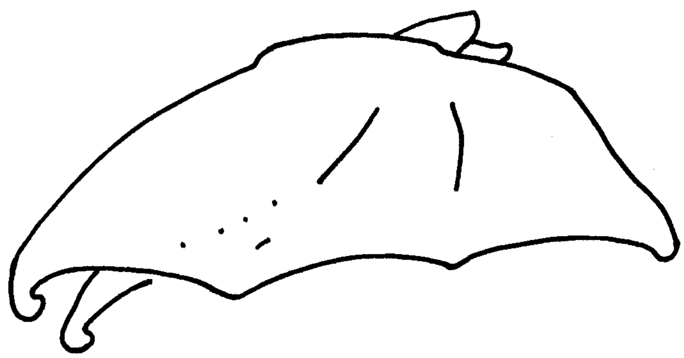
BAT RESEARCH NEWS



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EDITORIAL

Welcome to Volume 20, number 1. In this issue we have the second article on bats which I solicited, namely that dealing with radiotelemetry and bats. I hope that the information therein will be valuable to people who are thinking about putting radio tags on bats, and are not too sure just where to begin. I am still waiting on some articles which I had solicited, and will include them as they appear.

The Recent Literature Section is much longer than usual this time, a function of the help offered by a number of colleagues (Kunwar Bhatnagar, Jackie Belwood, Eleanor Fenton, Robert Barclay, Harlan Walley), and in no small measure to the thoughtfulness of Pat Brown who sent a copy of the computer print-out of a literature survey.

Your response to the In Press section is so overwhelming that it isobvious that I have been wasting my time on it; therefore I have scrubbed it from this issue.

We have been experiencing some production problems which seem to have run their course with Volume 19. We hope that they have finished with Volume 19. One difficult aspect is including a complete list of subscribers. Roy and I have been trying to do this for several issues, but the computer print-out,at present, is not compatible with the printing process and to duplicate the print-out directly would waste a great deal of space. We have not seriously considered typing the entire list for certain financial reasons.

Let us hope that 20 years from now that Volume 40 is in production.

We are forced by the costs which we face, to raise the subscription rate to $5.00per year, payable to Dr. G.R. Horst, Department of Biology, State University College, Potsdam, New York 13676, in U.S. $$$.

NEWS

Tom Kunz (Department of Biology, Boston University, Boston, MA 02215) wrote and pointed out that **Nyctalus,** formerly an East German Newsletter about bats, has metamorphosed into a legitimate publication dealing with bats. Volume 1 appeared in 1978. Persons wishing to submit manuscripts should address them to Dipl.-Landw. Joachim Haensel, Tierpark Berlin, DDR-1136 Berlin, Am. Tierpark 125.

Walter R. Gusciora, is a Principal Biologist with the State of New Jersey Department of Health (Division of Community Health Services, Consumer Health Services, 1911 Princeton Avenue, Trenton, N.J. 08648) sent a piece from the DAILY NEWS (New York's Picture Newspaper) dated 22 February 1978. This dealt with the heroic actions of the people in a Savannah Georgia High School in dealing with some bats which they managed to kill. Walter and a number of others felt that this really epitomized the wrong sort of public attitude towards bats.

Jorge Luiz Berger Albuquerque (90.000 Pracinha Joao Moreir Albeeto, 288, Porto Alegre, Rio Grande do Sul, Brasil) has written to say that he is studying Peregrine Falcons in Porto Alegre City. The Falcons winter there and in the evening hunt bats, mainly molossids, around the city. He would welcome anyone with information about raptors preying on bats.

The NSS Bat Subcommittee's newsletter (**Night Flyer**) is still operational and I recently received number 1 of Volume 2.

Rane L. Curl (Professor, Chemical Engineering, University of Michigan, Ann Arbor, Michigan 48109), a caver who has become interested in bats, has been trying to influence the Michigan Department of Natural Resources to provide some legal protection for bats. That appears to be an ongoing and uphill endeavor.

G.E. Cosgrove (Pathology Department, Zoological Society of San Diego, P.O. Box 551, San Diego, California 92112) has pointed out that there is a considerable section on bats in the new book **Zoo and Wild Animal Medicine**, edited by M.E. Fowler, W.B. Saunders Co., Philadelphia, 1978. The section editor for the bat material is D. G. Constantine, who has also provided the introduction, while R.E. Carpenter presented information on Old World Insectivorous bats.

Arthur DiSalvo (President, Association of State and Territorial Public Helath Laboratory Directors, Bureau of Labs, S.C. Department of Health and Environmental Control, Columbia, SC 29201) has provided some information about rabies. According to him, in 1977 there were 3,182 cases of animal rabies reported in the United States, with skunks representing 51% of these cases, and bats 20%. The ASTPHLD devoted a section of the programme of their 1978 Annual Meeting to a discussion of the role of bats in disseminating rabies, and the speakers included A. Greenhall, K. Girard, E.F. Baker. The ASTPHLD appears to recommend application of pesticides only on occasions where there is no other means of control.

Dan Bennack (The Museum, Michigan State University, East Lansing, Michigan 48824) is a graduate student working with Rollin H. Baker. He plans to study different aspects of the bat community and its ecology in the vicinity of Santa Cruz, Bolivia. He plans to be in Bolivia in the latter part of the summer of 1979, and would welcome an opportunity to work with other bat people who might be in the area.

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NATURAL DESTRUCTION OF KAOLIN MINE BAT ROOSTS IN TANZANIA

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Abandoned mines are attractive diurnal roosts for bats in Africa and elsewhere (Rosevear 1965; Brosset 1966), and an area in the Pugu Hills near Kisarawe, Kisarawe District, Coast Region, Tanzania is the site of a number of abandoned kaolin mines (6° 53'S; 39° 05'E; Cilek 1977) which were operated from 1941 to 1949 (Mine A) and which serve as roosts for several species of bats **(Rousettus angolensis, Nycteris thebaica, Hipposideros ruber ruber, Triaenops persicus afer,** and **Rhinolophus landeri lobatus).** Mine A is also the type locality for a number of species of invertebrates (Khalil 1975; Benoit 1978).

Since 1971 I have studied (Howell 1976; 1977) the reproductive cycles of **H. ruber, T. persicus** and **N. thebiaca** in Mine A, which contained, until recently, an estimated 500,000 **H. ruber,** 172,000 **T. persicus,** and 300 **N. thebeaca.** However, in August 1978 when I visited the location, I found that the main entrance to Mine A had been closed by the local residents after heavy rains, presumably in April 1978, had caused part of the mine to collapse. I entered the mine through another entrance and found that conditions therein had been drastically altered by the collapse which had sealed off the tunnel of the main entrance.

Before the collapse, air circulation in the mine had been good in all but one dead-end section, and the guano in areas of good circulation had been dry and powdery. Relative humidity before the collapse varied from 75-80% in areas with good circulation, to 90% in the dead-end section. Since the collapse of the main tunnel, air circulation had obviously decreased, and the bat guano was now moist and sticky. The humidity, which was not measured precisely, was much higher than it had been before the collapse.

Coincident with altered microclimatic conditions, the numbers of **H. ruber** have drastically declined, and **T. persicus** which had previously been found only in the dead-end sections, now occupied the areas formerly only used by **H. ruber.** There was no concurrent increase in **H. ruber** in other parts of the mine. Furthermore, an adjacent mine, Mine B, which had not collapsed, had not been occupied by **H. ruber.** In fact, this location only harboured the population (8-12) of **Rousettus angolensis** which had been resident there since 1971.

A third mine, Mine C, also closed in 1978 after collapses due to heavy rains, had been regularly occupied by three species **(H. ruber, N. thebaica,** and **R. landeri)**, and all of the entrances to this site appear to have been sealed by collapses.

It is possible that some of the bats which had roosted in the now collapsed mines may roost elsewhere, particularly in the adjacent Pugu Forest Reserve. **Hipposideros ruber** is known to roost in trees and buildings (Kingdon 1974), and I have found **N. thebaica** in test bore holes and human dwellings around Dar es Salaam. However, it remains to be determined just what has happened to the large populations of bats which used the mine roosts that are no longer available

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RADIO-TRACKING METHODS FOR BATS

J. Bradbury, D. Morrison, E. Stashko and R. Heithaus

Radio-tracking of bats has now been accomplished with a variety of species and with great success. It seems appropriate to summarize our collective experience to encourage and help our colleagues who might be interested in adopting this method in their own research programs. Some **advantages of radio-tracking** are:

1. Radio-tracking provides more continuous and detailed information on foraging ranges, habitat use, nocturnal social contacts, and the like than any other existing marking method.
2. Species which are netted at night but whose day roosts are difficult to find can be followed back to their roosts.
3. By placing transmitters with different frequencies on several bats simultaneously, associations among individuals can be monitored.
4. Certain behaviors produce characteristic changes in the quality of the transmitter's signal. In many cases these variations make it possible to distinguish among flying, resting, scratching, and even more subtle behaviors like clustering or passing through a roost entrance, even though the animal is not visible.
5. By modifying standard transmitters, additional information on a variety of physiological and environmental parameters can be encoded in the signal.

Some of the **limitations on radio-tracking** are:

1. **The 10% rule.** Our experience with fruit bats indicates that to minimize distortion of natural behavior, the transmitter package (including battery) and the attachment materials should not exceed 10% of the animal's weight. This cut-off percentage may be lower for insectivorous bats and others whose feeding requires greater in-flight maneuverability. Given that the minimal transmitter weight currently available is about 1.5 g)0.7 g transmitter, 0.5 g battery and 0.3 g silicon attachment), radio-tagging may be infeasable for bats weighing less than 15 g. Advances in technology are decreasing this limit all the time. The smallest bats we have radio-tagged successfully are 18-20 g fruit bats **(Carollia perspecillata).**
2. **Cost.** A good receiver costs about $700 and cheaper versions sacrifice range, portability and convenience. With a directional Yagi antenna and materials for 10 homemade transmitters, a minimal tracking operation requires about $1000. Where bats tend to fly fast and cover large areas, two receivers in communication via walkie-talkies are needed to allow for simultaneous triangulation of the animals.

Equipment Options.

1. **Transmitters.** The most commonly used frequencies for animal tracking are around 150 MHz, in the 2-meter band. This frequency is limited to essentially line-of-sight reception: it does not bend over ridges or around hills. Lower frequencies have longer waves which can bend around obstacles with less attentuation, but they require impractically long antennas for efficient transmission. Some workers have used 30 MHz because cheap FM radios can be used as receivers, but antenna efficiency (and so range) is low. Others have used 400 MHz, which gives improved directional accuracy with a small antenna at close range, but these signals attenuate quickly in vegetation.

Most transmitters are simple oscillators with a single transistor, and a crystal to keep the oscillating circuit from drifting off frequency. For this reason crystalless transmitters are not recommended, even though the crystal is the second heaviest component of the radio (the battery is usually heavier). Transmitters used for long term animal tracking emit pulsed signals. Continuous output transmitters are useful for physiological telemetry, but have a high current drain. Some options:

A. **Homemade Cochran transmitter.** See Appendix A for circuit design and Appendix B for construction information. Costs about $20 to build. Uses a 3rd overtone crystal which produces a strong output signal, but a high current drain, reducing battery life. Pulse rates range from 100-200/min. Weight unpotted about 1.4 g.

B. **AVM Model SM-1 transmitter..** Uses smaller, 5th overtone crystal. This reduces unpotted weight to about 0.7 g, current drain to 0.04-0.11 mA, and pulse rate to 60-100/min. Power output ¼ milliwatt. Range is less than homemade, but battery life is increased 2-3 X. Cost $50-$60. Available from AVM Instrument Company, 3101 West Clark Road, Champaign, Illinois 61820, (217) 356-1512.

C. **Multiple-stage transmitters.** Transmitters with more than one transistor can be used to increase power output and shorten pulse durations. One modification of the homemade design is shown in Appendix A. A commercially available transmitter with more power output (and higher current drain) is the AVM SB-2.

When choosing a transmitter-type, one needs to consider:

A. **Cost per transmitter.** This will be influenced by expected longevity on the animal, number of animals to be followed, and chances of recovering the radio.

B. **Range.** This will depend on the height of the receiving station and of the animal above ground level, strength of the output signal, and habitat. When the bat is flying at canopy level and the receiver is on a hill, ranges of 5-10 km are possible, but with a hand-carried antenna in high rain forest, range can drop to 500 m or less, depending on the terrain.

C. **Longevity.** This depends on current drain, pulse rate, battery size, and attachment technique.

D. **Weight.** Depends on the weight of the animal to be tracked, its behavior, the type of transmitter, and transmitter life needed.

2. **Antennas.** An antenna is most efficient when the length of its active element equals that of the emitted wave, but in practice a ¼ wavelength antenna is sufficient. In the 2-meter band, this means a 50 cm antenna.

A. **Transmitting antennas.** Stainless steel guitar strings cut to 50 cm (or 30 cm with the AVM SM-1 transmitter) have proven best for bats. The antenna is attached at one end to the transmitter; the other end is allowed to trail behind as the bat flies. Coiling the antenna around a collar or folding it into a packet greatly reduces transmitting efficiency.

B. **Receiving antennas.** Yagi-style antennas of lightweight aluminum are best for field use. Seven and 11-element Yagis are more sharply directional, but they are too unweildy for anything but fixed station use. Three and 4-element yagis are sufficiently directional and can be carried with reasonable ease in vegetation. For the name of your local distributor, contact Cushcraft, 621 Hayward Street, Manchester, New Hampshire 03103. You may want to tune the standard antenna more finely to your particular frequency by trimming the elements and adjusting the tuned element, following instructions given in The Radio Amateur's Handbook. "Null-peak" antenna systems (available from AVM Instrument Co.) include two parallel , 4-element Yagi antennas and connecting circuitry that "adds" or "subtracts" the two incoming signals. This system gives greater directional accuracy, but is more bulky.

3. **Receivers.** The best portable receiver available at the moment is the model LA-12 sold by AVM Instrument Company (address above). The unit weighs only 3 lbs. and runs off 8 AA batteries. It is dependable and versatile. Current price $695. For short-range work one can use cheaper FM receivers and 30 MHz transmitters. Receiver sensitivity falls off as the batteries run down. To maintain batteries at near peak voltage, we recommend using rechargable batteries where electricity is available. Two sets of batteries allow one to be charging while the other is in use.

4. **Batteries.** For most small transmitters, mercury cells with soldering tabs are preferred. Since the total package should not exceed 10% of the animal's weight, this limits battery size. Transmitter life and battery weight are roughly correlated: Life in milliamp-days x 0.3 = weight of the battery in grams. For example, a 1.0 g battery can be expected to have a life of 3 milliamp-days, which for a 0.1 mA SM-1 transmitter means a 33-day lifetime.

The voltage of a mercury cell does not drop off with use until just before it dies, so voltage is not a good measure of battery freshness. The easiest way to ensure maximum battery life is to use only batteries purchased in the past 3-6 months; i.e., don't use last summer's leftovers. Avoid reducing battery life by excessive heating during soldering, by using soldering paste, and clamp a hemostat as a heat sink on the tab between the battery and the soldering point. The battery could be refrigerated prior to soldering.

5. **Potting.** The transmitter and battery, once soldered together, must be protected from moisture and mechanical damage. The simplest method is to dip the transmitter-battery assembly in a 50:50 mixture of melted parafin and beeswax. To prevent bending and biting damage, the radio is then potted in dental acrylic (solvent and powder sold by dental supply houses and by AVM Instrument Co.). Acrylic is best applied using two disposable (fine tipped) pipettes, one for applying solvent a drop or two at a time and the second for delicately "puffing" on the acrylic powder.

The solder connection at the base of the antenna is subjected to a good deal of stress because the trailing antenna whips up and down as the bat flies. To reduce the chances of it breaking off, the antenna wire can be bent a half turn around the transmitter before the protective layers of wax and acrylic are applied. Acrylic should be applied primarily to secure the battery leads and the base of the antenna. If weight is critical, potting over the battery and crystal cases can be omitted, unless the species is a strong biter or engages in reciprocal grooming (e.g., **Desmodus**). An SM-1 transmitter with a 1.8 g Mallory RM-512 battery should require about 0.5 g of acrylic. Home-made transmitters, being more bulky, will need more.

6. **Attachment.** Although harnesses have been used on very large bats, behavioral distortion is reduced by gluing the transmitter directly to the fur between the shoulder blades. Silicone silastic (Dow RTV-732 or General Electric "permanent bathtub caulk") is recommended. It is flexible, and its rubber-like nature reduces the amount of acrylic needed to protect the transmitter. While a colleague holds the bat, use your finger to spread a small dab of silicone on the bat's back (about 1 cm x 2 cm) and on the underside of the transmitter. After centering the transmitter, use a small spatual to "frost" the transmitter with alternating layers of hair (from around the edges) and silastic. For small bats extra silicone can actually decrease attachment life, because with the added weight the bat is more motivated to scratch the package. One to 1.5 g of silastic were sufficient to keep 3.0-g packages attached to 50-g **Artibeus jamaicensis** for 7-22 days and 75-g **A. literatus** for up to 40 days. Somewhat more silastic on larger bats (e.g., 500-g **Hypsignathus monstrosus**) can hold for three months or more. The bat should be held for 10 minutes for initial hardening and then kept in a quiet place for one hour prior to release. During this time the bat can be restrained in a small, plastic mesh bag which lets the bat hang freely while allowing the antenna to protrude.

Some tracking hints.

1. **Estimating distance.** Signal intensity falls off with the square of the distance from the transmitter. In practice, signal intensity is also affected by many other factors. Experience with a given transmitter, vegetation type and terrain will allow you to make a rough estimate of distance from received intensity. It is therefore useful to devise some method for quantifying signal intensity; e.g., on the LA-12 receiver the magnitude of needle deflection at standardized gain control settings is useful.

2. **Antenna orientation.** In most cases it is better to hold the Yagi receiving antenna coplanar with the earth. In areas with many vertical objects, or in a steep canyon, it is sometimes better to turn the antenna with its elements perpendicular to the earth. Experimenting with antenna alignment is especially important when the signal intensity is low, such as when bats are in cave day roosts.

   Locating cryptic foliage roosts is facilitated if a colleague can be left behind to site along a bearing taken about 50 m from the transmitter while you go off to the side to take a second bearing. The intersection of these bearings should bring you directly under the roosting bat. If the bat is less than about 25 m up, the receiver should be able to pick up the signal with the Yagi antenna disconnected. Once you are under the transmitter, the received intensity is influenced as much by the relative orientation of the transmitting antenna as by the direction to the transmitter. To pinpoint a cryptic transmitter, point the antenna straight up over your head and rotate it to that position, perpendicular to the earth, which gives the strongest signal. Then compare signal intensities along two mutually perpendicular arcs: one perpendicular to the antenna elements, the other at right angles to this arc. The strongest signal should be when the antenna is pointing directly at the transmitter. If there is ambiguity, move to another position a few meters away and try again.

3. **Echoes.** Radio waves, like sound and light waves, will echo off objects as large or larger than their wavelenths. Be wary of echo effects in high forest with large (especially butressed) trees or in canyons and steep-sided stream beds. In addition, with the smaller 3- and 4-element Yagis, there is sometimes a "false" maximum (in the direction exactly opposite the transmitter) that is almost identical to the true maximum, In cases of double maxima and other ambiguities, move several meters away and try again.

4. **Behavioral distortion.** Unnecessary disturbance should be avoided at all stages of radio-tracking. For example, capturing fruit bats inside their day roosts may cause radio-tagged individuals to leave that roost permanently. Avoid radio-tagging pregnant bats because the disturbance promotes abortion. Release the animal as soon as possible after capture. As it sometimes takes a bat a while to adjust to the added weight of the transmitter, hang the animal in a safe, quiet place and let it fly off on its own. Don't release over water. The adjustment period includes resting and attempts to remove the transmitter. This usually makes it necessary to discard data from up to three hours after release. To minimize long-term behavioral distortion, use the smallest possible package. Finally, be cautious when approaching a bat in the field. Many bats will move if they are approached or illuminated.

5. **Signal Variations.** Flying and other movements bend the transmitting antenna and distort the relative intensities of the signal pulses. Accurate bearings on flying bats are difficult to obtain. Use caution in interpreting signals of varying intensity. Sometimes variations can be caused by high winds or grooming behavior. With experience one can learn to distinguish variations characteristic of flying, scratching, and moving through a constricted roost entrance. Distinguishing all but the flying-induced variation usually requires being within 100-150 m of the transmitter. Occasionally a transmitter will have a pulsing circuit that is sensitive to changes in the conductance of its immediate surroundings; i.e., touching it with a finger increases the pulse rate, but touching with a stick does not. Such transmitters can increase their pulse rates by as much as 20% when the bat is in a cluster with other bats.

6. **Frequency drift.** The frequency of most transmitters will change slightly when potted and again when attached to the animal. Before releasing a newly radio-tagged bat, determine the best frequency setting from a distance of 100 or more meters, where the reception band is narrower. A frequency setting should be recorded for each receiver to be used, because the fine tuning is rarely the same on different receivers. Frequency also tends to drift lower with time, so contact with each transmitter should be made at least every few days. Otherwise you may spend hours or days searching for a bat without knowing whether you're tuned to its present frequency.

7. **Triangulation.** For accurate triangulation, directional readings must be made as precisely as possible. The error in the location of a bat on a map can be large if the bat is far from the base stations and the signal can be determined to only $\pm 4°$.To reduce error in reading the direcition of the antenna, it is helpful to use a compass equipped with a leveling device and with a mirror on which there is an etched center line (e.g., a Brunton transit). The line of the mirror can be aligned with the main axis of the antenna for very accurate readings. For best results, base stations should make simultaneous readings. This is greatly facilitated by having walkie-talkie communication among base stations.

It is useful to put a transmitter on a colleague and practice tracking both stationary and moving transmitters. If triangulation is to be attempted, use a transmitter at known locations and distances to calibrate the accuracy of your system in the habitat to be used.

8. **Base stations.** Receiving stations should be located as high as possible. Antennas may be mounted on aluminum masts with hose clamps. The mast can be supported by a partially buried sleeve of pipe or plastic tubing. In areas with strong winds, antenna sway can be reduced by slipping the mast through a metal ring and suspending the ring just below the antenna with ropes tied to trees or posts. Any addition to height of an antenna can improve reception. Standing on a high point, adding an extension to the mast, or mounting an antenna on a car can be helpful. However, put off construction of any permanent tower(s) until after preliminary tracking with portable units indicates that the animals are likely to spend a significant amount of time in range.

9. **Mobile units.** Tracking from an automobile can be frustrating in areas with few passable roads. Tracking from a boat can be effective because signals carry over water with less attentuation. A small airplane is useful for quickly searching broad areas for "lost" transmitters. Most pilots are reluctant to attach a Yagi antenna to their landing gear, but an antenna suspended (or wedged) inside the cockpit of a plane flying at 800 feet will pick up transmitters in trees, but usually for not more than 500 m on either side of the flight path. Headphones are a must for hearing over engine noise.

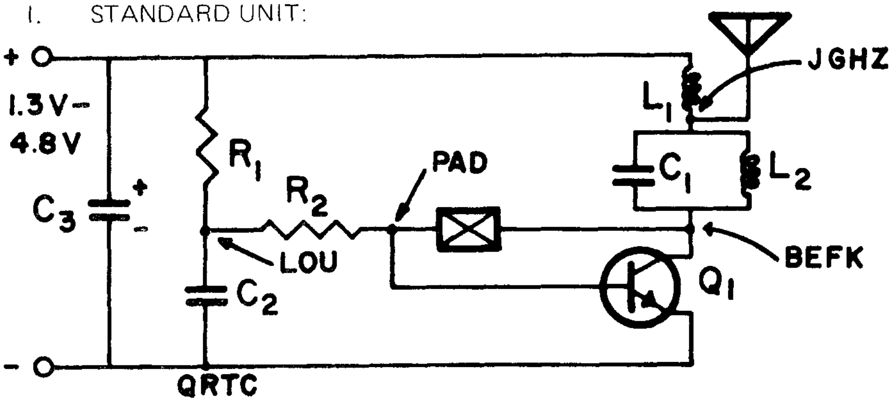
10. **Moisture.** Since receivers can be easily damaged by rain or high humidity, every effort should be made to keep them dry. We recommend putting a bag of dessicant inside the receiver. If tracking in bad weather is necessary, a watertight bag with a clear plastic "window" for viewing is very useful, and headphones permit hearing the signal over the noise of rain. In areas with high humidity, storing the receiver in a warm dry closet reduces condensation inside the receiver when it is taken outdoors.

11. **Modifications.** Several researchers have modified the standard transmitters to get additional information. A mercury switch in the battery circuit can be used to turn the radio off when the bat is hanging at rest. Photo cells can be added to modulate the battery supply resistance. One worker on prosimians put a second circuit in parallel with the pulsing circuit so that whenever the animal urinated on its feet, the saline urine connected the second circuit and changed the transmitter's pulse rate. Finally, a pulsing light circuit can be connected to the transmitter to allow for short-range monitoring of bat behavior when you are close enough to see the animal (cf. J. Wildlife Mgmt. 41:309-312; 1977.

Radio-Tracking Methods for Bats

APPENDIX A CIRCUIT DIAGRAMS FOR HOMEMADE RADIO TRANSMITTERS

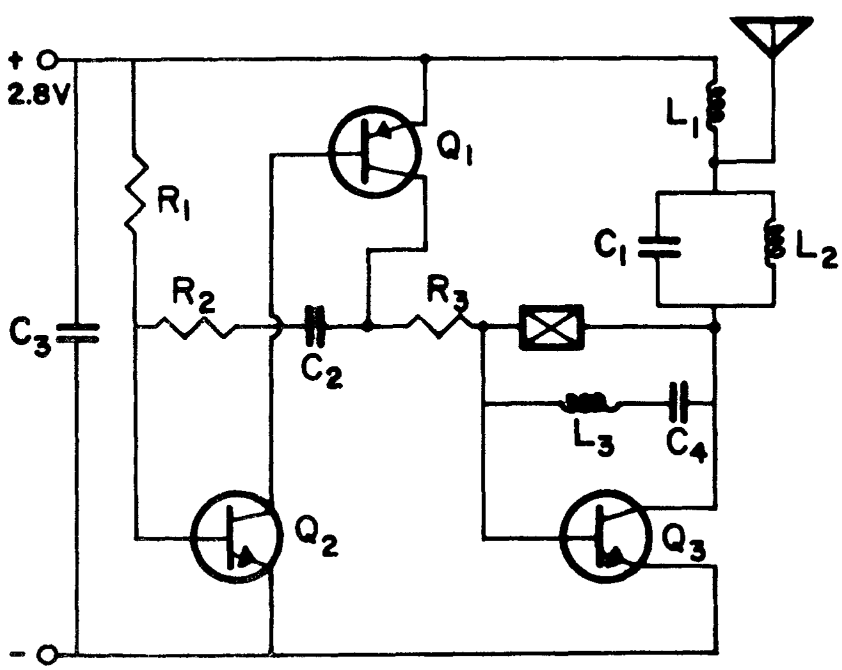
I. STANDARD UNIT:



Q_1= Transistor 2N 3904
R_1= 82 k (vary for pulse rate)
R_2= 1.8 k
C_1= 20 pFd.
C_2= 4.7 mFd.
C_3= .001 mFd.
L_1= 4 turn, // 32 wire
L_2= 12 turn, // 36 wire
X = crystal (see next page)

letter codes refer to common junctions on circuit board (see next page)

II. TRIGGERED UNIT:



Q_1= MMT 3904 (Motorola)
Q_2, Q_3= " "
R_1= adjust for pulse rate; 10 Meg gives 200-250 msec. intervals
R_2= 15 k gives 3-5 msec. pulse length
R_3= 10-22 K for 10-20 mAmp current drain
R_4= 10 K
L_1= 4 turn, // 32 wire
L_2= 12 turn, // 36 wire
L_3= choose to resonate with self-capacitance of crystal
C_1= 20 pFd.
C_2= .047 mFd, non-electrolytic
C_3= .001 mFd
C_4= 4 mFd, DC blocking capac.

APPENDIX B ASSEMBLY OF STANDARD RADIO TRANSMITTER UNIT

1. Essential Materials and Suggested Suppliers:

A. Component List:

1. Printed Circuit Board
2. 2 Resistors: 82 KΩ, 1.8 KΩ
3. 3 Capacitors: 20 PFD, 4.7 MFD (electrolytic), .001 MFD (electrolytic)
4. 1 Transistor: 2N 3904 (NPN Transistor)
5. 2 coils: 4 turns of # 32 wire, 12 turns of # 36 wire.
6. Crystal: one crystal with frequency in 2 meter band.
7. Antenna wire

B. Supplies and Tools Required:

1. Q-Dope
2. Strip-X
3. Suction or clamp vise
4. Hemostats
5. Small soldering iron and small resin flux solder
6. Solder paste (non-corrosive)
7. Eraser
8. Small diagonal cutters
9. Small long-nose pliers
10. VTVM meter with alligator clip leads for current measurements
11. Source of 1.5 volts DC (battery with leads attached)
12. 1/8" diameter glass or metal rod
13. Duco Cement
14. Plastic electrical tape
15. Forceps

C. Suppliers and Specific Comments on Ordering:

1. **Circuit Boards:** These can be ordered from Ithaco Inc., 735 W. Clinton Street, Ithaca, N.Y. 14850. Specify circuit boards for Cornell University Radio Transmitters. They require a minimum order ($30).

2. **Coil Materials:** The number 32 and number 36 coil wires are often hard to find at all except the larger electronic supply stores. Few people make their own coils anymore. Keep trying. You will also need a bottle of Plystyrene Q-Dope (GC # 37-2) and Strip-X (GC # 26-16). Both products are made by GC Electronics, Rockford, Illinois 61101 and are usually sold at the same stores which sell coil wire.

3. **Crystals:** The standard transmitters use either a 3rd or 5th overtone crystal to produce the 10th overtone. In ordering cystals, take the frequency desired, e.g. 148.3000, divide by 10 and multiply by 3 to get 3rd overtone value. Third overtone crystals cost about $7 each. Order from: International Crystal Manufacturing Company, 10 North Lee Street, Oklahoma City, Oklahoma 73102.

4. **Small Components:** These are generally available from a local distributor. For the resistors, be sure to buy the 1/8 watt size which are quite small and light. For the two electrolytic capacitors, (4.7 and .001 MFD), the Minitan Tantalum units are small and easy to mount. The 20 PFD capacitor should simply be as small as possible.

5. **Antenna Wires:** The best free wire antennas can be cut from steel guitar strings, either B or E strings* for most applications. Few animals can chew through these strings and they are unlikely to break or kink easily.

*(0.013 to 0.015 inches)

6. **Miniature Soldering Irons:** The smallest irons are made by Oryx Electrical Laboratories, Ltd., 21 Germaine Street, Chesham, Buckinghamshire, ENGLAND. Model 6 comes with a 1/16" tip; model 6A with a 3/32" tip. Either model can be run off of a Telvac Soldering Iron Transformer (Model 54204-T) made by Telvac Instrument Company, Tarzana, CA. However, any small (27 watt or less) iron with a fine tip will work.

II. Assembly Method Using Circuit Board:

A. **Coil Preparation:**

1. Mount the 1/8" glass or metal rod in a vise so as to protrude horizontally.

2. Holding a length of the proper wire in one hand, wind the other end around the rod until the correct number of turns, (when viewed from the side opposite to your hands), is visible.

3. Keeping tension on the coil, twist the two free ends of the wire around each other 4-5 times. Cut off wire outside of twists.

4. Put a dab of Duco Cement on the top of the coil and use the forceps to bring the turns of the coil close together. At the same time, rotate the coil on the rod so that it does not stick to the rod.

5. **Gently** remove the coil from the rod and dip into Q-Dope. Let it dry thoroughly.

6. Cut the wires between the twists and the coil and straighten the loose ends so they are parallel to each other and perpendicular to the axis of the coil.

7. Carefully dip the free ends of the coil wires into Strip-X and let sit several minutes. The insulation on the wires should quickly slide off the wire. Remove this insulation and wipe the wires clean. Incomplete removal of this insulation is the most common cause of a newly assembled transmitter's not functioning.

8. Store in clean dry place until needed.

B. **Circuit Board Preparation:**

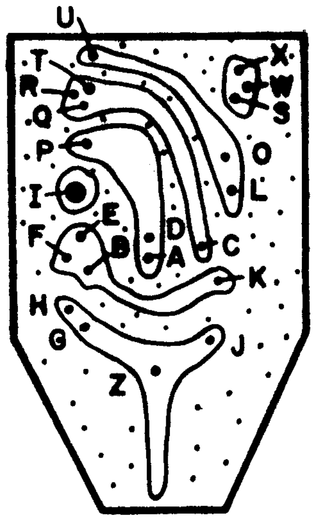
1. Cut circuit board from a sheet leaving 2-3 mm. plastic margin around all copper contacts.

2. Clean all copper surfaces by rubbing them vigorously with a pencil eraser.

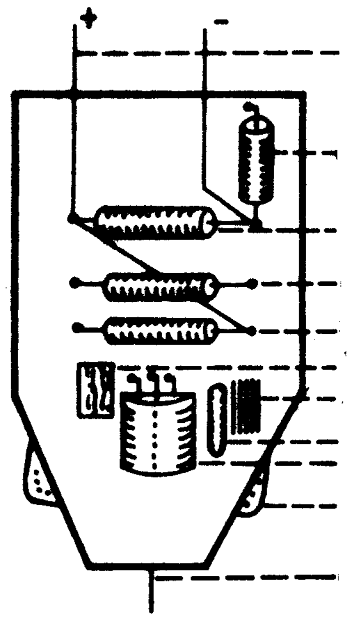
3. Mount a pair of hemostats in a table vise so that the circuit board can be clipped in flat and slightly tilted soldering.

C. **Assembly:**

Circuit Board Lables
(copper side)



Finished Transmitter
(component side)



1. Cut two 1" pieces of wire from either resistors or capacitors at hand. Insert one through hole A so that the wire emerges from the copper side about 3/4". Solder in. Use second wire in the same way for hole B. Cut wires on component side as closely to plastic aspossible.

2. Bend the transistor leads at a right angle about 1/8" from the body of the transistor. Insert transistor leads into holes C, D, and E FROM THE COMPONENT SIDE so that the transistor lies between the holes and the antenna end of the circuit board. Press in snugly, solder, and trim off stubs on copper side of board for all three leads. For transistors flat on one side, the flat side should be against the circuit board and the rounded side away from it. For other transistors, this connects the COLLECTOR to hole E.

3. Scrape any enamel off of the leads of the 20 PFD capacitor so that it will sit snugly against the circuit board. Insert into Holes F and G. Solder the inner hole, F, only.

4. Insert the 4 turn coil into Holes H and I. Wrap the end of the coil inserted into H around the protruding capacitor lead in G. This increases strength and contact. Add a tiny dab of solder paste. Solder Holes G and H together. Do not solder I yet.

5. Insert the 82 KΩ resistor, (or if slower pulse rates are required, any higher value up to about KΩ), into Holes L and I. Solder Hole L only.

6. Insert the 1.8 K resistor into holes O and P. Solder both points.

7. Insert one of the cut-off leads from a capacitor or resistor into Hole I. Wrap the ends of the 4 turn coil in this hole around both the resistor and the wire. Add a tiny dab of solder paste and solder all 3 leads. Bend the other end of the wire over and across the 1.8 K resistor and insert in Hole S. Do not solder yet.

8. Take a resistor or capacitor wire and put a small hook in one end. Hook into Hole W. Crimp against the board, but do not solder. Allow the wire to extend towards and over the end of the circuit board opposite to the antenna. This is the positive battery lead.

9. Bend the leads of the .001 MFD capacitor at right angles to the component at a distance of about 1/8" from the component. Insert the leads into Holes R and X WITH THE RED DOT POINTED TOWARDS R. Solder S, W and X all together.

10. Insert a capacitor or resistor wire with a hooked end into Hole Q. Lay it flat against the circuit board, but aim towards the center a bit. Crimp it against the board. This is negative battery lead.

11. Insert the 4.7 MFD capacitor into Holes T and U WITH THE GREEN DOT TOWARDS T. Adjust its position so that the negative battery lead cannot short out against the non-green dot end of the capacitor. Solder holes Q, R and T together and then solder Hole U.

12. Insert the leads for the 12 turn coil into Holes J and K. Adjust the position of the coil so that it is supported on the side by the transistor. Put a dab of paste on each contact and solder carefully. This fine #36 wire is hard to get a good joint with and is the most likely source of problems with faulty transmitters.

13. Cut antenna wire to proper length. Insert in Hole Z and crimp towards rear of board. Add a dab of solder paste and solder **well.**

III. Testing, Pulse and Frequency Selection:

A. Attach the 1.5 V. DC source to the transmitter with the current meter of the VTVM Interposed in series between battery and transmitter. It is also useful to turn on a receiver to hear the pulses.

B. Select a crystal in the range desired and touch its two leads to the two leads extending from the copper side of the transmitter.

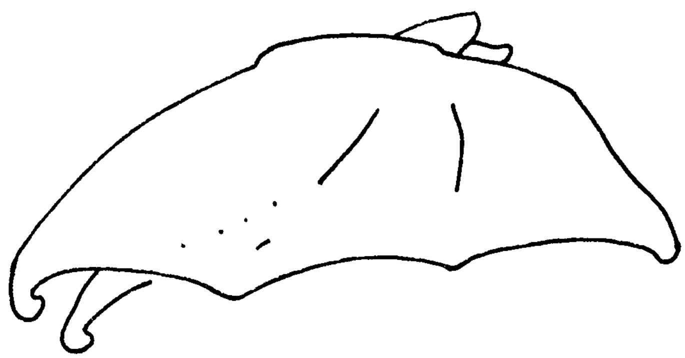
C. You should hear the pulsed sound from the receiver and see the pulsed deflections of the needle on the VTVM. Count the pulses to determine the pulse rate and tune the receiver to determine the exact carrier frequency of the transmitter. Note the average current drain from the VTVM readings. Repeat with another crystal at the same general frequency. You will find that nominally identical crystals will giver different pulse rates, current drains and carrier frequencies. Check out 4-5 and select the one desired.

D. Take the selected crystal and put a square of electrical tape on one flat side and on the edges. Place this insulated side against the copper side of the circuit board and twist each of the crystal leads around one of the two wires sticking out of the copper side of the board. Solder well and trim off the extra stubs close to the solder joint.

E. The radio is now complete and ready for attachment to a battery. Store in a dry place with pertinent information on frequency, pulse rate and weight. These should be checked again **after** soldering the crystal as they can vary with lead lengths.

F. Before the battery is attached, put a small piece of spaghetti insulation or electrical tape over the negative lead of the transmitter. Most mercury cells have a small negative terminal; the major case of the battery is the positive terminal. The insulation prevents the negative lead from shorting against the battery case. Attach leads to battery tabs using soldering paste and a hemostat, as described in section 4 on batteries.

BAT RESEARCH NEWS



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A NEW STRATEGY

With this new issue of BRN we are trying a new approach to production which we hope will smooth out some of the problems that have plagued us in the recent past. Specifically, we are now using a computer text programme that permits us to enter the relevant information and have the machine produce camera-ready copy. Before, I had sent the text to Roy who had had it re-typed and reproduced. The plan at this end is to pay individuals a per page fee for entering information in the computer and hopefully this will take some of the load off Roy and me. It also accounts for part of the rate increase.

Roy and I are grateful to most of you for being so patient about the production problems we have encountered , although we suspect that this 'patience' is really resignation, given the sporadic nature of BRN. The next issue will, if humanly possible, contain a complete membership list.

NEWS

The Union International de Speleologie, Commission de Bibliographie (c/o Institut de Geologie, Universite de Neuchatel, 11, rue Emile-Argand, CH-2000 Neuchatel 7, Switzerland) has sent out the most recent edition of Speleological Abstracts (17), dated December 1978. Those of you who are trying to keep up with the literature on caves may find it of interest.

Phoebe Wray, the Executive Director of the Center for Action on Endangered Species (formerly Endangered Species Productions) has sent some information about a new programme they have started. Specifically they have begun to build and erect bat boxes, mainly in New England, and have developed a fact sheet with directions for the boxes which is based on Bob Stebbings' models. They would appreciate the co-operation of researchers to check the boxes for use, and those willing to co-operate should get in touch with Phoebe Wray (175 West Main Street, Ayer, MA 01432).

William Caire (Biology Department, Central State University , Edmond, Oklahoma 73034) has sent me a copy of a brochure on bats which he has produced for Oklahoma. The brochure appears to be aimed at public education about bats.

Richard K. LaVal (Missouri Department of Conservation, Fish and Wildlife Center, 110 College Ave., Columbia, Missouri 65201) has written concerning the Indiana Bat/Gray Bat Recovery Team. Laval is the team leader, and Tom Kunz , Merlin Tuttle, John Brady and Don Wilson are the other members. The Recovery Team hereby solicits information on any biological aspect of these two endangered species that might be useful to those charged with the task of preparing a Recovery Plan. If you know of bat caves or have any other data or information that the Recovery Team should know about, call the Team Leader (314-474- 7545) or write to him, or contact any other member of the team.

Bat Research at Washington University in St. Louis

The next North American Bat research Symposium will be held in St. Louis, Missouri, in October, 1979. The local arrangements for the meeting will be made by the Bat Lab at Washington University. Research on bats is presently going on at Washington University in the Departments of Biology and Pyschology, and at the Tyson Research Centre, a 2000-acre forested ecological and biological research area out side the city. In addition, several departments in the Washington University School of Medicine cooperate in research on echolocation.

Washington University is a major center for research in neurobiology, including sensory neurophysiology, neuro anatomy, and biophysics, hearing, and echolocation in bats. Ethological, psychopysical, and neurophysiological studies are being conducted on a number of different species of bats. The organizers of the North American Bat Research Symposium plan several laboratory tours and demonstrations as part of the meetings.

The Department of Biology contains the laboratory of Dr. Nobuo Suga, whose research concentrates on electro physiological single-unit studies of the neural mechanisms of hearing and sonar in bats. At present this research is focused upon the representation of sonar target and echo features in the auditory cortex of Pteronotus parnellii and Myotis lucifugus. Dr. Suga, Dr. William O'Neill, Peter Wasserbach, Ted Sullivan, and Jim Jaeger are conducting experiments which involve recording nerve discharges from individual neurons in encoding and displaying information for perception by echolocation.

The Department of Psychology contains the laboratory of Dr. Jim Simmons, which concentrates primarily upon studies of echolocation behaviour in laboratory and field situations. At present, psychological experiments are under way on the acuity of perception of target fluttering movements and perception of arrays of vertical rods at various spacings by Eptesicus fuscus. Shelley Kick is doing Ph. D. thesis research on single-cell recordings from the auditory system of Eptesicus, studying mechanisms of depth perception by sonar. Beatrice Lawrence is beginning to study the auditory pathways of Eptesicus using autoradiographic labeling techniques. Dr. Fran Porter, in the Department of Physiology and Biophysics of the School of Medicine, is conducting research on social behaviour, group organization , and acoustic communication by Carollia perspicillata.

Dr. Richard Coles, the director of the Tyson Research Centre, is exploring means of developing artificial hibernacula for bats, using large, partially underground bunkers originally constructed for storage of ammunition. One such bunker is presently in use as a long-range sonar test facility for behavioural studies of perception of targets at extreme distance by *Eptesicus*.

At present, several species of bats including *Eptesicus fuscus*, *Myotis lucifugus*, *Pteronotus parnellii*, *Carollia perspicillata*, and *Rousettus aegyptiacus* are maintained in lab colonies. *Carollia* and *Rousettus* are being bred routinely. Much of the research with these bats is on echolocation and acoustic communication, and several computer facilities are devoted to this work, with a variety of interdepartmental interactions as part of the support required for research. TU

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QUICKIE

Renal Structure and Urine Concentrating Ability of *Myotis lucifugus*.

A mammal's ability to conserve urinary water is in general directly correlated with the aridity of the habitat of the animal. This relationship, which has been demonstrated for many taxa of small mammals also applies to insectivorous bats. The use of renal structure as a predictor of the urine concentrating ability of mammals in general has also been well documented. Geluso (1978) presented a scheme to predict the urine concentrating ability of insectivorous bats from their renal structure. Here I present further support for Geluso's prediction scheme for mean maximum urine osmolality by comparing the kidney morphology and the urine concentrating ability of *Myotis lucifugus lucifugus* with the insectivorous bats used to derive the scheme.

The methods of Geluso (1978) were used to calculate morphological indices which he found of value (r > 0.85) in predicting mean maximum urine osmolality in the insectivorous bats he studied. The structural indices determined for the kidney of M. l. lucifugus were 1) percent medullary thickness PMT = (total medullary thickness/cortical + medullary thickness) X100 , 2) ratio of inner medullary zone to cortex (IM/C = thickness of inner medullary zone/cortical thickness) and 3) ratio of medulla to cortex (M/C = medullary thickness/cortical thickness). These indices were calculated with data taken from the photomicrograph of a longitudinal section of the kidney of M. l. lucifugus in Rosenbaum (1970), and the mean maximum urine osmolality predicted by each of the indices was then determined with Geluso's prediction equations. The mean maximum urine osmolality produced by M. l. lucifugus was determined by Bassett and Wiebers (1979). The percent error of the predictions based on the three renal indices (predicted osmolality - actual osmolality/actual osmolality)X100 was calculated to assess the predictive value of each index.

The mean maximum urine osmolality predicted by each of the three renal indices agrees well with the actual mean maximum osmolaity determined for M. l. lucifugus (Table 1). The mean maximum urine osmolality produced by this bat 2199 milliosmolal (mosmol/kg) is 450 mosmol/kg less than the lowest value used by Geluso to determine his equations (Myotis yumanensis produced a maximum concentration of 2640 mosmol/kg). This result supports the use of these renal indices to predict maximum urine osmolalities in insectivorous bats that are poorer concentrators than the bats studied by Geluso. This prediction scheme may thus be applicable to those species found in the eastern United States which were not studied by Geluso and to the eastern populations of those species studied by Geluso. Comparitive studies of the renal structure and the urine concentrating ability of eastern populations of widely distributed bat species would be of great value in further defining the relationship of habitat water availability and kidney function.

The mean maximum urine concentration produced by M. l. lucifugus when subjected to physiological stress (Bassett and Wiebers, 1979) agrees well with the maximum value predicted from the amount of concentrating machinery present in the kidney. The concentrating machinery of this bat appears to operate in the same manner as that of other insectivorous bats. As the thickness of the inner medulla relative to the thickness of the cortex increases in insectivorous bats, the urine concentrating ability increases. As in Geluso's work, the IM/C index was the best predictor of mean maximum urine osmolality in M. l. lucifugus (percent error = 0.45). PMT and M/C were less accurate predictors of concentrating ability (percent error = 6.0). The thin segments of the juxtamedullary nephrons, are necessary for the production of a concentrated urine, are found solely in the inner medulla of the kidney. Geluso (1978) discussed at length the relationship of inner medullary thickness to the urine concentrating process in insectivorous bats.

A note of caution is in order regarding the morphological data used in this analysis. The longitudinal section of the kidney used to calculate the renal indices may or may not have been the section which showed the greatest medullary area. Geluso selected the section which contained the greatest medullary area from a group of serial sections through the kidney for his analysis. The conclusions presented are based on a minimal amount of morphological data; however, the morphology of the kidney would not be expected to vary significantly for adults of the same species. Further morphological data are needed to verify the conclusion presented.

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TABLE 1.--Renal Structure and the Prediction of Urine Concentrating Ability of *Myotis lucifugus lucifugus*.

RENAL STRUCTURAL INDEX	PREDICTION OF URINE CONCENTRATING ABILITY			
	Correlation of Index with Mean Maximum Urine Osmolality (1)	Value of Index (2)	Predicted Mean Maximum Urine Osmolality (mosmol/kg) (3)	Percent Error of Predicted Value (4)
PMT	0.882	81.08	2098	4.59
IM/C	0.919	2.78	2209	0.45
M/C	0.907	4.29	2361	7.37

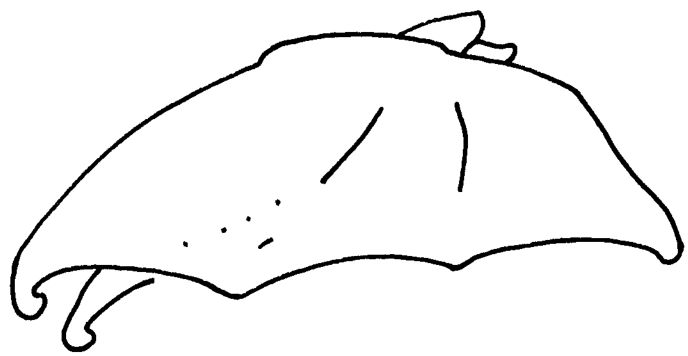
(1) From Geluso (1978)

(2) From photomicrograph in Rosenbaum (1970)

(3) From equations in Geluso (1978)

(4) Actual mean maximum urine osmolality = 2199 mosmol/kg (Bassett and Wiebers, 1979)

BAT RESEARCH NEWS



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Please Note ...

This issue includes the long awaited list of subscribers. Please check it over, make sure that you are on the list and that your address is correct. Address changes to Roy Horst.

The number 4 of Volume 20 will be a little late, as I plan to be in the field in Africa until the end of November. I hope to have copy ready for transmittal to Roy by the middle of December.

NEWS

A recent issue of the Journal of Reproductive Fertility, no. 14, Symposium Report of May 1979, contains a series of papers on chiropteran reproduction. The 10 papers (see Recent Literature) cover several aspects of bat reproduction and represent presentations made at the International Bat Research Conference held in Albuquerque in August 1978. Copies of this issue of the Journal may be obtained by sending U.S. $10.00 to: The Journal of Reproductive Fertility, P.O. Box 32, Commerce Way, Colchester, CO2 8HP, Essex, U.K. Paul Racey provided this information.

The NSS Bat Subcommittee is still producing its newsletter Night Flyer - copies may be obtained from Thomas Lera, 5350 Amesbury Drive no. 2103, Dallas, Texas 75206.

A new dictionary has recently been published in Europe: Gozmany, L., H. Steinmann, and E. Szili (editors). Septemlingual dictionary of the names of European animals. Akademiai Kindo, Heyden and Son Inc., 247 41st Street, Philadelphia PA 19104. The cost is $230.00; there are 1016 pp, over 12,000 separate entries, 150,000 names and 10,000 sources.

Rane L. Curl (Department of Chemical Engineering, University of Michigan, Ann Arbor, Michigan 48109) has written with some interesting information about the use of ROZOL (an anti-coagulant - chlorodiphenadione) against bats. ROZOL is registered with the US EPA as a rodenticide, and the manufacturer applied for having it registered for use against bats, but withdrew their application when the EPA asked for tests on efficacy, toxicology, teratology, etc. However, there is a provision of the EPA pesticides act that allows states to use unregistered pesticides for 'special local needs', and efforts have been made to have ROZOL registered for use against bats under this clause. Rane indicated in his letter that in July this ploy had worked in 13 states, but Minnesota had refused and New Jersey had cancelled the special local needs registration. Rane obtained his information from Denny Constantine, Donald Rothchild (EPA), and Clay Mitchell (US. Fish and Wildlife Service).

A recently published book 'Transactions of the Symposium on the Biological Resources of the Chihuahuan Desert Region, United States and Mexico', U.S. Department of the Interior, National Park Service Transactions and Proceedings Series 3: 1-658, contains several papers on bats:
Harris, A.H. 1977. Wisconsin age environments in the northern Chihuahuan desert: evidence from the higher vertebrates. pp. 23-52.
Findley, J.S. and W. Caire. 1977. The status of mammals in the northern region of the Chihuahuan desert. pp. 127-139.
Packard, R.L. 1977. Mammals of the southern Chihuahuan desert; an inventory. pp. 141-153.
Schmidly, D.J. 1977. Factors governing the distribution of mammals in the Chihuahuan desert region. pp. 163-192.

Another recent book 'Biological Investigations of the Guadalupe Mountain National Park, Texas' edited by H.H. Genoways, and R.J. Baker, also includes some papers on bats. This is the Proceedings of Symposium at Texas Tech University in 1975, and is National Park Service Proceeding and Transactions Series 4: 1-442.
Logan, L.E. and C.C. Black. 1979. The Quaternary vertebrate fauna of

Upper Sloth Cave, Guadalupe Mountains National Park. pp. 141-158.
Genoways, H.H. and R.J. Baker et al. 1979. Mammals of the Guadalupe Mountain National Park, Texas. pp. 271-332.
Altenbach, J.S., K.N. Geluso and D.E. Wilson. 1979. Population size of Tadarida brasiliensis at Carlsbad Caverns in 1973., pp. 341-348.

The Royal Ontario Museum (Toronto, Ontario, Canada M5S 2C6) has recently published a paper 'Apparatus for research on animal ultrasonic signals' by J.A. Simmons, M.B. Fenton, W.R. Ferguson, M. Jutting and J. Palin (Life Sciences Miscellaneous Publications, Royal Ontario Museum) which includes a considerable amount of data on different bat detectors, etc. The cost is $2.00 Canadian, and the publication may be ordered directly from the ROM. Below is a reproduction of Table 2 from this paper, a comparison of different kinds of bat detectors.

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Table 2 Summary of some characteristics of apparatus for studying ultrasonic signals, including: Broadband—electrical output of ultrasonic signal suitable for recording, complete analysis and display; Derived— electrical output of derived signal suitable for incomplete analysis and display; Display—audio, meter, visual; Batteries—ease of access; Frequency Identification—without accessories; Frequency Range of Microphone; Sensitivity—relative ability to detect signals; Cost—as of August 1978; Commercial—where units can be ordered. For further details see text.

System	Broadband	Derived	Display	Batteries	Frequency Identification	Frequency Range in kHz	Sensitivity	Cost in U.S. $	Commercial
Modified Lincoln (Figs. 6, 8, 9, & 10)*	yes	no	audio[1]	good	no	10–200	good	ca800	Carleton[2]
QMC S100*	yes	yes	audio	good	yes	10–180	good	850	QMC[3]
QMC K1SM1*	yes	no	no	good	no	10–180	good	200	QMC[3]
Leak Detector[4] (Fig. 5)	no	yes	audio[1]	good	no	30–50	good	ca 100	Carleton[2]
QMC Mini	no	yes	audio	good	yes	10–180	good	100	QMC[3]
Holgate	yes[5]	yes	audio	poor[6]	yes	10–180	fair	800	Holgate[7]
Knowles (Fig. 12)	yes[8]	yes	audio	good	no	10–100	fair	—	no
Knowles (Andersen and Miller 1977)	no	yes	audio	good	no	15–150	fair	—	no
Brüel and Kjaer 4135 ¼-in. microphone[9]*	yes	no	meter audio[1]	—[10]	no	1–100[11]	poor	2,000	Brüel and Kjaer[12]
Period Meter	*	yes	visual[13]	good	yes	10–160	—[14]	ca 600	Carleton[2]

[1]With accessory such as earphones, microsonic amplifier, or equivalent; [2]Science Workshops, Carleton University, Ottawa, Canada K1S 5B6. Completed unit cost on a per order basis as actual cost assessed by unit. Workshop will sell components at cost for those who want to assemble their own; [3]QMC Instruments Ltd., 229 Mile End Road, London E14AA, England; [4]Also available from other outlets, but we strongly recommend the Massa TR-89G sensor; [5]Broadband signal is weak and contaminated; [6]Accompanying information does not mention batteries that provide polarizing voltage to the microphone; [7]Holgates of Totton, Commercial Road, Totton, Hants, England; [8]Spectrum somewhat distorted; [9]Microphone with preamplifier and amplifier (2209 or 2606); [10]Batteries vary as model of amplifier; [11]frequency range determined by amplifier and microphone grid; [12]Brüel and Kjaer, DK-2850 NAERUM, Denmark; [13]frequency-time structure on oscilloscope; [14]Limited by microphone.

* = units compatible with period meter.

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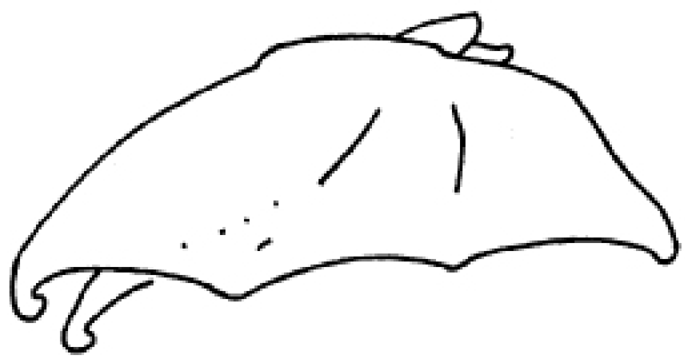

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Bat Research News

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Late Issues

This issue is a month late in preparation because I spent the last seven weeks pursuing African bats in the field. It may end up being considerably later than that when it arrives (along with numbers 2 and 3) because of continuing problems we are experiencing with duplication. For the record number 1 of volume 20 was at the duplicators on schedule in mid February; number 2 there by mid May, and number 3 there by the third week in August. Due to priority scheduling of jobs in the office where the duplication is accomplished, Bat Research News has been getting short shift. Roy and I are trying to resolve this problem.

News

Call for Papers: The Eighth International Congress of Speleology is scheduled to be held in Bowling Green Kentucky in the USA between 18 and 23 July (inclusive) 1981. The biology section is asking for papers dealing with bats from a cave-related point of view (ecology, evolution, special conservation problems, cave environments and bats, etc.). If you are thinking of presenting a paper please send your name, address and paper title to Dr. Virginia Tipton, Biology Department, Radford University, Radford Virginia 24142. An early response (within three months of receiving this notice) is requested, and abstracts will be due six months before the meeting. The possibility of publishing the papers from the programme is being explored, and if this comes to pass, complete manuscripts will be required three months before the meeting.

S.B. Lall (2-GH-6, Machlamagri Scheme, Udaipur-313001, India) has written with news of some of the bat research going on in his laboratory where most of the work is focused on male and female reproductive cycles. They have also done some work on the behaviour and social organization of *Pteropus giganteus*. There is a total of six graduate students involved in the bat research.

E.D. Kitzke of Racine Wisconsin sent in some information on bats and Rozol which was published in the September 1979 issue of *Pest Control*. The article ('Effects of Rozol tracking powder on bats (Tadarida brasiliensis)' by Lee R. Martin, describes the use of rozol in an effort to rid a warehouse of a nuisance colony of *T. brasiliensis*. Application of 2.5 pounds of rozol tracking powder per fifty yard section of bat roost resulted in a large decline in the bat population in treated areas relative to untreated controls. There is virtually no discussion of what effects the tracking powder had on the bats, and no mention of large numbers of dead bats accumulating below the treated roosts.

This summer Shelagh Hurley and I (Department of Biology, Carleton University) tested the effectiveness of DDT, fenthion and zinc phosphide in killing bats - none of them is very effective at all. When the bats are confined to a small area and exposed to high doses of either zinc phosphide or DDT at relatively high concentrations, a few will succomb, but in larger areas where the populations are more dispersed, neither toxin killed any bats within 24 hours of application. Fenthion seemed to have no effect at all (within 24 hours of application). For those of you who have wondered about the effectiveness of ultrasonic rodent repellers, the period of suspense is over; the little brown bats we tested with two models of rodent repellers showed no evidence of response or distress. Some of the bats preferred to roost on the screen of the operating rodent repelling device.

I have seen no evidence to suggest that sealing access routes is not the best and perhaps the only effective means of controlling bats in buildings.

M. Anciaux de Faveaux (Constantine, Algeria) has kindly send the following selection of 1978 and 1979 references to publications on parasites of bats:

Protozaoaires

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Landae, I., Rosin, G., Miltgen, F. and Hugot, J.P. 1979. Le genre *Polychromophilus*: pluralité des espèces, caractères et évolution de la schizogonie tissulaire. Ann. Parasit. hum. comp., 54:___.

Rosin, G. Landau, I. and Hugot, J.P. 1978. Considérations sur le genre *Nycteria* (Haemoproteidae) parasite de Microchiroptères africains, avec description de quatre espèces nouvelles. Ann. Parasit. hum. comp. 53(5): 447-459.

Shamsuddin, M. and Mohammad, M.K. 1978. Observations on the large bat-trypanosomes of Iraq. Bull. Nat. Hist. Res. Center, Baghdad. 7(2): 35-47.

Trematoda

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Saoud, M.F.A and Ramadan, M.M. 1978. A review of the Trematode genus *Anchitrema* Looss, 1899 (Dicrocoeliidae), with a rediscription of *A.* *sanguineum* (Sonsino, 1894) and *A.*

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Lewis, R.E. 1978. A new species of Myodopsylla Jordan and Rothschild, 1911 from northern United States, with a dey to the genus (Siphonaptera, Ischnopsyllidae). J. Parasit. 64(3): 524-527.

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Mardon, D.K. and Allison, F.R. 1978. A new species of Coorilla Dunnet and Mardon (Siphonaptera, Ischnopsyllidae), with records of other fleas from

Queensland. J. Austral. Entomol. Soc. 17(2): 167-170.

Peus, F. 1978. Flöhe aus dem Mittelmeergebiet. IX. Thrakien. Folia Parasitol. Praha. 25: 49-60.

Whitaker, J.O. Jr. and Mumford, E. 1978. Foods and ectoparasites of bats from Kenya, East Africa. J. Mammal. 59(3): 632-634.

Acariens

Bassols, I. 1979. Present state of knowledge of the Mesostigmata ectoparasitic on bats in Mexico (in Spanish). Dpt. Zoologia, Escuela Nac. Ciencias Biol. Mexico.

Camicas, J.L. 1978. Tiques et arbovirus. Revue bibliographique. Cahiers O.R.S.T.O.M., Sér. Entomol. médic. and Parasit. 16(2): 165-180.

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_______ and Nadchatram, M. 1978. Oriental Mesostigmata. IV. Rhinonyssinae, Spiturnicidae and Blattisociinae from Malaysia and New Guinea. Oriental Insects, 12(1): 85-86.

Fain, A. 1978a. Mites of the family Myobiidae (Prostigmata) from mammals in the collection of the British Museum (Natural History). Bull . British Museum Nat. Hist., ser. Zoology, 33(3): 193-229.

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Haensel, J.:Ergänzende Fakten zu den Wanderungen in Rüdersdorf überwinternder Zwergfledermäuse (Pipistrellus pipistrellus). Mit 1 Abbildung. p. 85.

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Haensel, J.: Invasionsartiger Einflug von Braunen Langohoren, Plecotus auritus, in ein Gebäude der Stadt Nauen. p. 95.

Kleine Mitteilung, p.165.

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"LOCOMOTOR MORPHOLOGY OF THE VAMPIRE BAT, DESMODUS ROTUNDUS"

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Altenbach's monograph is the sixth in a series of special publications by the American Society of Mammalogists. Unlike the previous publications, he has attempted to interpret the adaptive significance of anatomical rather than behavioural or ecological features "in the evolutionary and day to day biology of the organism." His approach combines classical description of locomotor behaviour, osteology and myology with advanced techniques of high speed still and motion photography and simultaneous electromyography to determine the "temporal sequence of contraction of muscles during normal movements." Its detailed descriptive nature makes this book an excellent reference for any student of chiropteran biology or functional morphology. Typographical errors are few and do not detract from the general quality of the publication. The book is set out in the form of a standard scientific report. The introduction provides an extensive review of the literature from 1800 to 1972. Here the author sets out five major objectives of his work, each of which appears to have been effectively dealt with in the following sections. Although the methods used usually are described clearly, the actual number of bats upon which descriptions and observations are based is not entirely obvious.

Excellent photographs and diagrams of walking, hopping, climbing, jumping, flying and alighting movements as well as standing and hanging postures are provided in the Locomotion section. While the accompanying descriptions are very detailed and thorough, a glossary of terms or a figure clarifying the movements and positional arrangements would have been helpful at this point. It is not until the beginning of the section on Postcranial Ostelogy that some positional terms related to limb and girdle movements and anatomy are defined.

For the accounts of postcranial osteology and functional myology of the pectoral girdle and limbs, the author has taken on the difficult task of describing a dynamic process of interrelated movements of parts within the limits of two dimensions. Although the descriptions and diagrams are good, access to a bat skeleton, preferably Desmodus, is highly recommended for readers who have difficulty visualizing dynamic processes.

Altenbach has succeeded admirably in integrating his material and in fulfilling the objectives set out at the beginning. In the discussion, he provides his interpretations of the "functional significance of its [Desmodus'] locomotion-associated anatomy" and "the significance of specialized locomotor behaviour in Desmodus." It is Altenbach's hope, and mine, that this work will serve to "stimulate others to add additional interpretation of functional morphology to bat biology", and to complete this picture by stimulating "publications of functional morphological data on the pelvic girdle and limbs."

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