AUSTRALIAN BAT RESEARCH NEWS

Number 8
December 1968

Published jointly by the Australian Bat-banding Scheme, Division of Wildlife Research, C.S.I.R.O., and the Bat Research Committee of the Australian Speleological Federation.

FOR PRIVATE CIRCULATION ONLY

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EDITORIAL

Two issues ago an editorial on conservation attracted some notice and we can claim with due modesty that it did spur some further thought in this very important field. Consideration is currently being given to the protection of nursery colonies of the Bent-winged Bat at Wee Jasper, New South Wales. To add more fuel to the fire, I am also printing in this issue sections of a paper (those sections dealing with bat conservation only) which I gave to the last biennial conference of the Australian Speleological Federation. Others may care to comment upon the suggestions of this paper in future issues.

BANDING NEWS

Further interesting recoveries:

Miniopterus schreibersii

20-02335 male, banded Glen Fernleigh Cave, N.S.W. on February 15,1963 by Peter Dwyer. Retrapped Panmure Cave, Victoria on March 21,1965 by John Edge. Total distance 780 miles southwest.

20-08723 female, banded Cheitmore Cave, N.S.W. on March 31,1963 by Ken Simpson. Retrapped Snake Hill, South Australia on May 27,1967 by Ken Heyne. Total distance 500 miles west-southwest.

PERSONAL

We record with deep regret the death of John Edge, well known naturalist and bat bander of Allansford, Victoria. John had been in poor health for some time, but his death, on December 30 last, was deeply felt by all his friends. His deep interest in, and knowledge of the wildlife of the Warrnambool area was well known, and only equalled by the help and hospitality he gave to visiting naturalists.

Two changes of address are noted. Andrew Spate is now at P.O. Box 312, Orbost, Victoria; and Ken Simpson is at the National Museum of Victoria, Russell Street, Melbourne, where he is working on the Chowilla dam area study programme.

RESEARCH NOTES

W.H.Ewers, of the Department of Biological Sciences, University of Papua and New Guinea, is currently working on bat malaria in various Pteropodidae and in cave-dwelling micro-chiroptera.

Robert E.Goodwin, of Colgate University, New York, is studying the bat fauna of Timor. This is the first systematic investigation of the bats of Timor and it should produce results of considerable interest to students of the Australian fauna.

Drs. F.P.Möhres and E.Kulzer anticipate visiting Australia during the earlier part of 1969, with a view to extending their previous work on echo-location and thermoregulation in bats to Australian species.

OBSERVATIONS AND NOTES

Fishing for bats? Following a recent A.B.C. broadcast on bats, I had an interesting letter from Mr. C.G.Heller, of 324 Gore Street, Fitzroy Victoria, which I quote: '.... you may be interested to hear of two experiences I had while fly-fishing for trout just after dusk a couple of years ago. While whipping the fly in the air I heard a sound as if coming from the artificial fly and concluded the hook had picked up a leaf floating on the surface of the water, which often happens. To my surprise I found a bat had taken the fly in its mouth and was squeaking, not unlike the squeak of a mouse. Now if the bat had taken the fly from the surface of the water, as swallows sometimes attempt to do, I would certainly have noticed it. It is clear therefore that the bat took the fly whilst in the air and it - the fly - would have had a velocity of perhaps up to 80 miles an hour on the end of about 50 feet of line. There is no question that on the two occasions this has happened the bat was hooked in the mouth.'

Flying Fox for dinner. It is of interest to note that the pièce de résistance at the 1968 dinner of the New York Explorers' Club was Australian flying fox, arranged by John Nelson and myself. On phoning the local manager of Pan-American Airways to arrange transport I found he was not at all surprised (lots of others were !) because he had regularly eaten flying fox while stationed on Guam.

G.M.Allen devotes a chapter of his book to the use of bats as food in various parts of the world. Certain of the New Guinea indigènes eat micro-chiroptera and flying foxes, and Lord Medway had also commented to me that members of the Niah Cave expeditions found the naked bat, Cheiromeles, a useful and palatable source of fresh meat.

Bat workers in Asia. During a recent visit to Asia I was very glad to meet a number of bat workers, all of whom showed me the usual and traditional hospitality. Perhaps I may be excused a few lines to list the people concerned, both for the information of others and by way of saying thanks:

Dr. Yoshinori Imaizumi, Chairman of the Division of Zoology, National Science Museum, Tokyo.
Mr. Tedashi Kuramoto, of the Akiyoshi-dai Science Museum, who is currently banding bats in the caves of the Akiyoshi area of Japan. This Science Museum is a well established research institution, financed from the profits of tourist operations in the caves, and engaged

in the study of all aspects of the karst area. They have a small but well equipped underground laboratory in one of the caves.
Lord Medway, Adrian Marshall, and Al Beck, all in Kuala Lumpur. Lord Medway is currently working on Tylonycteris, a flat-headed Vespertilionidthat roosts inside the internodes of bamboo, gaining entry to the bamboothrough small holes left by emerging beetles. Adrian Marshall is studying the biology of the Nycteribiidae, while Al Beck is carrying out an extensive programme of both collecting and banding. We spent a thoroughly fascinating evening at Batu Caves mist-netting and banding both Eonycteris and Hipposideros diadema (ouch !).

CONSERVATION

Some principles in conservation of bats (relevant sections of the paper 'Biological aspects of cave conservation' delivered to the 1966 Conference of the Australian Speleological Federation by Elery Hamilton-Smith).

The significance of bat populations

Apart from the intrinsic value of preserving all native faunas, two special factors make the adequate protection of bat colonies a matter of particular importance. Firstly, the gregarious cave-dwelling bats provide an invaluable living laboratory for research into a wide variety of biological problems. Such a population is more readily accessible to study, and more readily delineated as a population, than those of most mammal species. The well-known work of Peter Dwyer on Miniopterus schreibersii in New South Wales indicates something of the wide range of basic data which can be obtained from the intensive study of these bats.

Secondly, there is no question that bats have a very appreciable effect upon the balance of insect populations and are therefore of ecological significance, especially to the agriculturist. Davis, Herreid and Short (1962), using extremely conservative figures, estimated that the free-tailed bat in Texas consumed some 6,600 tons of insects per annum. Dwyer (1964) estimated that the M. schreibersii of the MacLeay Valley, N.S.W., consume two hundredweight of insects per night, and this too appears a very conservative estimate.

The threats to bat populations

One of the obvious possible threats to a cave-dwelling bat population is destruction of its maternity site through guano-mining. The maternity cave inevitably develops the deepest deposits of guano and, if readily accessible to mining, is likely to be exploited. However, this does not necessarily result in damage to the population. Guano was mined from the Bat Cave, Naracoorte, South Australia for a number of years but the bats have remained. In this instance, no structural damage was done to the cave and, for aesthetic reasons, it is likely that mining was confined to those seasons when the bats were absent. Similarly, many of the bat caves of the southern United States are mined clear of guano each winter, and are repopulated (and the guano replenished) during each summer.

On the other hand, it is fortunate that proposals for mining of two other sites in Australia, which would have resulted in destruction of the caves concerned, did not come to fruition. Dwyer and Hamilton-Smith (1965) have indicated that the selection of a maternity site is intimately related to the cave structure being such as to retain warm air. If this meteorological character of a cave is destroyed by structural alteration of the cave in mining, then there is little question that the cave would be abandoned. A suitable new site would be difficult; it may be that the traditional movement pattern of a population is comparatively inflexible; and there is every likelihood that a large death toll would result. Certainly, it is now well established in M. schreibersii that many of the pregnant females only arrive at the maternity colony immediately before birth of the young and, in a few instances, perhaps within a day or so following birth. It is most unlikely that those individuals would succeed in rearing their young if the normal maternity site was destroyed.

Caves may also be destroyed from the viewpoint of a bat if filled in at the entrance. J.B.Hood of Naracoorte (pers. comm.) has expressed concern that many caves are filled by farmers to facilitate cultivation. If this process limits the caves available to a bat population significantly, then there is likely to be both a negative effect upon the numbers of bats and a resultant upward trend in insect populations.

Deliberate vandalism in various forms may kill large numbers of bats. I have personally encountered one instance of small boys light-a fire in a cave to kill the bats which were there. Davis (pers.comm.) reports one instance where a party of three people killed over 10,000 bats in a single afternoon. The bats, roosting in a Kentucky cave, were swept from the ceiling and trampled. Sporting magazines occasionally encourage the shooting of bats as being good practice for clay-bird shooting ! Such activities are, of course, illegal in Australia, as all bats except Pteropus are fully protected species, but any legislation is only as effective as the machinery for its enforcement.

It has been suggested that the widespread use of insecticides is likely to contribute significantly to mortality in bats, both through direct contact with insecticides and through feeding upon insects carrying recently applied chemicals. This factor is currently the subject of a number of studies and it is a little early to know just how significant the use of insecticides is in this regard. However, Greenhall and Stell (1960) have shown that many insecticides are fatal to bats and can be used where deliberate reduction of populations is necessary. Luckens and Davis (1964) have also shown that Eptesicus fuscus is ten times more sensitive to DDT poisoning than any other mammals tested.

Regretfully, depredations can also occur in the name of science. Excessive collection of specimens or disturbance of colonies at vulnerable stages of the annual cycle may both have a truly appreciable effect. One third of a small population of the sparsely distributed and apparently comparatively rare Myotis adversus was collected to provide specimens for one of our research institutions. The remainder of the population subsequently disappeared. The same institution decimated a nursery group of Rhinolophus megaphyllus with a twelve-gauge shotgun, collecting over 200 individuals, but doubtless killing many more. This sort of collecting is both unnecessary

and completely undesirable. Seebeck and Hamilton-Smith (1967) have also described high mortality during the disturbance of a wintering colony. In this case, the disturbance was unavoidable, but it highlighted the vulnerability of a wintering colony.

A long-term study of bat populations in the Netherlands showed a considerable decline in population from 1942 to 1957(Sluiter and van Heerdt 1957), but this trend reversed over the period 1958 to 1962 Sluiter and van Heerdt 1964). The authors attribute this to three factors: the cessation of a banding programme; cessation of quarrying in the vicinity of certain caves; and the cessation of mushroom growing or other commercial use of caves within the study area.

Many other European authors have attributed reduction of populations to banding activity, and this appears valid in certain countries. Hooper (1964) warns that banding should only be used when absolutely essential to a research programme. Beaucournu (1962), in examining the dangers of banding, suggests that mortality has resulted primarily from the rough handling of animals or from banding during hibernation, rather than from any intrinsic danger of banding in itself. Every care has been taken to avoid banding mortality in Australia and such data as are available, e.g. Dwyer (1965), suggest that, on the whole, the precautions taken have been successful. Considerable care is exercised in the registration of banders, as outlined in Simpson and Hamilton-Smith (1965). Banding at vulnerable stages of the annual cycle has been reduced as vulnerable periods have been noted. Weight reductions have been noted in animals banded during wintering by various banders, and so winter banding has been minimized. Nursery colonies have been disturbed as little as possible until the young are weaned.

A conservation programme for cave-dwelling bats

Although these suggestions are based primarily upon Australian experience with Miniopterus schreibersii, it seems reasonable to assume that similar principles could be applied to the conservation of other cave-dwelling species in temperate climates. Basically it is suggested that the periods of maximum vulnerability during the annual cycle must be given high priority within the programme.

The first and most significant period of vulnerability is the three or four months from the birth of the first young to the weaning of the last. In the first place, the maternity colony serves to concentrate within one site at least the adult females of a population, and often an even higher proportion of the total. At no other time of the year will an equal number of bats be congregated in the one cave. However, more importantly than this perhaps is the fact that the young are particularly helpless (Dwyer 1963) and may easily be killed by undue disturbance. Davis (1966) and other workers who have studied the population dynamics of bat populations show that minimal infant mortality is necessary for the maintenance of stability in population numbers.

Accordingly, every effort should be made to ensure the protection of maternity sites, including the limitation of visiting such caves to a minimum during the maternity season, and the complete protection of the cave from any structural damage which may alter its meteorological character.

It is fortunate that in southeastern Australia most maternity sites have at least a degree of protection already, as summarized below. However, this is no reason for complacency, and active steps should be taken to ensure more adequate care of these sites.

The maternity sites of M. schreibersii in SE. Australia

Naracoorte	situated in a caves reserve under supervision; entry to cave requires ladder.
Warrnambool	access through private property, gates of which are locked; cave difficult to locate and difficult of entry.
Nowa Nowa	situated in forest reserve; location not well known; access tracks obscure and deteriorating.
Wee Jasper	cave well known and readily accessible, but entry during breeding season usually prevented by foul air.
Bungonia	cave well known and often visited, despite ladder pitch; foul air normally protects maternity site within cave.
Willi Willi	cave in reasonably inaccessible terrain and not well known.
Riverton	location of cave not well known.
Rockhampton	location of cave not well known; entry difficult and particularly unpleasant in summer.

The second period of high vulnerability is clearly during wintering, when the animals must conserve their energy reserves to survive. Any disturbance which awakes wintering groups will reduce the fat reserves available to each animal further and so result in an equivalent reduction in the chances of survival. Fortunately, wintering populations are dispersed in a large number of sites, each housing a comparatively small number of animals. Nevertheless, disturbance of wintering colonies in any way should be minimized.

There is also some evidence that handling of pregnant animals increases the probability of abortion and subsequent loss at least of the young. As each adult female bears only one young per year in most species (McKean and Hamilton-Smith 1967), this could readily have an appreciable effect upon the population. It cannot be proven at this point that handling will cause this, but it appears likely from observation. This gives reasonable ground for minimal handling of bats in late spring when adult females are pregnant.

The three points already made are of particular importance to cavers, bat-banders, or others who may visit caves containing bats, or handle bats for any reason. It is implied from the above that banding should be concentrated upon late summer and autumn. In fact, this is the most useful period for banding because the animals tend to be concentrated in a small number of sites and juveniles are still readily identifiable as such; this fact may be recorded during banding and subsequent recoveries are then of known age. Experience has also indicated that banding at maternity sites is most effective in terms of providing meaningful results on migration patterns.

The wise framing of protective legislation and its adequate administration or enforcement is obviously also of considerable importance. For example, maternity caves should be given the highest legal protection, and the enforcement of this protection adequately policed. Although such legislation should not unduly restrict research programmes, unnecessary or excessive collecting should never be allowed to occur.

This in turn suggests that there is a need for an adequate programme of public education. In the widest sense there is a need for the public to learn that bats are extremely cheap and useful insecticides, rather than beasts of ill omen. In a more specialized sense, it is perhaps even more important that research workers, cave explorers, and others who come into contact with bats develop an understanding of the factors which may adversely affect populations.

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DAVIS,R.B., HERREID,C.F. & SHORT,H.L. 1962. Mexican free-tailed bats in Texas. Ecol. Monogr. 32: 311-46.

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DWYER,P.D. & HAMILTON-SMITH,E. 1965. Breeding caves and maternity colonies of the bent-winged bat in southeastern Australia. Helictite 4: 3-21.

GREENHALL,A.M. & STELL,G. 1960. Bionomics and chemical control of free-tailed house bats (Molossus) in Trinidad. U.S. Fish & Wildl. Serv. Spec. Sc. Rept. 53: 1-20.

HOOPER,J.H.D. 1964. Bats and the amateur naturalist. Studs. Speleol. 1: 9-15.

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McKEAN,J.L. & HAMILTON-SMITH,E. 1967. Litter size and maternity sites in Australian bats. Vict. Nat. 84: 203-6.

SEEBECK,J.H. & HAMILTON-SMITH,E. 1967. Notes on a wintering colony of bats. Vict. Nat. 84: 348-51.

SIMPSON,K.G. & HAMILTON-SMITH,E. 1965. Third and fourth annual reports on bat-banding in Australia. CSIRO Aust. Div. Wildl. Res. Tech. Pap. 9: 1-24.

SLUITER,J.W. & van HEERDT,P.F. 1957. Distribution and decline of bat populations in South Limburg from 1942 to 1957. Natuurhist. Maandblad. 46: 11-12.

SLUITER,J.W. & van HEERDT,P.F. 1964. Distribution and abundance of bats in South Limburg from 1958 to 1962. loc.cit. 53: 164-73.

CURRENT LITERATURE

Section A - Papers of Australian Interest

CONNOLE,M.D. & JOHNSTON,L.A.Y. 1967. A review of animal mycoses in Australia. Vet. Bull. 37: 145-53.
Six specimens of guano from Australian bat caves were examined for Histoplasma capsulatum and found to be negative.

DOUGLAS,A.M. 1967. The natural history of the Ghost Bat, Macroderma gigas (Microchiroptera, Megadermatidae) in Western Australia. W. Aust. Nat. 10: 125-38.
Deals with the range and abundance of M. gigas, including an 1855 report by Austin obviously referring to this species; sub-fossil occurrences; hunting methods and feeding; food remains in roosting sites; behaviour and habits; reproduction.

DWYER,P.D. 1968. The biology, origin, and adaptation of Miniopterus australis (Chiroptera) in New South Wales. Aust. J. Zool. 16: 49-68.
(Author's summary) The biology of Miniopterus australis was investigated in north-eastern New South Wales (latitude c. 30°S.) between 1960 and 1966. In this area the species reaches the southern limit of its distribution and is largely confined to the subtropical coastal belt. Mating occurs in the winter months June and July, and is followed by a period of retarded embryonic development to mid-September. Births occur in December. The only nursery colony of M.australis located was that of the southernmost population of the species. It included about 4000 individuals (approximately 1800 young)in December and was intimately associated with a much larger nursery colony of M.schreibersii. A comparison of the winter behaviour of M.australis with that of M.schreibersii at the same latitude revealed that pre-winter increase in weight is less marked, that feeding behaviour persists longer, and that there are fewer, and less rigid, periods of torpidity in the former species. In its reproductive and wintering characteristics M.australis, at 30°S., has diverged less from the tropical, and presumably ancestral, pattern for the genus than has M.schreibersii at the same latitude. It is argued that M.australis has colonized New South Wales from low latitudes later than M.schreibersii and that colonization southwards may have been dependent upon, or promoted by, the prior existence of M.schreibersii nursery colonies.

An analysis of retrapping data for the southernmost population of M.australis suggests that this is represented as two subpopulations (highland and lowland) between which adult individuals seldom exchange. Spermatogenesis, and hence mating, occurs slightly earlier in the highland subpopulation. It is suggested that earlier mating in this subpopulation may be selectively advantageous, and that the long-term effect of selection here could be to shift the

timing of reproductive events in the entire population back towards that observed in M.schreibersii. Earlier mating should be correlated with a stronger manifestation of pre-winter increase in weight and of winter torpidity. The combination of all these changes in M.australis would permit further range expansion to the south and west, provided that suitable nursery sites are available and can be found.

GREEN,R.H. 1966. Notes on Tasmanian bats. Tas. Nat.(Suppl. Bull. Tas. Field Nats. Club no.7), Nov.1966, pp.1-2.
A popularised summary of the same author's earlier work on Eptesicus pumilus and Nyctophilus geoffroyi.

HAMILTON-SMITH,E. 1967. Fauna of the Nullarbor caves. In Caves of the Nullarbor (Sydney: Speleological Research Council) pp.35-42.
Discusses distribution of Nyctophilus geoffroyi and Chalinolobus morio in the Nullarbor caves; a single record of Taphozous georgianus, and points out that reports of Chalinolobus gouldii and Eptesicus pumilus are not authenticated and probably due to mistaken determinations. The effect of C.morio upon cave invertebrate faunas is pointed out, and behavioural differences between eastern and western assemblies of this species are described.

HAMILTON-SMITH,E. 1968. The Australian Bat-banding scheme. In: Speleo-Handbook (Australian Speleological Federation) pp.77-8.
Brief account of the banding scheme.

HAMILTON-SMITH,E. 1968. Biology of the long-tailed blossom bat of the Pacific. Bull. Aust. Mammal Soc. 2: 124.
Abstract only, dealing with Notopteris macdonaldi neocaledonica.

HILL,J.E. 1966. A review of the genus Philetor (Chiroptera: Vespertilionidae). Bull. Brit. Mus. (Nat.Hist.) Zool.14: 371-87.
The genus Philetor is reviewed and its geographical distribution is extended from New Guinea to Malaya by the inclusion of Eptesicus verecundus Chasen 1940. Particular attention is given to features considered of value in determining the affinities of the genus within the Vespertilioninae and its relationships are examined in detail.

HOOGSTRAHL,H. & KOHLS,G.M. 1965. Bat ticks of the genus Argas (Ixodoidea, Argasidae). 6. The female and larva of A.(Carios) australiensis. Ann. Ent. Soc. Amer. 58: 816-20.
The female and larva of Argas (Carios) australiensis Kohls and Hoogstrahl are described for the first time. Larvae of this species are quite similar, except for large size, to those of other species in the subgenus Carios, but the adults differ widely from those of the others. This developmental phenomenon serves to illustrate certain principles in argasid phylogeny and nomenclature.

KIRKPATRICK,T.H. 1967. Mammals, birds and reptiles of the Warwick district, Queensland. 1. Introduction and mammals. Qld. J. Agr. Anim. Sci. 23: 591-8 (also issued as Bull.no.380, Div. Plant Industry, Qld. Dept. Primary Industries).
Records Pteropus poliocephalus, P.scapulatus, Nyctophilus timoriensis, N.geoffroyi, Eptesicus pumilus, Pipistrellus tasmaniensis,

Chalinolobus gouldii, Nycticeius orion, N.rupellii, Miniopterus schreibersii blepotis, Taphozous flaviventris, Tadarida norfolkensis, and Rhinolophus megaphyllus. Of these species, P.tasmaniensis is an addition to the Queensland fauna, and the little-known T.flaviventris is recorded as commonly occurring in the Warwick area.

LEITNER,P. & NELSON,J.E. 1967. Body temperature, oxygen consumption and heart rate in the Australian False Vampire Bat, Macroderma gigas. Comp. Biochem. Physiol. 21: 65-74.
Macroderma gigas maintains its body temperature within the limits of 35-39°C at ambient temperatures from 0° to 35°C. There is no evidence of daily torpor or seasonal hibernation. At an ambient temperature of 38°C body temperature becomes hyperthermic and various emergency mechanisms for heat dissipation (panting, salivation, and licking) are initiated. The zone of thermal neutrality extends from 30° to 35°C and minimal oxygen consumption is 0.94 cm^3 O_2 $.g^{-1}$ hr^{-1}, 97 per cent of the value predicted on the basis of bodyweight. Since thermal conductance continues to decrease below the lower critical temperature, temperature regulation in Macroderma does not conform to the simple model of homeothermy based upon Newton's law of cooling. Resting heart rate is minimal (235 beats/min. at 35°C) within the thermal neutral zone and below 30°C increases linearly by about 5 beats.$min.^{-1}$ $(°C)^{-1}$. Mean breathing rate remains minimal at ambient temperatures from 25°C to 37°C and increases both above and below this range.

PHILLIPS,CARLETON J. 1966. A new subspecies of Horseshoe Bat (Hipposideros diadema) from the Solomon Islands. Proc. Biol. Soc. Washington 80: 35-39.
Describes H.diadema malaitensis from Malaita Island and discusses its differentiation from related subspecies.

REES,R.G. 1967. Keratinophilic fungi from Queensland. 1. Isolations from animal hair and scales. Sabouraudia 5: 165-72.
Two species of bats examined with negative results.

SEEBECK,J.H. & HAMILTON-SMITH,E. 1967. Notes on a wintering colony of bats. Vict. Nat. 84: 348-51. (N.B. see errata published with index to Vict. Nat. vol.84, March 1968).
Describes the removal of a population of Miniopterus schreibersii and Myotis adversus from a water tunnel and their transfer to another site. A high mortality was incurred and its possible causes and implications are discussed. Banding recoveries within the population are recorded and a number of new records of M.adversus are included.

VAN DEUSEN,H.M. 1966. The seventh Archbold expedition. Bioscience 16: 456-63.

VAN DEUSEN,H.M. 1967. In the land of bikpela rat moa. Pt.I. Nature and Science 4(11): 2-5; Pt.II. ibid 4(12): 2-6.
Accounts of the seventh Archbold expedition to the Huon Peninsula of New Guinea with a number of references to bats collected.

WAKEFIELD,N.A. 1967. Mammal bones in the Buchan district. Vict. Nat. 84: 211-14.
This paper abstracted in last issue of this newsletter, but note errata published with index to Vict. Nat. 84 (March 1968).

Section B - Papers of General Interest

BHATNAGAR,K.P. 1967. Bacula of some Indian Megachiroptera. J. Mammal. 48: 494-7.
Describes the bacula of Rousettus l.leschenaulti, Pteropus g. giganteus and Cynopterus s. sphinx.

CONSTANTINE,D.G. 1966. Transmission experiments with bat rabies isolates: responses of certain Carnivora to rabies virus isolated from animals infected by nonbite route. Amer.J.Vet.Res. 27: 13-15; Reaction of certain Carnivora, opossum, and bats to intramuscular inoculations of rabies virus isolated from free-tailed bats, ibid. pp.16-19; Bite transmission of rabies to foxes and coyote by free-tailed bats, ibid. pp.20-23 (with D.F.WOODALL); Reactions of certain Carnivora, opossum, rodents and bats to rabies virus of red bat origin when exposed by bat bite or intramuscular injection, ibid. pp.24-32 (with G.C.SOLOMON & D.F.WOODALL); Responses of certain carnivores and rodents to rabies virus from four species of bats, ibid. pp.181-90.

CONSTANTINE,D.G. 1967. Activity patterns of the Mexican Free-tailed Bat. Univ. New Mexico Publ.Biology no.7: 1-79.
An extremely thorough study dealing with annual activity patterns, the significance of weather in relation to movements, and mortality in this species. It is suggested that the stress of prolonged flights followed by rapid cooling may be largely responsible for the mortality recorded.

DAVIS,W.H., BARBOUR,R.W., & HASSELL,M.D. 1968. Colonial behaviour of Eptesicus fuscus. J. Mammal. 49: 44-50.

HAYMAN,R.W., MISONNE,X., & VERHEYEN,W. 1966. The bats of the Congo and of Rwanda and Burundi. Ann. Mus. Roy. de l'Afr. Cent. (Tervuren) - in oct.Zool. 154: 1-105, pl.I-XX.
Keys and annotated checklists with distribution maps and comprehensive bibliography.

HOOPER,J.H.D. & W.M. 1967. Longevity of rhinolophid bats in Britain. Nature 216: 1135-6.
Records R. ferrumequinum retrapped 19.25 years after banding.

HUSSON,A.M. 1962. The bats of Suriname. Zool. Verhand.58: 1-282, pl.I-XXX.
A comprehensive monograph.

IMAIZUMI,Y. 1964. The Mammals of Japan. 196 pp., 68 pl. (Osaka: Hoikusha).
A general text on Japanese mammals, with text in Japanese but taxonomic data in Latin and English with excellent illustrations of all species; skull and/or dentition included in nearly all illustrations.

KLIMA,M. & GAISLER,J. 1967. Study on growth of juvenile pelage in bats. 1. Vespertilionidae. Zool. listy. 16: 111-24.
II. Rhinolophidae, Hipposideridae. ibid. pp.343-54.
Deals with the species Myotis emarginatus, Plecotus austriacus and Miniopterus schreibersii; Rhinolophus hipposideros and Asellia tridens.

KOOPMAN,K.F. 1967. The southernmost bats. J. Mammal. 48: 487-8.
Records Myotis chiloensis from Navarino Island, 55°S.

KRZANOWSKI,A. 1967. The magnitude of islands and the size of bats. Acta Zool. Cracoviensia 12: 281-346.
An analysis of the increase or decrease in size displayed by insular as opposed to continental forms of bats.

PHILLIPS,C.J. 1967. A collection of bats from Laos. J. Mammal. 48: 633-6.
Records Rousettus l.leschenaulti, Eonycteris s.spelea, Macroglossus minimus sorbrinus, Megaderma spasma subsp., Rhinolophus malayanus, Hipposideros bicolor sinensis, Hipposideros c.cineraceus, Aselliscus stoliczkanus, Tylonycteris pachypus fulvida.

RANSOME,R.D. 1968. The distribution of the Greater Horseshoe Bat Rhinolophus ferrum-equinum during hibernation in relation to environmental factors. J. Zool. 154: 77-112.
A study which shows the importance of temperature as a factor determining the selection of hibernating sites, that bats will feed outside from time to time during hibernation, and that therefore the environmental conditions prevailing outside of the hibernating site are also of great importance in ensuring survival.

VILLA-R, B. 1966. Los Murcielagos de Mexico. 491 pp., 171 figs., 98 maps. (Instituto de Biologia, Universidad Nacional Autonoma de Mexico).
A monograph, in Spanish, which not only deals with the taxonomy of Mexican bats, but includes chapters on bats in mythology and history, fossil bats, orientation, feeding patterns, predators, ecology, economically useful characteristics, histoplasmosis, rabies, the 'bat-bombs' scheme of World War II, and a useful section on techniques of collection, preparation, and study.