when I increased the tension to its maximum, I began to catch large numbers. Still, many escaped by wedging themselves between the wires of the two frames and crawling out.

"Although I question the ability of the trap to capture bats of all sizes at any single wire tension setting, I think it will prove very useful anyplace where bats are concentrated, but, as now constructed, will bias the sample in favor of small bats. Changing tensions, wire spacing, and spacing between the two frames all will have an effect on kinds and numbers of bats caught, and further experimentation is needed.

"Above-ground sampling is quite feasible, wherever bats are flying in large numbers, as in fruiting trees or natural flyways of various kinds. I understand Tom Keyse has had much better success than I, in Costa Rica, and that he has been hoisting the traps into trees. It appears that the trap should and will become a standard tool for bat studies both in the tropics and elsewhere, in spite of its shortcomings. One of the drawbacks of the trap is its size and shape, making it impractical to carry very far for one person. I put wheels on mine, drilling holes for a small axle through the tubes to which the telescoping legs are attached, and attaching small, easily removable wheels (bicycle or tricycle will do).

"Among the many Toniata sylvicola and T. bidens netted, one sylvicola was kept captive for about 8 days. During this period she averaged one Anolis limnifrons and 2 or 3 very large katydids nightly. An injured hummingbird placed in the cage was killed and partly eaten, but fruit was refused, as were smaller bats placed in the cage at intervals. Finally the bat died, for no obvious reason. Also, a Micronycteris hirsuta was netted carrying a 3-inch grasshopper, which is in agreement with the findings of Don Wilson (Mammalia, 35:107-110). Have you ever noticed that all the species which are known to capture non-flying insects and invertebrates, or terrestrial and arboreal vertebrates, have enlarged ears?"

Jiri Gaisler and I would like to try out this modified harp trap in a study to measure relative population densities in cave bats in Czechoslovakia where it is difficult if not impossible to utilize other methods (such as photographic). By the time my students arrived this fall to play with my modified harp trap (from John Farney's production line), I was already off to Yugoslavia, so it sits in an unusual condition, awaiting trials on temperate bats at a later date. Or maybe on intemperate bats, if I don't capitalize Temperate.

FRED LOHRER of the Archbold Biological Station wrote Larry Watkins as follows: "The enclosed Xerox pages are from Eastern Bird Banding Association News. The banding pliers (advertised as long nose pliers with openers and holes to fit band sizes, one for sizes 0, 1, 1A and 1B, and one for soft and hard 2 and 3 bands at \$6.50), are not inexpensive, but they do the job well and bands can be opened almost any way and will be shut well. At the Tortugas where thousands of Sooty Terns are banded every year the bands used the year I went were 1/2 opened on plastic tubing - just strip them off and clamp them on. Just don't swallow them in your excitement! William B. Robertson, Everglades National Park, Homestead, Florida, orders the bands. Hope this info is of some use." If anyone is interested and does not get the EBBA News, I will forward the advertisement mentioned, as I get it regularly - R.L.M.

A rabid bat tried to alight on some chickens in Oakfield, Maine, in August of this year, bounced off a dog, and then aimed itself at the farmer. The local game warden gave a good rational report to the newspapers on not handling wild animals, with little fanfare other than the newspaper headline which proclaimed: "Bats Attack Chickens, One Found To Be Rabid", although there was only one bat involved. Robert Redford, of theatre fame, recently underwent rabies treatment because of having been bitten by a bat. The American Rifleman, in an article entitled "Important Facts About Rabies" (October 1972 issue) notes the danger from bats, but does not overemphasize the incidence of rabies in bats.

The Flittermouse Grotto has been chartered in North Carolina. According to the Met Grotto News, they wanted to call themselves the Bat Cave Grotto, but that name was already in use. I note in the Chouteau Grotto's publication, Foresight, that at one of their meetings in 1972 their chairman reminded everyone that bats are not as numerous as they used to be and that precautions should be taken to preserve them. Even with the entire number 2 of volume 34 of the Bulletin of the National Speleological Society (April 1972) dedicated to the AAAS symposium of last December, moderated by ROBERT HENSHAW, this is a good indication of the normal continuing concern many grottoes have at the local level, and such reminders are well in order.

In "A Natural History of Unnatural Things", by Daniel Cohen, McCall Publishing Co., New York, 1971, 148 pp., page 55 shows "A nineteenth century engraving of a vampire bat" - in the credit listing, it is listed as being from the New York Public Library Picture Collection - with a full uropatagium and tail and a single large nose spear, do I see a nineteenth century omen that the "family"

Desmodontidae being considered as a subgroup of the phyllostomatids is already in the works?

Dr. Mickel ANCIAUX de FAVEUX has two works available, as follows; edition limited to 100 copies:

1) REPARTITION BIOGEOGRAPHIQUE ET CYCLES ANNUELS DE CHIROPTERES D'AFRIQUE CENTRALE. (2 volumes, 464 pages, tables, figures and maps). Price \$20. Contents: Essay on origin of populations in Africa; ecological localization of the bats in Katanga and Rwanda, analysis of the elements of environment, lethargy; annual breeding cycles in the monoestrian and polyestrian Chiroptera, agents of breeding; social life of the Chiroptera of Katanga and Rwanda; bibliography of 441 references.

2) PARASITOLOGIE DES CHIROPTERES DU CONTINENT AFRICAIN. (1 volume, 282 pages, maps). Price \$10. Contents: Study of microorganisms (fungi, bacteria, viruses, rickettsiae, spirochaetes), protozoa (Zooflagellata and Sporozoa), helminths (trematodes, cestodes, nematodes), insects (Hemiptera, Siphonaptera, Diptera), Pentastomida and Arachnida (pseudoscorpions, Acarina). Most of this study is about Africa south of the Sahara (Ethiopian region). Parasites are filed according to hosts and refuges, with regard to ecology. Critical analysis based on three themes: parasites and taxonomy, parasites and ecology, parasites and zoogeography. Bibliography of 613 references.

Order from Dr. Michel ANCIAUX de FAVEAUX, Avenue de l'Hippodrome 1, B - 1050 Bruxelles, Belgium; payment through Banque Belgoise, Account no. 445.6619 of Michel ANCIAUX de FAVEAUX, Cantersteen 1, B - 1000 Bruxelles.

Scala International magazine for March 1972 has an article on ultrasonic diagnosis in medicine which introduces the subject by explaining bat echolocation, with a double-page photo of a flying bat.

KUNWAR BHATNAGAR, dissertation completed on olfaction in bats - behavioral, anatomical and electroencephalographic investigations, is now at the School of Medicine at the University of Louisville (Kentucky). I found the abstract of his dissertation most interesting, and I look forward to seeing some of his conclusions published in the literature, especially with regard to the taxonomic and evolutionary trends indicated.

EDITH G. BRAGG (Idaho State University, Pocatello) is doing research on the movements and physiology of Plecotus townsendii, Eptesicus fuscus, Myotis leibii, M. californicus, and M. volans in abandoned mine tunnels and desert lava tubes in southeastern Idaho. She has color banded more than 250 Plecotus and 50 Eptesicus with celluloid bands. She has found four male Plecotus 70 miles from where they were banded in the desert. She is interested in knowing if there is anyone else in the area using color banding or who might have found any of her banded bats. The main concentration of bats with which she is working at present is in Lava Hot Springs, Idaho, but she plans to work with bats in any mine or lava tubes within a 100-150 mile radius since it appears that there are no other studies in the area.

and

In "Gravestones of Early New England/the Men Who Made Them", by H. M. Forbes, Da Capo Press, New York, 1967, 141 pp., the following may be of passing interest: opposite page 117 is an illustration of the gravestone of Susanna Jayne, wife of the Marblehead (Massachusetts) schoolmaster, 1776, with a figure of "Death" with a bat under each corner, which the author suggests signifies "the evil of the world which by Death has been conquered...". Bats has a poor image in those days, too! Thank you, Bacardi, for trying to change all that!

SHORT NOTE

## Adaptive Morphology of the Tongue of Nectar-feeding Bats

It seems advantageous for a small mammal with a high metabolic rate to ingest food in as efficient a manner as possible. The critical foods for the glossophagine bats, and probably the macroglossines as well, are nectar and pollen. Pollen is the only reliable source of protein for Leptonycteris and most of the other glossophagines. The bats do not eat anthers or pollen directly from the plant; they pick up a heavy coating on the fur and clean it off later, ingesting it at that time. The stomach contents may be as high as 25 per cent pollen. The highly divergent, coronal scales of the hairs of nectar-feeding bats are in contrast with the smoother scales of most bats not associated with plants.

A number of authors have noted the length of the tongue in flower-feeding bats and have noted that the tip bears filiform papillae (Park and Hall, 1951; Villa, 1966; Van der Pijl, 1969). Most authors state that these papillae are directed posteriorly, although Cockrum and Hayward (1962) state that the tongue "...is covered with a series of forward-projecting bristle-like papillae...". Stereoscan photographs of the tip of the tongue in Leptonycteris are shown on the cover. Anterior in each photograph is to the left. Magnifications range from 20X to 1000X. The lower photographs are of the medial portion of the tongue which appears smooth to the unaided eye.

The tongue attaches to the posterior sternum (Hall and Kelson, 1959) and is highly extensible; the total length of the tongue may be one-third of the body length of the bat. Only the antero-lateral portion of the tongue bears the ridges of conical papillae. These ridges are 0.5 mm wide and extend from the tip of the tongue posteriorly for 10 mm. The conical papillae average 0.90 mm in length (height) and 0.07 in width at the base. These conservative figures allow space for 2002 papillae of this elongate type on the tongue. Each cone is calculated to have a surface area of 0.09904 mm<sup>2</sup>. The tongue surface area derived from 2002 cones is then 200 mm<sup>2</sup>. These lateral filiform ridges account for only a part of the total tongue surface; as can be seen from the lower cover photographs, the remainder of the tongue is not smooth.

This anatomical modification, which is paralleled in the Old World macroglossines, allows bats to ingest much nectar in a short time. The surface area calculation must be considered with the length of the entire tongue, the number and closeness of the filiform papillae whose closeness adds a trapping action as well as providing large area, and the fact that the remaining portion of the tongue is somewhat rough, aiding further in nectar uptake.

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----- Donna J. Howell, Auditory Research Laboratories, Princeton University, Princeton, New Jersey 08540, and Norman Hodgkins, Micrographics, Newport Beach, California 92660.

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(Just noted several typographical errors I made on earlier pages - I did better at late night typing as a graduate student! Sorry - R.L.M.)

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Compiled by Larry C. Watkins, Museum of Natural History, The University of Kansas, Lawrence, 66044.

(The above listing was cut short by the inability to reproduce the typed sheets Larry provided in time to have the entire coverage in this issue, so the remainder will be in the January issue, along with news of the Third International Bat Research Conference (Yugoslavia) and the Third North American Conference on Bat Research (San Diego). There is a great deal to report on in the line of international bat protection, and I have already started the January issue on this subject.

SEASON'S GREETINGS

from

Bat Research News