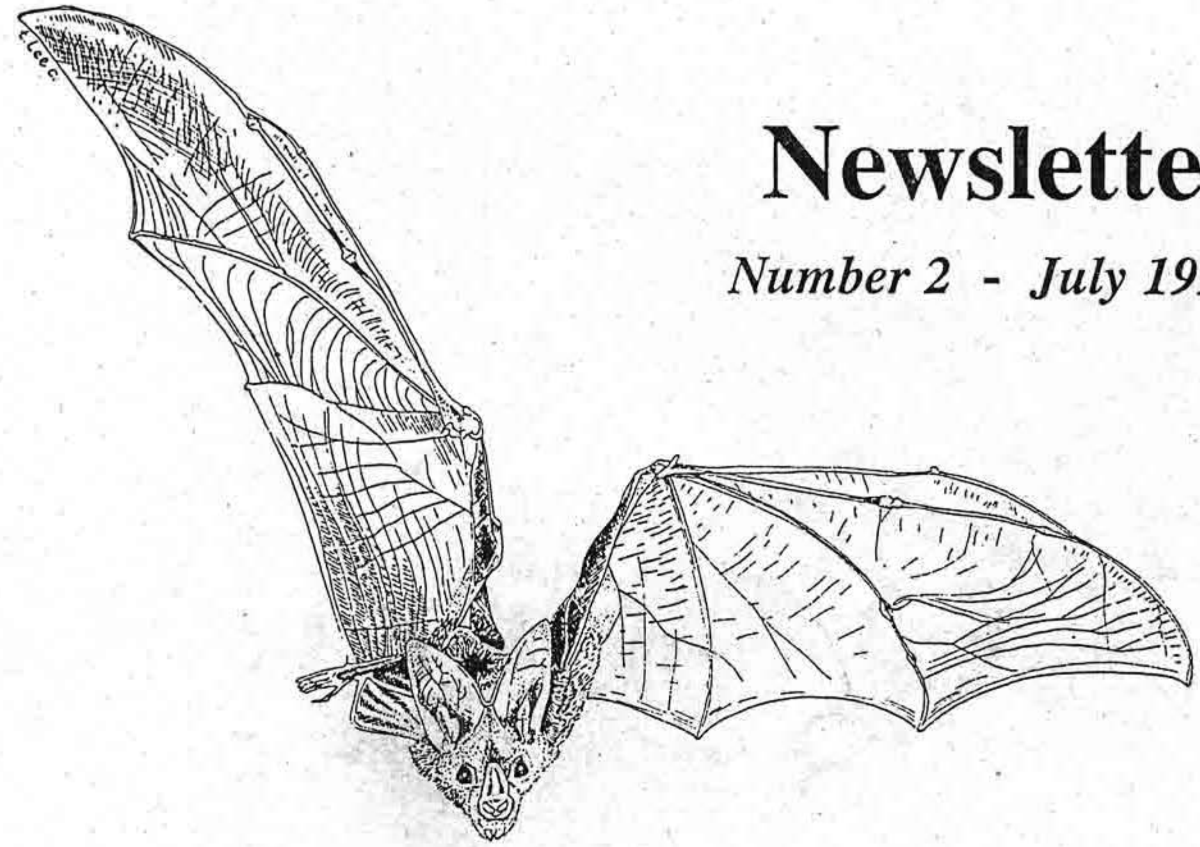
# Australasian Bat Society



# Newsletter

*Number 2 - July 1993*

# INSTRUCTIONS TO AUTHORS

The Australasian Bat Society Newsletter will accept manuscripts for one of two broad sections of the Newsletter. For consistency the following guidelines should be followed:-

***For Scientific Articles***

1. Manuscripts should be submitted with two copies to Dr Philip Towers,. School of Science and Technology, Charles Sturt University, PO Box 588, Wagga Wagga NSW 2678.

2. Manuscripts should be submitted in clear, concise English, typed with double spacing on A4 paper and free from typographical and spelling errors.

3. Papers should consist of: Title; Name and addresses of authors; Abstract (approx. 200 words); Introduction; Materials and methods; Results, Discussion and References. References should conform to the Harvard (author-date) System.

4. All pages, figures and tables should be consecutively numbered and correct orientation used throughout. Metric Units should be used throughout, and *SI* units used wherever possible.

5. "Camera ready" copy is essential for diagrams and figures, and the Newsletter does not have the facilities for photographs. Tables should be in a format suitable for reproduction on a single page.

6. Manuscripts are not being refereed routinely at this stage, although editorial amendments may be suggested and specialist opinion may be sought in some cases.

***For News, Notes, Notices etc.:-***

Manuscripts should be submitted with two copes to Dr Philip Towers, School of Science and Technology, Charles Sturt University, PO Box 588, Wagga Wagga NSW 2678, and be in concise English, typed with double spacing on A4 paper and free from typographical and spelling errors.

Manuscripts will usually be edited to conform to the newsletter.

Phil Towers
**Editor**

---

**President**

Dr Len Martin
Department of Physiology
and Pharmacology
University of Queensland
QLD 4072
Australia
Ph (07) 3653 128
Fax (09) 365 1766

**Secretary**

Jillian Snell
PO Box 612
Milsons Point
NSW 2061
Australia
Ph/Fax (02) 954 1800

**Newsletter Editor**

Dr Philip A Towers
School of Science & Technology
Charles Sturt University
Wagga Wagga
NSW 2678
Australia
Ph (069) 222 576
Fax (069) 222 737

# NEWS AND VIEWS

### *THE FIFTH AUSTRALIAN BAT RESEARCH CONFERENCE - HOW, WHEN AND WHERE ?*

***Greg Richards***

It has been over two years since our last gathering at the University of Queensland in April 1991, so it is now time to start thinking about our next get together. When the ABS was in its conception phase the questionnaire to prospective members asked for opinions re our conference, and from memory the consensus was :

- that the meetings be held every two years
- that the venue be either in a "central location" for cheap travel, or in a bat conservation "hot-spot", or at a place where we can do some pre- or post-conference field work together.

In reality though, the venue should probably be decided by whoever we can con into organising the meeting. It will undoubtedly be a major task fraught with headaches, but should provide great personal satisfaction and many accolades from conference participants. Perhaps we could set the ball rolling in the following way:

- potential organisers could advise the Secretary of their intent, timing, and likely venue
- potential participants could advise the Secretary whether they are likely to attend and whether they will present a paper (this will give a rough size requirement for the venue plus a probable time duration for the meeting)
- potential assistants could advise the Secretary of roles they could play, such as organising travel discounts, book sales, student assistance, corporate sponsorship, wine tastings, etc (I'll have a go at the latter three).

Keep in mind that we will be having a formal business session, where one of the tasks will be to elect a new committee. The Secretary should be advised of agenda items.

---

### *NABU : A NATIONAL ARCHIVE OF BAT ULTRASOUND*

***Greg Richards***

With so many researchers now using the highly successful ANABAT electronic call detection system, and considering the duplication of effort in obtaining reference calls necessary for use in surveys, it seems propitious to establish a central repository for bat calls. Such a central repository has been suggested by several colleagues, and in the nearly completed Action Plan for Bat Conservation it was identified as an essential future need. For these reasons I have obtained approval to administer a national bat sound library under the umbrella of my research group, the Australian National Wildlife Collection (ANWC), based at CSIRO's Division of Wildlife and Ecology, Canberra. The ANWC is listed as part of the National Heritage, so this institution will provide long-term security, as it does for its archive of bird calls. Archived bat calls will automatically become part of the gazetted National Heritage.

I propose that the repository be termed the *National Archive of Bat Ultrasound (NABU)*, having the following objectives and purposes :

- to securely store reference calls recorded from Australasian bats, as cassette recordings, computer files, and printouts from the ANABAT system, as well as high speed real-time recordings;

- to provide reference calls to researchers for use in taxonomic, zoogeographic, biological survey and monitoring, and related studies;

- to provide a resource for assessing and clarifying the degree of geographic variation in the calls of each species.

Such a working archive needs guidelines for its effective operation, and for this purpose I need feedback to arrive at consensus agreement. For example, it would seem fair that people who contributed calls could expect to receive other calls for survey purposes free of charge; but it also may be unfair to provide the same service free to people who have either not made a contribution or who are in private enterprise. Therefore, I suggest that in the ground rules for *NABU* a fee for service should apply in various circumstances to subsidise some of the costs. A task for the administrator would be to obtain short and long-term funding to develop and ensure safe storage, to cover running costs, and possibly some targeted field work.

From a research point of view, I also foresee that part of the service would include identifying those species of bats that show some geographical variation in call structure, and advising users of the ANABAT system to be cautious in their identification of certain species in particular regions. Experience has shown that what has often been presumed as geographical variation within a species has often turned out to represent undescribed taxa; consequently *NABU* would encourage the lodging of voucher specimens with reference calls, either in the ANWC or cross-referenced with a state museum record.

I look forward to feedback on this proposal. Your support will help to obtain funding, and your comments will help to refine the operation of this facility.

---

### *DR LEN MARTIN - "ABS PRESIDENT EXTRAORDINAIRE"*

Dr Martin received information recently that a flying-fox camp on private property near Gympie in Queensland was partially bulldozed and the remaining scrub set on fire - quite an achievement in one day! The flying-foxes moved, no one quite knows where, although a new camp was reported in Maryborough. Gympie is a fruit growing region and flying-foxes are 'persona non gratia', however a correctly constructed netting structure over an orchard would solve predation problems and should be of high priority on any orchardist's list, including planting Spring and Summer flowering native trees to satisfy the needs of both flying-foxes and birds. Fruit growers just have to take on these costs in their business, like any other business, there are costs in setting up which are retrieved further down the track.

Any letters of protest about this senseless action can be written to: The Town Clerk, Widgee Shire Council, 242 Mary Street, Gympie, Queensland 4570.

---

### *BATS IN THE BELFRY FACE EVICTION. THE TIMES, BRITAIN*

***(edited version)***

High in the rafters of the 13th century country church of All Saints at Mattersey in Nottinghamshire, 2 colonies of bats have made their homes according to John Mills, the church warden. The traditional mythological links between bats and dark forces do not worry Mr Mills and the 489 souls of the village, so much as the bats' unsavoury contributions to Sunday worship. These, he fears may drive the congregation away. "The bishop is going grey. It is not just the droppings but the urine which etches the brass, the wood, everything it touches. Bats are doing enormous damage to the fabric of the church. They can be very active when the priest is celebrating communion".

However, the bat Conservation Trust argues that churches are an important last refuge for many bat species. A survey by the Trust claims that vicars gave bats a resounding 'thumbs up'. The results were based on 2,600 replies from 8,000 questionaries.

The Rev. Ron Wood vicar of St Andrew, a 12th century church in Dorset said churches should delight in their role as guardians of one of God's most maligned creatures. "We have 14th century medieval wall paintings here, but recently we had a bat-flap installed in one of the windows for access and egress. "There are no problems", he says, "I go in in the morning to say my prayers and clean up a bit of bat do. This slight inconvenience is more than recompensed by the privilege of having the bats around."

The Bat Conservation Trust is on 071-240 0933 (Britain).

---

## *COMMENT ON BATS AND ENVIRONMENTAL IMPACT STATEMENTS (EISs)*

***Jillian Snell***

Recently, I scanned several EISs, Barrington Wilderness Area, Guy Fawkes River Wilderness Report, Mt Royal Management Area, Wingham Management Area and Glen Innes Forest Management Area. Bats are considered in all of these.

Nevertheless, my concerns are as follows:-

1. Logging of old growth forests and therefore loss of roosting sites such as hollows in old trees, an important roost site for insectivorous bats (it takes many years for hollows to develop)

2. EIS surveys conducted in an areas where flying-foxes may not be present at that time. During the next season, however, flying-foxes may be present feeding on blossom, which was not recorded as a critical food resource for them. Thus, it would appear analysis of a possible flying-fox food resource should be conducted over an extended period ie. say minimum of 5 years due to the unpredictable nature of our seasons and the irregularly flowering Australian native species.

   Diminishing habitat is forcing these migratory animals to fly further between feeding sites and starvation is a common problem (Les Hall & Greg Richards, Flying-Fox camps, Wildlife Australia, Autumn 1991, 19-22).

   An ongoing monitoring strategy for bats is recommended in one of the EIS documents, hopefully this will be followed through. There is also the other problem of maintaining genetic diversity in forests as flying-fox numbers continue their spiral downward, plus the need for regeneration of popular timber species such as Spotted gum and Forest Red gum.

   "Given the irregular flowering pattern of many eucalypts, such migratory animals may be particularly important as pollinators during years of intensive flowering and greatest reproductive potential".

*Seasonal Movements of Grey-headed Flying-foxes, Pteropus poliocephalus, from Two Maternity Camps in Northern New South Wales, Peggy Eby, (NSW) NPWS, Wildlife Res., 1991, 18, 547-59).*

Thus it is difficult for EISs to accurately gauge the importance of an area of forest for flying-foxes during the next season or even a few years later. Furthermore, the importance of flying-foxes as pollinators and seed dispersers should be taken more seriously by forestry people.

---

***SPECIES PLAN OF MANAGEMENT FOR PTEROPUS IN NEW SOUTH WALES.***

***Peggy Eby, ES & R Branch, NSW NPWS, PO Box 1967, Hurstville NSW 2220***

One of the fundamental responsibilities of the New South Wales National Parks and Wildlife Service is conservation of the native flora and fauna of the state. The Service has recently initiated a program to assemble all available biological information pertinent to management of various species. Reports are being compiled on their biology and status. These reports then form the bases for draft management plans which will be available for public comment. Plans of Management aim to identify strategies and actions which should be implemented to ensure the survival of the species. Species of plants and animals which are at risk, threatened or endangered as well as species which may present a problem to commercial enterprises within the state have been nominated for Plans of Management. Pteropus are among the species the Service has targeted.

While the intention is that the Species Plans of Management will be updated as new information regarding the species comes to light, it is important that the original documents be as comprehensive and considered as possible. In reality, if adopted by the Minister for the Environment, these plans could form the basis for management decisions for many years. It is likely that the process of writing reports and Draft Plans of Management for Pteropus will begin sometime during the next financial year. There are a number of people who have a great deal of experience and understanding of these animals in particular areas of the state or regarding particular aspects of their biology. I hope that the Pteropus Plan of Management will be a co-operative effort. I'd appreciate hearing from <u>anyone</u> interested in participating (to however small a degree) in developing this potentially important document. When a more precise time frame is available, I'll submit another notice.

---

***Molly Crawford, 6 Natalie Place, Kinka Beach, Via Yeppoon QLD 4703***

Jeff Simmons, member of the Bat Society and a cinematographer in his spare time, and myself, are attempting to make a documentary film on the mangroves of the Port Curtis District. This extends from Yandaran (25km north of Bundaberg) northwards to Cape Palmerston National Park (60km south of Mackay). The documentary will include references to fauna found in the mangrove habitat.

In January of this year we became aware of a congregation of Little Red Flying-foxes, Pteropus scapulatus, in mangroves bordering the Causeway lake, south of Yeppoon. Later, by mid February, these had established a camp in the mangroves along Barwells Creek, just north of Yeppoon. It was estimated that there could have been as many as 5000. They had all moved on by the end of February. We hope we have them on film. There is a permanent camp of the Black Flying-fox, Pteropus alecto, in the mangroves of Ross Creek, Yeppoon.

We would be interested to hear whether any members know of camps of the Spectacled Flying-Fox, Pteropus conspicillatus, or of the Grey-headed Flying-fox, Pteropus poliocephalus, in the mangroves of the Port Curtis District.

***HUGH SPENCER ATTENDED THE NORTH AMERICAN BAT RESEARCH SYMPOSIUM WHICH WAS HELD AT THE END OF OCTOBER IN QUEBEC, CANADA, AND PRESENTS HIS OBSERVATIONS.***

The meeting was held in the much refurbished Chateau Frontenac in Quebec City, a beautiful location, largely wasted on the conference participants because the sessions were too interesting and the weather was cold and drizzly.

There were three days of papers and a workshop on bat marking and tracking techniques, and a dinner at a local restaurant, which was mostly notable for the fact that virtually every one of the 250 odd participants chose the salmon (which was very good). Everybody enjoyed the meeting, and it was most certainly one of the most interesting that I have attended.

Compared with Australian bat meetings, this conference was noticeable by the high level of mutual support between the participants that was evident. But a new trend has appeared, which should send shivers of apprehension down many Australian bat researcher's spines - Pteropodid bats are starting to draw the attention and interest of US bat workers. Ironically only some of this derives from field research, the rest is from observations on colonies of flying foxes being kept for endangered species rearing programs. The most important of these is that run by the Lubee Foundation (Louis Baccadi Estate) in Gainsville, Florida. There is much interest in behavioural studies - no doubt triggered by the work of Jack Pettigrew. I noticed a grudging acceptance by some high profile researchers that maybe Pettigrew is right, and one paper was less than supportive of the current DNA techniques used by the US mammalogical fraternity to attempt to unseat Pettigrew's theory of the dual origin of flight in mammals. Much of this interest stems from the fact that these researchers are meeting flying foxes for the first time, and they are realising that they are indeed a totally different type of beast. A t-shirt was being sold, along with much bat-analia, carrying the message "The Great Debate" and showing a flying-fox saying "I'm a bat" and a microbat exclaiming "No, I'm a bat" with a lizard looking on stating "They're both bats!" Bat Conservation International was there, and announced the creation of a major bat research facility in Austin, Texas, a joint effort between BCI and Texas A and M University "International Bat Research and Education Centre".

---

***YELLOW-BELLIED SHEATHTAIL BAT ATTACKS COSSID MOTH.***

***R. Hobson, PO Box 416, Gatton QLD 4343***

On the night of 13th February, 1993 I was spotlighting an area of remnant Brigalow woodland at The Gums, a small township WSW of Tara on the Darling Downs, Queensland. I was in the company of Pat McConnell and Nicki Thompson from Toowoomba and we were there at the behest of the local shire council to conduct a fauna survey of The Gums Reserve, an area under dispute regarding a rezoning proposal of part of that reserve.

Microchiropterans were about in numbers and we were able to "Anabat" several species as well as identify, by call and sight, several Yellow-bellied Sheathtail Bats, Saccolaimuc flaviventris. At one stage, c21.00hrs, we had two of this species highlighted in a pair of spotlights at c15 metres height - clearly recognisable animals. A third party appeared on the scene, slightly smaller in size to the sheathtails and we initially thought it to be a third, and smaller, species of bat. At this stage one of the yellow-bellies swooped upon the interloper and appeared to make contact with same. The victim immediately dived to ground close by and we immediately descended on it, hoping to record another bat species.

Upon inspection, however, the sheathtails victim proved to be a very large moth, later identified as a Cossid Moth, Xyleutes affinis. Close inspection of the insect did not reveal any apparent physical damage and it eventually flew off apparently none the worse for its adventure.

The Cossidae (Wood Moths, Goat Moths) "are robust moths, varying enormously in size from small to very large (wingspan 9 - 236mm), and some are amongst the largest moths known". *Common, I.B.F. "Moths of Australia". Melbourne University Press, 1990.* Xyleutes affinis is one of the largest of the Cossids and would rival some of our microchiropterans in size and weight. It would be quite a meal for a bat such as the Yellow-bellied Sheathtail. The question is posed, "Do these large, cumbersome insects evade capture from highly manoeuvrable and fast predators such as S. flaviventris by immediately going to ground when attacked?" or "Was the moth merely drawn towards the light source on the ground in this instance?" The moth did not appear to be attracted to our spotlights before the bat launched its attack.

---

## *SOURCES OF BAT GEAR.*

***Lindy Lumsden, DCNR P.O. Box 137, Heidelberg 3084 Victoria***

Over the last couple of years I have managed to track down a few sources of all sorts of amazing bat gear. So for others like me that can't resist batty things, try these:

In Australia: Jill Morris and Lynne Tracey, as well as selling their great book 'Australian Bats' (advertised in the last newsletter), also stock T-shirts in various designs, tea towels, bags and jackets. Address:

Book Farm
330 Reesville Rd
Maleny QLD 4552

Overseas:

**Bat Groups of Britain** - sell jewellery, badges, stickers, rubber stamps, cards, kites etc and even a bat clock, as well as a range of British bat books including Phil Richardsons' delightful introductory bat book simply called 'Bats'.

Address: 10 Bedford Cottages
Great Brington
Northampton NN7 4JE
Great Britain

**Speleobooks** - this 34 page catalogue, devoted entirely to things relating to caves and bats, includes some great T-shirts, bags, jewellery, posters, stuffed toys, cards, rubber stamps, and less likely things such as bat door knockers and a bat boomerang! They also sell a wide range of bat books - both general and technical - sometimes at discount prices such as Griffin's classic 'Listening in the Dark' for $6.

Address: Post Office Box 10
Schoharie
New York 12157-0010
USA

**Bat Conservation International** - their catalogue has a wide range of batty things. Address:

P.O. Box 162603
Austin
Texas 78716-2603
USA

BCI hasn't sent me a copy of their recent catalogue (maybe they are trying to save me money!!), but I do have the latest Bat Groups of Britain and Speleobooks catalogues, which I could send people copies of, or they are available from the above addresses.

Happy collecting!

# ARTICLES

## A REVISION OF THE INVENTORY AND ENGLISH NAMES OF AUSTRALIAN BATS

***By Greg Richards*, Les Hall, Glenn Hoye, Lindy Lumsden, Harry Parnaby, Terry Reardon, Ronald Strahan, Bruce Thomson and Chris Tidemann***

* ***Division of Wildlife & Ecology, CSIRO, PO Box 84, Lynehm ACT 2602***

Whilst preparing the second edition of the Australian Museum Complete Book of Australian Mammals, it was essential to update the working list of Australian bats, and in doing so the opportunity was taken to revise the English names for some species. We consider that 70 species of bats are known from Australia, but there are many more in the pipeline for description. Richards and Hall recognised 83 distinguishable forms, whether described or not, as conservation units for use in the draft Bat Action Plan.

As our knowledge base increased and distribution patterns were extended, some English names became inappropriate, and other names had become unsuitable due to taxonomic changes (e.g. *Vespadelus* species could no longer be called Eptesicuses), and other names (such as the Greater Wart-nosed Horseshoe Bat) did not help the public image of the animals, nor did they fit well in database fields! The authors formed a consensus to arrive at new common names that were the most suitable for each species.

In developing new English names, we have taken into account several international conventions, such as renaming hipposiderid species as Leafnosed-bats to distinguish them from the rhinolophids. The *Vespadelus* group (ex *Eptesicus* and then ex *Pipistrellus*) gave the greatest headaches and there is a general lack of consensus on the names offered, so they are primarily the responsibility of the senior author. These are usually quite common bats and either roost in caves or in tree hollows in forest, which gave a major division for their English names, but this concept failed for the inland tree dwellers since there is no forest as such in the arid zone. Alternative names are difficult to conceive, but we are prepared to receive suggestions.

### Family Pteropodidae

| | |
|---|---|
| *Pteropus alecto* | Black Flying-fox |
| *Pteropus conspicillatus* | Spectacled Flying-fox |
| *Pteropus macrotis* | Large-eared Flying-fox |
| *Pteropus poliocephalus* | Grey-headed Flying-fox |
| *Pteropus scapulatus* | Little Red Flying-fox |
| *Pteropus brunneus* | Dusky Flying-fox |
| *Pteropus sp.* | Torresian Flying-fox |
| *Dobsonia moluccense* | Bare-backed Fruit Bat |
| *Syconycteris australis* | Common Blossom Bat |
| *Macroglossus minimus* | Northern Blossom Bat |
| *Nyctimene robinsoni* | Eastern Tube-nosed Bat |
| *Nyctimene vizcaccia* | Torresian Tube-nosed Bat |

### Family Emballonuridae

| | |
|---|---|
| *Taphozous australis* | Coastal Sheathtail Bat |
| *Taphozous georgianus* | Common Sheathtail Bat |
| *Taphozous hilli* | Hill's Sheathtail Bat |
| *Taphozous kapalgensis* | Arnhem Sheathtail Bat |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail Bat |
| *Saccolaimus mixtus* | Papuan Sheathtail Bat |
| *Saccolaimus saccolaimus* | Bare rump Sheathtail Bat |

### Family Megadermatidae

| | |
|---|---|
| *Macroderma gigas* | Ghost Bat |

### Family Rhinolophidae

| | |
|---|---|
| *Rhinolophus megaphyllus* | Eastern Horseshoe Bat |
| *Rhinolophus philippinensis* | Greater Horseshoe Bat |

### Family Hipposideridae

| | |
|---|---|
| *Hipposideros ater* | Dusky Leaf-nosed Bat |
| *Hipposideros cervinus* | Fawn Leaf-nosed Bat |

| | |
|---|---|
| *Hipposideros diadema* | Diadem Leaf-nosed Bat |
| *Hipposideros semoni* | Semon's Leaf-nosed Bat |
| *Hipposideros stenotis* | Northern Leaf-nosed Bat |
| *Rhinonicteris aurantius* | Orange Leaf-nosed Bat |

**Family Vespertilionidae**

| | |
|---|---|
| *Myotis adversus* | Large-footed Myotis |
| *Myotis sp (nr australis)* | Small-footed Myotis |
| *Pipistrellus adamsi* | Cape York Pipistrelle |
| *Pipistrellus westralis* | Northern Pipistrelle |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle |
| *Fal sistrellus mckenziei* | Western False Pipistrelle |
| *Vespadelus pumilus* | Eastern Forest Bat |
| *Vespadelus caurinus* | Western Cave Bat |
| *Vespadelus regulus* | Southern Forest Bat |
| *Vespadelus vulturnus* | Little Forest Bat |
| *Vespadelus darlingtoni* | Large Forest Bat |
| *Vespadelus douglasorum* | Yellow-lipped Bat |
| *Vespadelus troughtoni* | Eastern Cave Bat |
| *Vespadelus baverstocki* | Inland Forest Bat |
| *Vespadelus finlaysoni* | Finlayson's Cave Bat |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat |
| *Scotorepens balstoni* | Inland Broad-nosed Bat |
| *Scotorepens greyii* | Little Broad-nosed Bat |
| *Scotorepens orion* | Eastern Broad-nosed Bat |
| *Scotorepens sanborni* | Northern Broad-nosed Bat |
| *Chalinolobus dwyeri* | Large-eared Pied Bat |
| *Chalinolobus gouldii* | Gould's Wattled Bat |
| *Chalinolobus morio* | Chocolate Wattled Bat |
| *Chalinolobus nigrogriseus* | Hoary Wattled Bat |
| *Chalinolobus picatus* | Little Pied Bat |
| *Miniopterus schreibersii* | Common Bent-wing Bat |
| *Miniopterus australis* | Little Bent-wing Bat |
| *Murina florium* | Tube-nosed Insect Bat |
| *Kerivoula papuensis* | Golden-tipped Bat |
| *Nyctophilus timoriensis* | Greater Long-eared Bat |
| *Nyctophilus geoffroyi* | Lesser Long-eared Bat |
| *Nyctophilus gouldi* | Gould's Long-eared Bat |
| *Nyctophilus arnhemensis* | Northern Long-eared Bat |
| *Nyctophilus bifax* | Eastern Long-eared Bat |
| *Nyctophilus howensis* | Lord Howe Island Bat |
| *Nyctophilus walkeri* | Pygmy Long-eared Bat |

**Family Molossidae**

| | |
|---|---|
| *Tadarida australis* | White-striped Freetail Bat |
| *Chaerephon jobensis* | Northern Freetail Bat |
| *Mormopterus beccarii* | Beccari's Freetail Bat |
| *Mormopterus loriae* | Little Freetail Bat |
| *Mormopterus norfolkensis* | Eastern Freetail Bat |
| *Mormopterus planiceps* | Southern Freetail Bat |

## *A REVIEW OF THE AUSTRALIAN ACTION PLAN FOR BAT CONSERVATION*

***By Greg Richards (Division of Wildlife & Ecology, CSIRO, PO Box 84, Lyneham ACT 2602) and Les Hall (Dept of Anatomical Sciences, University of Qld, St Lucia Qld 4067)***

### Introduction

The Endangered Species Unit of the Australian National Conservation Agency (ex Australian National Parks and Wildlife Service) supported the development of Action Plans for all vertebrate groups in Australia, in an effort to pinpoint the conservation needs of our fauna and to direct the future funding of plans for their recovery. Nearly two years ago we were given the task of preparing an Action Plan for bats, which resulted in a 200 page report that is briefly summarised below.

The Bat Action Plan opened a can of worms larger than we expected, because as we well know, relatively little is known about this faunal group compared with others in Australia. In the case of many species it was difficult to determine whether they were declining or not, whether they were in fact threatened, or whether the rarity of some was simply an artifact of their difficulty of capture. The greatest problem, however, was that we did not know exactly how many species we had in this country.

### Revision of the national species inventory

Upgrading the national species inventory was therefore our first task, and we were confronted with a list of formally named species, plus the knowledge that more were in the pipeline for description, complicated further by our suspicions that several species were in fact complexes that would produce more forms when the were examined closely. We decided to amalgamate the lot, following the strategy of conserving 'evolutionary units', and hopefully preparing for future taxonomic revisions when funding becomes available. Our list exceeded 80 forms, which is a far cry from the 60 or so previously known, making bats the most species rich order of mammals in Australia, and now constituting one-third of the land mammal taxa.

Some of the additions to past inventories will be of interest. After re-examination of the skull that is the only type material for the Lord Howe Long-eared Bat (*Nyctophilus howensis*), and after discussions with the collector, we concurred that the skull was not of sub-fossil age as previously concluded, but was probably 50-100 years old. We assume that the species is extinct, and probably died out soon after the inadvertent introduction of Ship Rats to the island in 1918.

The oscillation of the Dusky Flying-fox (*Pteropus brunneus*) on and off other inventories presented a vexing problem. Was it actually a good species? Why hasn't it been seen for so long? Luck was with us when Pamela Conder offered to check the only known specimen (the type) in the British Museum, and although its integrity as a species was confirmed, she suspected that the type locality may not actually be in Australia. However, until resolved otherwise, we have no choice but to retain this species in the Australian fauna.

We concluded that both the above island species are now extinct.

**Diagnosis of rare and threatened species**

In this major analysis we diagnosed the species that may need recovery planning by using three methods: an analysis of rarity, a subjective assessment to elucidate threatened species, and the application of the standard criteria that IUCN uses for determining species that may be threatened.

To analyse species rarity, we compiled a database of most of the distribution records available for bats in Australia. Most of the museums assisted with data and many personal observations from colleagues were also included, giving nearly 52,000 records to analyse. Initially we assumed that the proportion of records for each species would give a comparative estimate of rarity, but this would not have accounted for the difficulty in obtaining information on some species. We therefore weighted the number of database records for each species by a factor that indicated their degree of difficulty of capture, and were able to produce a 'relative rarity index' for each species in the database. Almost 25% of our species were classified as rare.

To determine which species were threatened, we used a system devised by Dan Lunney, Harold Cogger and Chris Dickman to evaluate threats to mammals in New South Wales. Their proforma numerically weighted parameters such as population sizes and declines, declines in distribution patterns, the extent of threats and potential for recovery, and ecological specialisations. We extended the proforma to apply at a national level, and this allowed us to devise a numeric index of our subjective assessments.

We then applied IUCN threat criteria to each species, resulting in a group of 37 that required conservation planning to various degrees. Interestingly, the prioritising of each species by their subjective assessment points closely followed their IUCN ratings. Two species were listed as *Extinct*, 3 as *Endangered*, 8 as *Vulnerable*, 13 as *Rare*, and 11 as *Insufficiently Known*. Research to either recover or reassess the status of these species has been proposed, exceeding several million dollars in estimated cost. However, as well as identifying single species with conservation problems, we could also identify quite a few problems on a national scale.

### National conservation research proposals

As the development of the Action Plan proceeded, several high priority lines of research became obvious. The most vital of these was to resolve the taxonomy of species in IUCN threat categories. As outlined above, our list of conservation (or evolutionary') units contains a considerable number of species that are awaiting description, a task that befits a full-time taxonomist with resources available, rather than part-timers working on a shoestring budget. Without this research, we will not know exactly what species we are dealing with, and where they are distributed, and what threats to their survival are likely. A short list of fourteen urgent projects was compiled.

Among the other projects proposed are surveys of distribution patterns of particular species groups, targeting areas for survey of Endangered and Vulnerable species, public education, some research on Flying-foxes In the last of the priority projects we proposed that a conference be held in 5 years time to review the results of the Action Plan, in an effort to guide future research funding during a second phase.

### Regional conservation analyses

One of the current strategies in fauna conservation is to preserve biodiversity, and this is rapidly becoming a global obligation. From past experience we knew that some areas were species richer than others in Australia, and using Geographic Information System (GIS) technology, with the help of Paul Walker and Bob Smyth from CSIRO, we were able to pinpoint such areas by operating on the database compiled for the purposes outlined above. However, it soon became obvious that analysing the distribution patterns of flying mammals was quite different to that for most ground mammals. The capture point for some bats (such as Flying-foxes) would merely indicate their use of space within, say, 30 km, whereas for other species their foraging area may be only 5 km. Hence we devised a foraging range variable for analysis with the GIS, that was based on known information for some species, and predicted for others based on their flight morphology.

We first tested the use of this concept by just analysing the Cape York Peninsula region, a test case prior to the national analyses. Our objective was to identify areas of high diversity, and to see if they would also constitute key conservation areas. The first GIS operation was to place a grid using the 1:100,000 mapsheets over the study area, then averaging the number of species in each and in their adjoining mapsheets, and then mapping the averages in five classes of species richness, where the maximum in any area was 25. The rainforested areas surrounded by eucalypt forests and woodlands proved to have the highest diversity, and included Iron Range, Cooktown, and the Atherton Tableland.

To target key conservation areas, we decided that in an area the size of Cape York Peninsula, the minimum set of areas required would be those that would support species with their distribution restricted to Cape York, species that were rare in the region, and those that showed some form of ecological specialisation (such as to roosts, or in their foraging). Eleven areas were identified, all of them were also high in their species richness, with the top five mapsheets being Cape Weymouth, Atherton, Coen, Helenvale and Cooktown.

Having achieved our goal at a regional level, we were then better placed to conduct the national analyses, and had developed techniques peculiar to analysing bat faunas, and at a regional level.

### National conservation analyses

A new can of worms opened when we moved to this level, and we were faced with data that was apparently biased in its sampling - for example, many database records came from the populated east coast, and the deserts were sparse in their information. With the knowledge that the more effort one spends in surveying bats then the more species that are likely to be found, would our results be biased and (perhaps) incorrectly show that species richness was highest in areas with the most intensive levels of survey? Not so, using a grid of over 3000 of the 1:100,000 topographic mapsheets as grid cells, a correlation analysis of the number of observation records against the number of species per mapsheet showed that there was no relationship between the two variables.

The level of surveying across the nation was very poor, with over 90% of mapsheets having none or just a few records. Surveying effort was highest in Victoria, where the state government has funded large surveys, as well as in parts of Cape York Peninsula, Western Australia, and coastal New South Wales. The fact that only 10% or so of Australia has some information is symptomatic of the amount of attention to bat research in the past. This situation is even worse if one takes the arbitrary value of 100 records of bats per mapsheet (each of which covers 2500 km2) as the minimum required to analyse distributions, habitat requirements, etc, then about 3% of Australia (or 240,000 km2 out of 7,560,000km2) has been surveyed at this level.

Having been shown by the correlation analysis that we could safely analyse which areas had the greatest species richness, we were able to show that the states with tropical habitats had some areas (mapsheets) supporting the greatest species diversity. Using the data that was available to us, we were able to identify fourteen areas that supported twenty or more species, the top few being Coen, Atherton, Bayfield (Shoalwater Bay area) and Mossman, all in Queensland. However, only 0.1% (or 58,000 km2) of Australia supports 20 species or so.

**Critical conservation areas**

Are there areas in Australia that are vital for conserving our total bat species diversity? Knowing that it is difficult to obtain land for reserves, what is the bare minimum amount required to preserve a single population of each species? To answer these important questions, we conducted a Critical Areas analysis, something that had been done for butterflies in Britain and applied to Fruit bats worldwide.

The first consideration was to conserve species endemic to Australia, and 46 were identified. Some of these were distributed nationally, others were restricted to just one 1:100,000 km mapsheet, the next consideration being to target areas for reserves that contained populations of the latter. Three species were found on only one mapsheet, and a reserve there would conserve them. However, any such reserves would obviously conserve other bat species, for example, the Kapalga mapsheet would not only conserve the White-striped Sheathtail Bat (*Taphozous kapalgensis*) but would conserve ten other species (endemic or not) as well. This proved to be a valuable consideration for endemics that were found on two or more maps, and a choice had to be made to place a reserve area in only one of them, where the mapsheet with the highest number of other species would be chosen. The analysis showed that only fifteen areas in Australia were required to conserve all our endemic species, and all other species as well. Over 50 species were represented twice or more on the 15 mapsheets selected.

By using the 1:100,000 mapsheet grid in our analyses, we were able to check the paper map itself and determined that of the 15 'critical conservation areas', 7 already contained reserves. For the 8 remaining areas, only three state governments would need to create reserves to complete the network of critical areas that were identified: 1 in New South Wales, 2 in Western Australia, and 5 in Queensland.

## *A ROOSTING COLONY OF THE NORTHERN MASTIFF-BAT* CHAEROPHON JOBENSIS *AT DERBY, WESTERN AUSTRALIA.*

*L. F. Lumsden1, P. D. Johnstone2 and I. D. Temby1*

1. *Department of Conservation and Natural Resources, 123 Brown St. Heidelberg Vic. 3084.*
2. *Point Nepean National Park, P.O. Box 117, Sorrento Vic. 3943.*

The roosting habits of the Northern Mastiff-bat *Chaerophon jobensis* are not well known, and few roost sites have been reported. Roosts are normally in hollow tree spouts, but colonies have also been recorded using buildings (Richards 1983), and a rock overhang (Begg and McKean 1982). Observations are presented here of a roosting colony of *C. jobensis* in the jetty at Derby, W.A.

On 20 July 1988 at 1400 hr, audible social bat calls were heard from the Derby jetty. On investigation, it was found that individuals of *C. jobensis* were roosting in the pylons of the jetty's free-standing wooden buffer.. The weather was sunny and the temperature was approximately 25oC, with a small amount of cloud and a moderate breeze.

The Derby jetty was updated in the 1960's as a wharf for transporting live cattle overseas. The last commercial ship visited in 1983. The jetty is made of concrete and steel. It is U-shaped, with the seaward edge approximately 200 m long and facing north-west. This edge is protected by a wooden buffer which consists of 104 individually numbered pylons, 1.5 m apart. These are connected by cross members and cross braces approximately 1 m wide (Fig. 1). Most pylons have a fender which consists of a vertical rubbing block extending from the waterline to the top of the pylon. As a result of being exposed to the weather these fenders have twisted and warped, and the pylons have started to split, creating gaps up to 40 mm wide.

Between 1400 and 1630 hrs, all 104 pylons were checked. Sixty-six bats were counted roosting in 25 pylons, in group sizes varying from one to seven (Table 1). Because the bats could retreat into gaps that were not visible, these counts are a minimum. For example, in another seven pylons bats could be heard but not seen.
One bat was extracted from its roost to confirm the species' identity. It was an adult male *C. jobensis* with a forearm length of 50.7 mm.

At this time the bats were active, with considerable calling and movement within the roosts. The bats were generally roosting in gaps 20 - 30 mm wide (i.e. not much wider than the depth of the body of the bat): wider gaps (over 30 mm) were not observed to be used. Tidemann and Flavel (1987) found that several species of vespertilionids and molossids selected roost sites where the entrances and cavities had one dimension minimally wider than themselves. Many of the *C. jobensis* were roosting in gaps between the pylon and the vertical fender, while others were in cracks within the pylons or in gaps between the pylons and the cross braces. The vertical fenders were only 270 mm wide, allowing considerable light into the gap between the fender and the pylon. There was sufficient light to enable most of the bats to be seen readily without the aid of a torch, but they were not in direct sunlight. There was less light where bats were in cracks in the pylons. Many cracks within pylons were not visible and bats retreated into these when disturbed.

The bats were all roosting on vertical surfaces, mostly head down but some were upright. Those located behind the vertical fender were roosting directly over the water. It was quite moist in this space and the fur of many bats was damp. All the bats were roosting at, or above, the height of the crossbrace (with the exception of one group that was about one metre below the crossbrace). The tide fluctuates greatly at Derby and the height of the bats above the water is likely to vary from 2 to 11 m. The buffer, being free standing, swayed sideways with the tidal current, but the bats did not appear to be disturbed by this.

That evening, an attempt was made to observe the bats leaving the roosts. At 1730 hrs (shortly before sunset) there was much audible calling. None were seen to leave; however the calling had decreased markedly by 1815 hrs. By 1830 hrs, when calling had ceased, the pylons were checked and no bats were observed. It appears that the bats left the roosts by dropping downwards and then flying towards the shore, under the jetty. No bats were seen to fly out from the jetty over the water. A band of mangroves lines the shore behind the jetty. *Chaerophon jobensis* forages extensively in mangrove communities in the Kimberley (McKenzie and Rolfe 1986), and has been recorded in the mangroves at Derby (N. McKenzie pers. comm.).

The next morning between 0840 and 1050 hrs, all the pylons were checked again. Very few audible calls were heard, and some of the bats appeared to be asleep. Although this search was more thorough than during the previous afternoon, fewer bats were observed, suggesting that they had retreated further into the cracks in the pylons. Many locations where bats had been seen the previous afternoon were now in direct sunlight, and were not occupied. In all but one pylon (in which 6 bats were seen) from one to three bats only were visible (Table 1).

On the afternoon of 4 August 1988, bats were heard calling and were observed (by IDT) in a number of pylons. They were identified as large molossids, although it was not possible to catch any. Shortly after sunset, two large bats flew from the direction of the roost, calling loudly as they headed towards the land, passing the observer some 60 m from the roost site, near the northern end of the jetty.

Bats were still present at the site on 5 June 1989, but they were only heard calling from a few pylons (R. and V. Lumsden pers. comm.)

*Chaerophon jobensis* has previously been recorded roosting in large colonies (e.g. Richards 1983). Sixty-six bats were observed at the Derby jetty colony: other bats were heard but not seen, and were therefore not counted. There was also many other roost sites into which we could not see, so the colony is likely to be larger than this count indicates. Given the paucity of information on the breeding biology of *C. jobensis* (N. McKenzie, pers. comm.) this site would appear to be ideal to study this species. The social organisation within this colony, having at least 40 separate roost sites, would also be of interest. The site has probably only become suitable as a roost since commercial shipping ceased in the early 1980's. As the wooden buffer weathers further, many of the cracks and gaps currently used may become too large to be suitable as roost sites. New cracks are likely to form, but the roost probably has a limited life.

We would like to thank Andrew Bennett for commenting on this note.

**REFERENCES**

Begg, R. J. and McKean, J. L. (1982). Cave dwelling in the molossid bat *Tadarida jobensis colonicus*. *Northern Territory Nat.* 5: 12.

McKenzie, N. L. and Rolfe, J. K. (1986). Structure of bat guilds in the Kimberley mangroves, Australia. *J. Anim. Ecol.* 55: 401-20.

Richards, G. C. (1983). Northern Mastiff-bat *Chaerophon jobensis*. p 321. In 'The Australian Museum Complete Book of Australian Mammals'. Ed. R. Strahan. Angus and Robertson, Sydney.

Tidemann, C. R. and Flavel, S. C. (1987). Factors affecting choice of diurnal roost site by tree-hole bats (Microchiroptera) in south-eastern Australia. *Aust. Wildl. Res.* 14: 459-73.

Fig. 1 The structure of the wooden buffer of the Derby jetty.

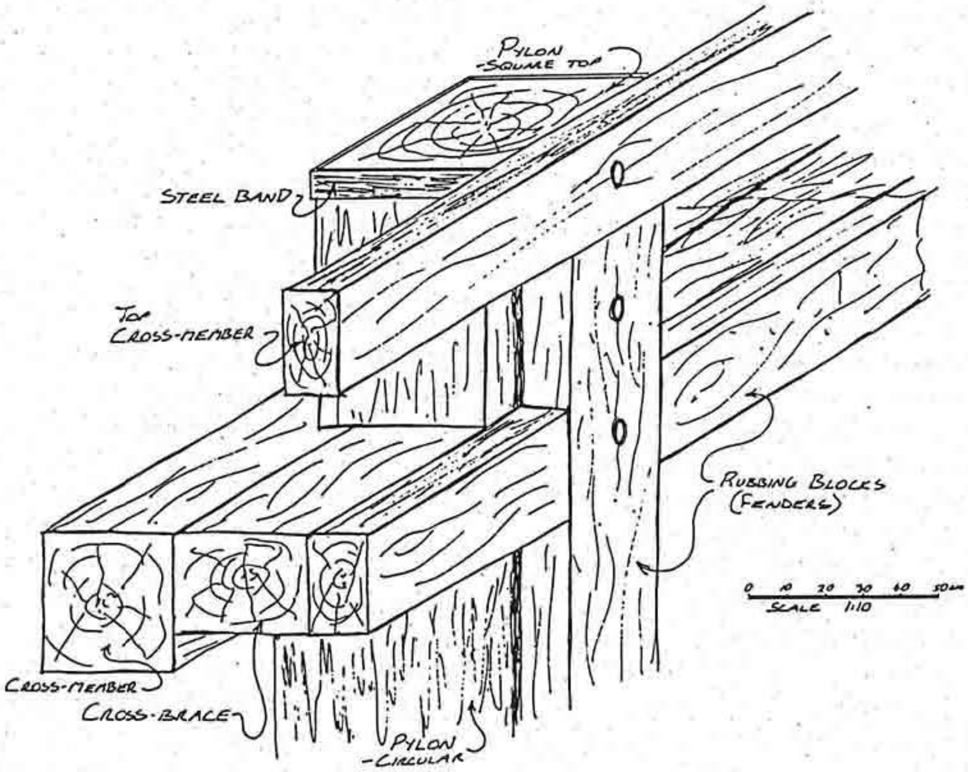



Table 1. Minimum group sizes and pylon usage of *Chaerophon jobensis* at the Derby jetty.

| | | 20/7/88 Afternoon | 21/7/88 Morning |
|---|---|---|---|
| **Group size:** | 1 | 7 | 9 |
| | 2 | 10 | 2 |
| | 3 | 3 | 7 |
| | 4 | - | - |
| | 5 | 1 | - |
| | 6 | 3 | 1 |
| | 7 | 1 | - |
| No. of bats seen | | 66 | 40 |
| No. pylons where bats seen | | 25 | 19 |
| No. pylons where bats heard only | | 7 | 2 |
| Total no. pylons in use | | 32 | 21 |
| No. pylons where bats present both checks | | 15 | |
| Total no. pylons used | | 40 | |

## *NOTES ON RECORDING REFERENCE SEQUENCES OF BAT ECHOLOCATION CALLS AND BAT ACTIVITY AT DIFFERENT HEIGHT LEVELS.*

***Alex Kutt, Department of Conservation and Natural Resources, PO Box 260, Orbost, Victoria, 3888.***

### Ultrasonic Bat Monitoring

The development of bat capture techniques, particularly the harp trap, has progressed steadily over the years with improved designs and quality (Constantine 1958; Tuttle 1974; Tidemann and Woodside 1978). But as with most direct trapping methods, the results rely on the behaviour of the target animal, the researchers' skills as a biologist and good luck. Though harp traps have a capture success rate up to ten times greater than mist nets (Tidemann and Woodside 1978), they generally only capture a small percentage (30-80%) of passing bats (Kunz and Kurta 1988). Observations of harp traps placed in flight paths indicate that as little as 5-10% of passing bats may be captured (L.Conole pers.comm.2). Furthermore, most high flying canopy and above canopy foraging species are also missed (Richards 1992) as they concentrate their activity in levels above where a harp trap is usually placed.

Recording bat presence and activity by detecting species specific high frequency echolocation calls with ultrasonic bat detectors seems an attractive and easy alternative. The main advantage of the technique is that it is not reliant on capturing the bats themselves. In North America and Europe, detectors have been a relatively common research tool since the 1970's (Kunz and Brock 1975; Anderson and Miller 1977), but Australian researchers seem to have been slower in embracing the methodology (Woodside and Taylor 1985; Crome and Richards 1988; Richards 1992). This point may be debatable. The expense of the detecting equipment and lack of Australian products were probably major disincentives for their use, but with the availability of cheap, reliable local detectors (e.g. AnaBat II detectors, David Titley Electronics, Ballina N.S.W.), they should become accessible to all researchers. As Richards (1992) points out, the combination of both harp traps, mist nets and detectors will provide the most accurate inventory of bats for a particular area, as the techniques compliment each other (e.g. traps and nets capture bats with a low detectability; detectors record bats with a low capture rate).

Over the summer of 1992-93, I examined habitat utilisation by vertebrate species in thinned, unthinned (30 yr ) and mature (>30 yr) lowland forest regrowth (Kutt et.al. in prep). Incorporated in this was a survey of bat activity at each treatment site using ultrasonic detectors. A number of issues regarding the interpretation of recorded call sequences became apparent during the survey. In particular the questions: at what resolution should the data be interpreted (as an index of bat activity by counting number of passes or to identify species also), and are the detections from a recorder placed at ground level representative of bat activity for an area?

### Bat Activity at Different Levels

The easiest place to position a recording device when working in the field is at ground level. Though detectors quite often have a range of up to 30m or more, in more closed canopies their range for certain species is sometimes reduced. Species with a high call intensities emitted at low frequencies may not be affected, but species that call at a low intensities and at a high frequency may have a reduced range of detection (Fenton and Bell 1981). This may be accentuated by the fact that bats foraging in enclosed forest canopies are more likely to use low intensity calls (Hill and Smith 1984). Thus these species that are utilising the canopy (>30m) and areas above to forage may not be recorded. This is important in survey design and the interpretation of results since it has been demonstrated in Queensland that different assemblages of bats differentially utilise gaps and closed canopy areas in the forest (Crome and Richards 1988).

As a simple experiment , I decided to simultaneously record activity of bats in a commonly used flight path, using one recorder at ground level and another mounted 12m directly above it. The site was located in mature Eucalyptus sieberi regrowth, (Hippo Track, West Bemm Forest Block, East Gippsland, Victoria), with a maximum canopy height of about 30m. The canopy itself was relatively enclosed, with a cover of roughly 30-50%. Anabat II detectors were used to simultaneously recorded activity for 40 minutes at each height. Two sets of recordings were taken at the site at each height. The total number of passes and the proportion of each species activity for the total number of passes for that species were then determined (Table 1).

**Table 1**: The number of passes and relative proportion of bat species recorded simultaneously at different detector heights, Hippo Track, West Bemm Forest Block, East Gippsland, Victoria.

| | **Detector on Ground** | | **Detector at 12m** | |
|---|---|---|---|---|
| **SPECIES** | **Passes** | **Proportion** | **Passes** | **Proportion** |
| *V. vulturnus/regulus* | 40 | 0.93 | 3 | 0.07 |
| *C. darlingtoni* | 12 | 1.0 | 0 | 0.0 |
| *C. morio* | 3 | 1.0 | 0 | 0.0 |
| *Nyctophilus sp.* | 4 | 0.4 | 6 | 0.6 |
| *S. orion* | 6 | 0.32 | 13 | 0.68 |
| **TOTAL** | 65 | 74.7% | 22 | 25.3% |

Given that it is probable that some of the bats recorded at 12m were also recorded by the detector placed on the ground, the results are nevertheless quite interesting. Rather than discuss in detail the reasons for the pattern seen (mainly as the trial was simple and not repeated), a few simple trends are suggested:

(i) Bat detectors at ground level may inventory more species. They recorded all species detected with the recorder placed at 12m, as well as other, possibly low level foraging, species.

(ii) Conversely, detectors placed at higher levels in the canopy, miss the lower flying species (*V.darlingtoni, C.morio*), but record larger numbers of the higher canopy foragers (*S.orion*) & gleaners (*Nyctophilus sp*).

It should be noted however that the species recorded are all subcanopy foragers, and the bias of the results may be attributed to this (i.e. these species were all probably active in the area below the recorder mounted at 12 m). If above canopy species such as molossids were present, the results may have differed.

Bat detectors set at ground level and set in flight paths may be adequate for inventory surveys in an area with a relatively open canopy. But caution might need to be taken when inferring bat activity or presence from recorders at ground level, when the canopy is more enclosed. Crome and Richards (1988) suggest that closed vegetation may affect the ability of ground mounted recorders to record all species flying over a forest canopy and also comment on the need for investigation into canopy mounted recorders for recording activity at different levels. Overall the variability between bat numbers and species at different levels deserves to be examined further.

**Recording Reference Calls**

The second issue of concern is the level of resolution at which recorded sequences of bat vocalisations should be taken. The options are either at a diagnostic level for identifying the presence or activity of different species in varying habitats (Coles and Guppy 1989; Corben 1989), or more simply by using number of passes as an index of activity in different habitats without using the recorded echolocatory sequences to identify the species present (Brown *et.al.* 1990).

Local call sequences are essential for the correct identification of bat species being recorded in an area of survey as regional or geographic differences in echolocation sequences of the same species may occur (Harry Parnaby pers.comm3.). The physical environment of foraging area, the ambient climatic conditions and the sex, age and health of the bat itself may also influence the types of search calls used. I have noted that for bats released the following night after capture, late at night or when temperatures are markedly different to those when caught, recorded call sequences for the same species can vary. Bats alter their calls during the search, approach and terminal phases when foraging (Hill and Smith 1984). Obviously the most commonly encountered call in free flight, or all the variations of the sequence must be known in order to confidently predict species presence. The problem that leads directly on from this is how does one successfully record reference sequences of bat species for the area of study so they will accurately reflect the calls recorded in free flight during a survey?

A number of different methods for recording reference sequences of bat calls from animals in a local area can be used. The most common technique is to capture a bat in a harp trap or mist net, identify them, and then record the echolocation calls on release. An occasional problem with this technique is the bat failing to call on release until it is out of range, or emitting sequences that may not be indicative of its typical calls used when foraging.

Alternative techniques that have been suggested are to record the echolocation calls of a bat in free flight and then to shoot it for identification purposes (G.Richards pers.comm4.), or to mark captured and identified bats with luminescent tags and record their calls as they fly about after release (L. Lumsden pers.comm.5). Both these techniques have limitations. The shooting technique seems a bit impractical* and recording the calls of tagged bats relies on the bat remaining in the area after release. Where roost sites are known for some species, calls can be recorded as the bats leave and move about in the immediate vicinity.

In attempting to record reference sequences in my study area, I utilised three techniques for recording calls; two traditional techniques and one innovative method. The sequences produced were of a mixed quality and success. Notes and comments on each method follow, and the examples of recorded calls are all from *Vespedalus vulturnus*.

(1) Recording calls in a confined space. Initially I released trapped bats into a confined space (a hallway or enclosed room, dimensions 5mx1m and 3mx3m respectively). The calls recorded

and analysed produced patterns that were of rapid frequency modulated (FM) sweeps of steep, long bandwidths (Fig.1). These are unlike echolocation calls encountered in natural conditions and reflect the bat modifying its call due to the confined space or strange situation (Hill and Smith 1984). The use of broad FM sweeps provides highly discriminated and detailed information for the bat, especially in terms of position and surface detail (Fenton 1982). The pattern may also represent some echo being recorded from a small enclosed area.

(2) Recording calls in free flight on release. All bats were recorded on release after trapping. This method seemed to provide the most realistic representation of a bat in free flight (Fig.2), though a large volume of bats trapped and released were needed to obtain good sets of sequences for analysis, as many flew out of range before emitting any calls. One interesting call pattern often recorded when a released bat circles above the canopy, is reproduced in Figure 3. Note the characteristic dual pulse with a truncated steep FM component and a longer shallow FM component. It is similar, (but at a higher frequency), to the pattern commonly seen in the echolocation calls of *Chalinobus gouldi*, a slow flying, open canopy foraging species (Dwyer 1965). These long, shallow FM components, (approximating a more constant frequency pulse), possibly have the ability to increase the maximum range of echolocation (Young 1989). In this case, the call may represent an orientation sequence for the bat, locating large familiar objects (using a low repetition, shorter bandwidth call as detail is not required) or a long range, open area foraging sequence.

(3) Recording calls with bats on a cotton harness. In an attempt to keep bats within range when recording calls on release after trapping, I experimented in recording calls of bats restrained by a loose cotton harness looped around their necks. When the bats were released, the cotton was fed out from a loose pile on the ground until the bat was 5-10m away, and then with just slight restraint , it could be encouraged to circle overhead. The bats would often land on the ground after a few minutes, or the cotton could be slowly pulled in so the bat circled close to the handler and recaptured easily. The technique worked best on the smaller and slower flying bats (*Vespedalus spp, Nyctophilus spp, Chalinobus morio*). Larger bats (*Falsistrellus tasmaniensis, Miniopterus schreibersii, Myotis adversus, Scotorepens.orion*), usually flew in a straight line to the end of the cotton too quickly and landed without circling, but a few sequences were still recorded. An example of a call recorded on a cotton harness is provided in Figure

4. The frequency of the many of the sequences recorded on the harness are higher than those recorded in free flight and may be more like those recorded in a confined space (steep FM component with a shallow tail). These echolocation calls may be indicative of a bat under stress. Other recorded sequences recorded matched calls of bats in free flight suggesting that the method is worth further investigation.

I think the main conclusion to be drawn is that bat call sequences are very variable under different conditions, and caution is still needed in the interpretation of bat echolocation sequences. Once again I don't offer any solutions to recording calls, but rather provide some information that will hopefully promote thought and discussion. The most accurate way of recording ultrasonic bat sequence calls still seems to be in free flight directly after release, although there is strong support for using sequences from shot samples (G. Richards pers.comm.). This brings me to my final point.

**Australian Register of Bat Ultrasound Sequences (ARBUS)**

What became apparent to me during my attempts to come to grips with the variability and difficulties in recording type sequence calls, was the lack of reference material to guide my pursuits. Science by nature is meant to be altruistic, but this is sometimes not the case and the pursuit of the golden truth is often a lonely affair.

Therefore, it occurred to me that a register of Australian ultrasound sequences would be a useful and productive institution that would not only promote research into bat calls, but on bats in general, one of the more poorly studied taxonomic groups apart from invertebrates. There must be hours of recorded sequences sitting in a variety of cupboards,shelves and hard disc drives all around Australia that could be lodged or filed.

The concept basically is that an individual or institution could volunteer to keep a register on computer of sequences provided by individuals from around Australia. Researchers could then send blank disks to the Library and receive species call files on that disk for their own use. All information lodged would still remain the property of the person contributing the calls, and naturally could not be used in publications without the permission of the "owner" of that sequence. A small fee for the service could be charged and this would contribute to the overheads of such a venture. I haven't really thought in detail about the costs or feasibility of such a scheme, however I'm looking for a bit of feedback first. Any interested parties or institutions could contact me for further discussion or comment at BIOSIS Pty.Ltd. 322 Bay St, Port Melbourne, Victoria, 3207. Ph.(03) 646-9499 or 882-0111.

Greg Richards advises that a centralised registry of reference calls is one of the projects that he and Les Hall proposed in the Bat Action Plan. Perhaps now is an opportune time to launch this registry.

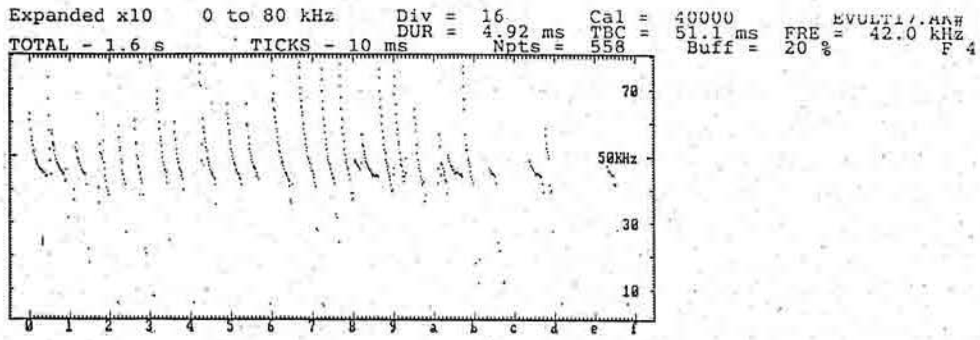



**Figure 1** Call sequence of *V.vulturnus* in a confined space.

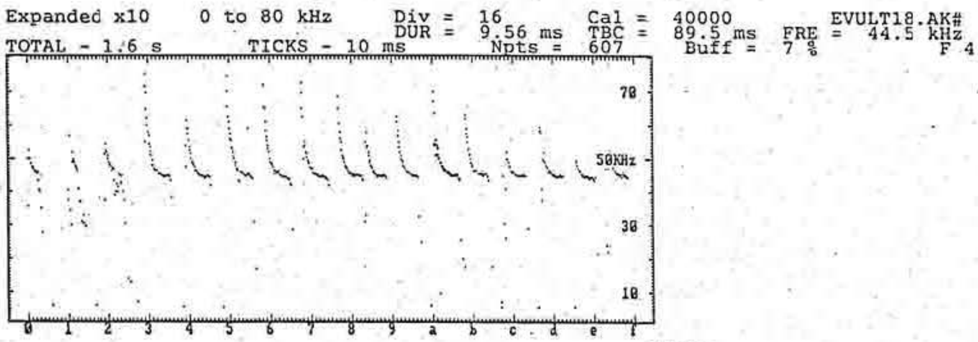



**Figure 2** Call sequence of *V.vulturnus* in free flight indicating common search pattern.

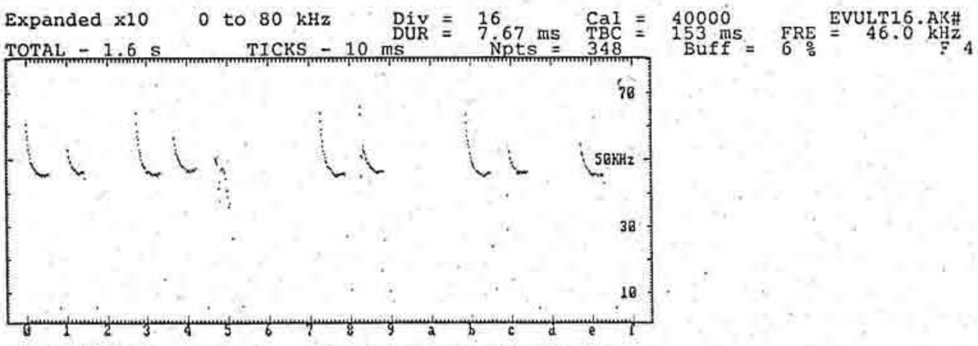



**Figure 3** Call sequence of *V.vulturnus* in free flight indicating dual pulse pattern.

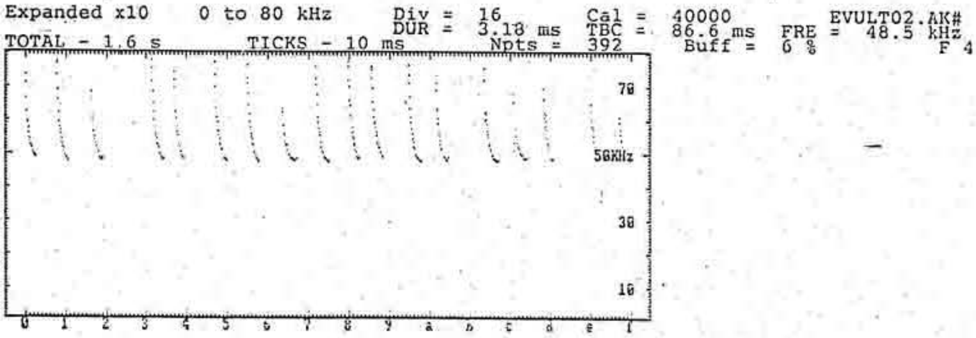



**Figure 4** Call sequence of *V.vulturnus* on cotton harness.

## ACKNOWLEDGMENTS

I would like to thank the following for their contributions; Lawrie Conole, Stephen Henry and Jeanette Kemp for reviewing this article and providing useful and expert comment; Tony Mitchell for help with field work and for constantly listening to my odd ideas; Harry Parnaby and Lindy Lumsden for providing some echolocation reference sequences and information on recording bat calls. Greg Richards for providing expert and insightful comment on many aspects of this note.

Many thanks to the anonymous referee whose comments improved this note immensely.

This work was conducted while employed by the Victorian Department of Conservation and Natural Resources, Orbost Region, and their assistance is gratefully acknowledged. All trapping and handling of bats was carried out in accordance to The Department of Conservation and Natural Resources Wildlife Act 1975 Research Permit No.RP-92-046.

### References

Anderson, B.B. and Miller, L.A. 1977 A portable ultrasonic detecting system for recording bat cries in the field. Journal of Mammalogy. 58, 226-229.

Brown, G.W., Cherry, K.A., Gilmore, A.M, Meggs, R.A, Milledge, D.R., Morris, B.J. and Nelson, J.L. 1991 Use of thinned and unthinned eucalypt forest by vertebrates. Technical report no.18. Management of Eucalypt Regrowth in East Gippsland. Department of Conservation and Natural Resources.

Coles, R.B. and Guppy, A. 1989 Identification of Australian bats by echolocation calls. Macroderma. 5, 7.

Constantine, D.G. 1958 An automatic bat-collecting device. Journal of Wildlife Management. 22, 17-22.

Corbin, C. 1989 Computer based call analysis for microbat identification. Macroderma. 5, 7.

Crome, F.H.J. and Richards, G.C. 1988 Bats and gaps: Microchiropteran community structure in a Queensland Rainforest. Ecology. 69(6), 1960-69.

Dwyer, P.D. 1965 Flight patterns of some eastern Australian bats. Victorian Naturalist. 82, 37-41.

Fenton, M.B. 1982 Echolocation, insect hearing and feeding ecology of insectivorous bats. pp.261-285 in Kunz, T.H. (ed) The Ecology of Bats. Plenum Press, New York.

Fenton, M.B. and Bell, G.P. 1981 Recognition of species of insectivorous bats by their echolocation calls. Journal of Mammalogy. 62(2), 233-243.

Hill, J.E. and Smith, J.D. 1984 Bats. A Natural History. Rigby, Australia.

Kunz, T.H. and Brock, C.E. 1975 A comparison of mist nets and ultrasonic detectors for monitoring flight activity of bats. Journal of Mammalogy. 56, 907-911.

Kunz, T.H. and Kurta, A. 1988 Capture methods and holding devices. pp.1-29 in Kunz, T.H. (ed) Ecological and behavioural methods for the study of bats. Smithsonian Institute, Washington, USA.

Kutt, A.S., Thompson, B.R. and Trumble-Ward, A. in press Short term effects and long term implications of Thinning eucalypt regrowth on flora and fauna in lowland forest, East Gippsland, Victoria. Management of Eucalypt Regrowth in East Gippsland, Technical Report, Department of Conservation and Natural Resources, Victoria.

Richards, G.C. 1992 Fauna survey, Wingham Management Area, Port Macquarie region. Part 4. Bats. Forest resources series no.22. Forestry Commission of New South Wales.

Tidemann, C.R. and Woodside, D.P. 1978 A collapsible bat-trap and a comparison of results obtained with the trap and mist nets. Australian Wildlife Research. 5, 355-362.

Tuttle, M.D. 1974 An improved trap for bats. Journal of Mammalogy. 55, 475-477.

Woodside, D.P. and Taylor, K.J. 1985 Echolocation calls of fourteen bats from eastern New South Wales. Australian Mammalogy. 8, 279-297.

Young, D. 1989 Nerve cells and animal behaviour. Cambridge University Press, Cambridge.

1 *Present address, BIOSIS Pty.Ltd. 322 Bay St. Port Melbourne, Vic.,3207.*
2 *Lawrie Conole, Bat Biologist, 2/45 Virginia St, Newton, Vic, 3220.*
3 *Harry Parnaby, Bat Biologist, Mammal Section, Australian Museum, Sydney South, 2000.*
4 *Greg Richards, Bat Biologist, Division of Wildlife and Ecology, CSIRO, Canberra.*
5 *Lindy Lumsden, Bat Biologist, Arthur Rylah Institute for Environmental Research, Department of Conservation and Environment, Victoria.*

** A short note on shooting. The main drawback to using this technique, especially for short term surveys, is the difficulty and time involved in gaining ethics and permit approval. This is a pity, as it has been drawn to my attention that the method is the best one for accumulating accurate and reusable reference sequences. Not only does the technique provide good call sequences in natural, the voucher specimen and* *the recorded sequence can be stored and re-accessed from relevant institutions. This allows re-identification if any taxonomic revisions occur at a later date (G.Richards pers.comm.).*

---

## *RECORDS OF BATS ON THE ATLAS OF VICTORIAN WILDLIFE*

***Lindy Lumsden, DCNR P.O. Box 137, Heidelberg 3084 Victoria***

Over the last 20 years extensive fauna surveys have been undertaken in Victoria by the Department of Conservation and Natural Resources (including under its many previous names). These surveys were conducted predominantly to provide information to the Land Conservation Council to assist in making land-use decisions; for sites of significance investigations; and for regional pre-logging surveys. Since the inception of harp traps in the late 1970s trapping for bats has been a routine component of these surveys.

An atlas system has been developed within the Wildlife Research Section of the department. Distributional data is stored on a point locality basis and can be retrieved as a 5' grid map; as a species list for any shaped area; or as details of all records of a species from a particular area. This data is also linked to a Geographic Information System.

As a result of the extensive departmental survey work, with contributions also from the two Victorian mammal survey groups, other departmental and non-departmental staff, and some records from the Museum of Victoria, the Atlas currently has 21,610 records of the 22 species of bats from Victoria. Under the Atlas system a record is defined as a species at a site on a particular date, irrespective of the number of individuals of that species. For example 100 bats of 8 species caught at a site one night equals 8 records not 100.

Therefore the number of individuals caught is considerably larger than the number of records. For most species the records have resulted almost exclusively from caught individuals, although a large proportion of *Tadarida australis* records are due to hearing the audible echolocation call.

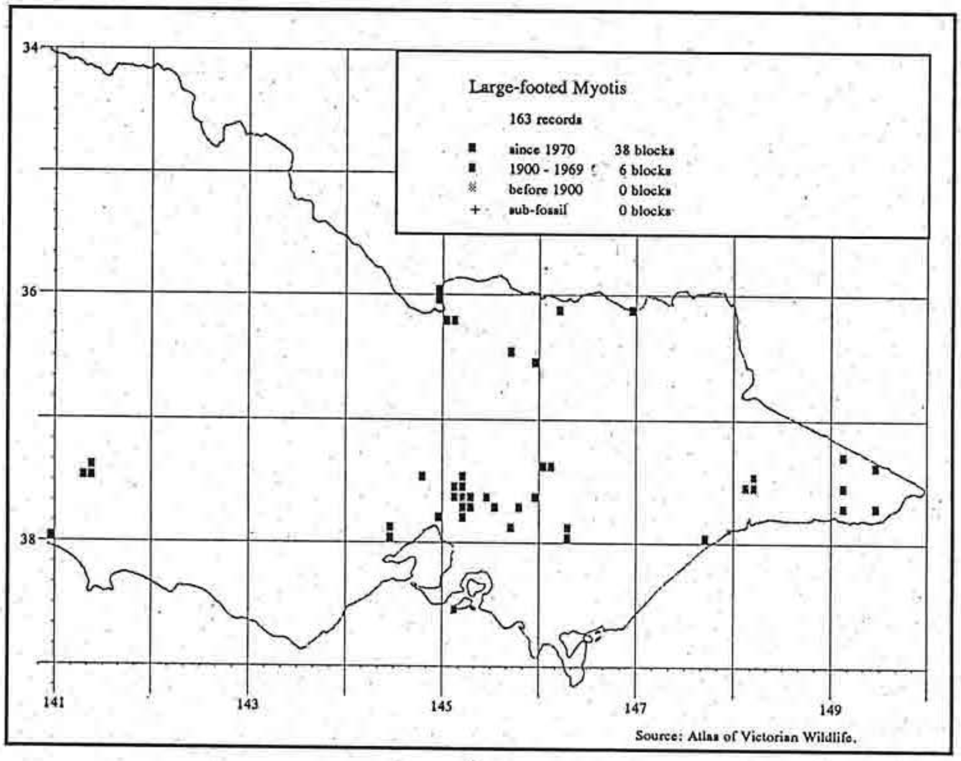
The number of records of each species in Victoria is as follows:

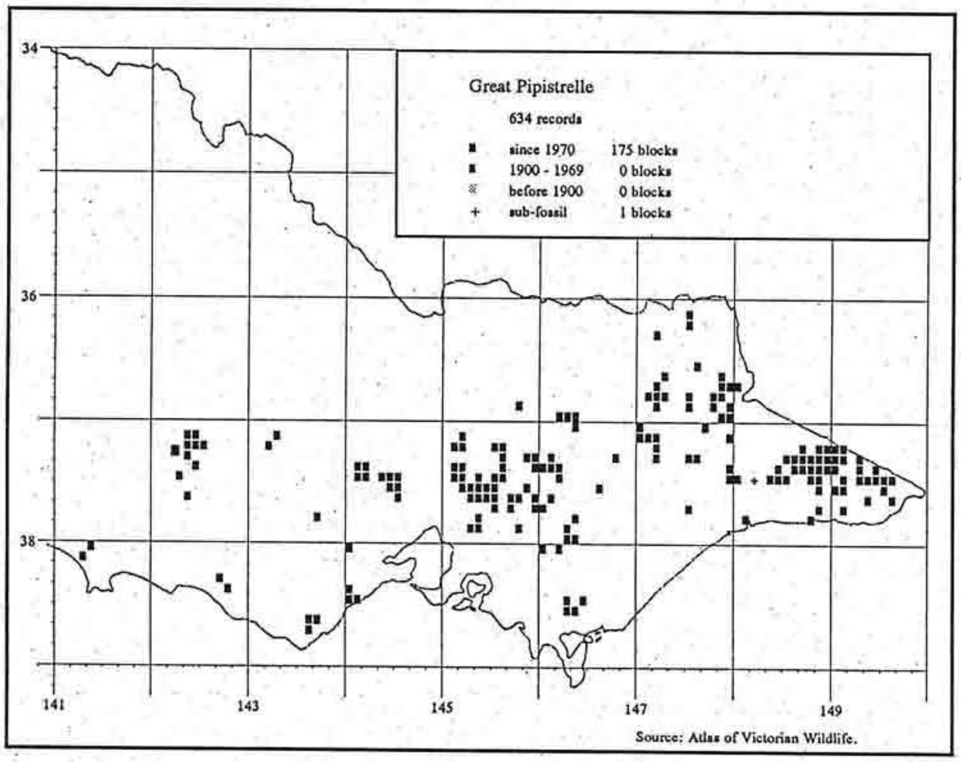
| | | |
|---|---|---|
| Grey-headed Flying-fox | *Pteropus poliocephalus* | 214 |
| Little Red Flying-fox | *Pteropus scapulatus* | 49 |
| Yellow-bellied Sheathtail-bat | *Saccolaimus flaviventris* | 16 |
| Southern Freetail-bat | *Mormopterus planiceps* * | 432 |
| White-striped Freetail-bat | *Tadarida australis* | 967 |
| Eastern Horseshoe-bat | *Rhinolophus megaphyllus* | 286 |
| Gould's Wattled Bat | *Chalinolobus gouldii* | 1938 |
| Chocolate Wattled Bat | *Chalinolobus morio* | 3016 |
| Eastern False Pipistrelle | *Falsistrellus tasmaniensis* | 634 |
| Common Bent-wing Bat | *Miniopterus schreibersii* | 1189 |
| Large-footed Myotis | *Myotis adversus* | 163 |
| Lesser Long-eared Bat | *Nyctophilus geoffroyi* | 3185 |
| Gould's Long-eared Bat | *Nyctophilus gouldi* | 1278 |
| Greater Long-eared Bat | *Nyctophilus timoriensis* | 4 |
| Inland Broad-nosed Bat | *Scotorepens balstoni* | 140 |
| Eastern Broad-nosed Bat | *Scotorepens orion* | 134 |
| Inland Forest Bat | *Vespadelus baverstocki* | 4 |
| Large Forest Bat | *Vespadelus darlingtoni* | 2154 |
| Southern Forest Bat | *Vespadelus regulus* | 2570 |
| Little Forest Bat | *Vespadelus vulturnus* | 3237 |

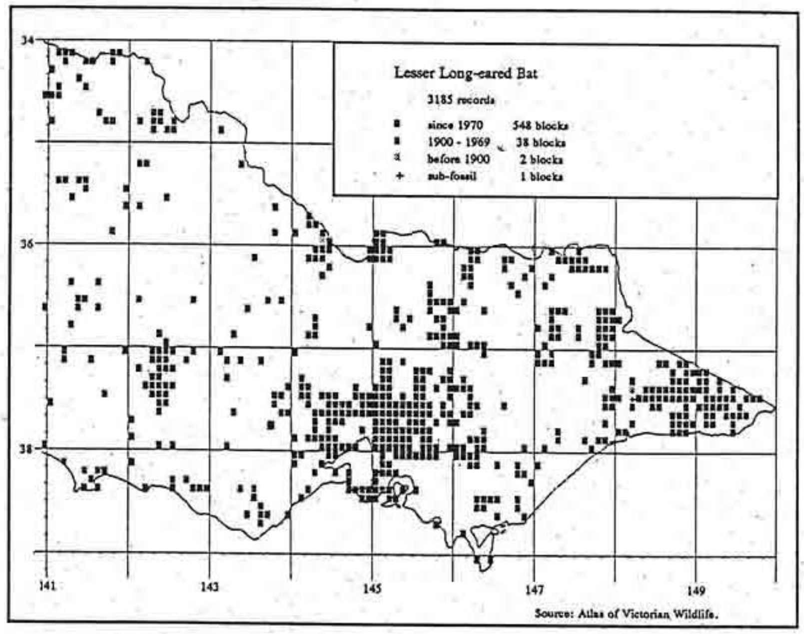
* Due to the current taxonomic problems with the genus *Mormopterus* the three species from Victoria (two penis types of *M. planiceps* and the one in eastern Victoria - species 2 in Adams *et al.* 1988) have been combined in this list.

The distribution maps of several species are provided as examples: a widespread and common species - *Nyctophilus geoffroyi*; a restricted but relatively common species - *Falstrellus tasmaniensis*; and a widespread but uncommon species - *Myotis adversus*.

Adams, M., Reardon, T.R., Baverstock, P.R. and Watts, C.H.S. (1988). Electrophoretic resolution of species boundaries in Australian microchiroptera. IV. The Molossidae (Chiroptera). *Aust. J. Biol. Sci.* **41**: 315-26


Large-footed Myotis
163 records
since 1970 38 blocks
1900 - 1969 6 blocks
before 1900 0 blocks
sub-fossil 0 blocks
34
36
38
141
143
145
147
149
Source: Atlas of Victorian Wildlife.


Great Pipistrelle
634 records
since 1970 175 blocks
1900 - 1969 0 blocks
before 1900 0 blocks
sub-fossil 1 blocks
34
36
38
141
143
145
147
149
Source: Atlas of Victorian Wildlife.




## *INFLUENCE OF PREY POPULATIONSON THE COMPOSITION OF INSECTIVOROUS BAT ASSEMBLAGES*

***Robert Taylor, Forest Practices Unit, Forestry Commission, 30 Patrick Street, Hobart, Tasmania 7000***

### Introduction

Taylor and O'Neill (1986) compared the bat species captured at five sites widely distributed across Tasmania. It was hypothesised that the differences in the composition of the bat assemblages between sites may be influenced by:

(1) the composition and biomass of the insect populations
(2) the structure of the vegetation (via its influence on how bats are able to forage); and/or
(3) the availability of hollows.

This paper reports on an examination of the first of these hypotheses. It has been shown that different species eat different sizes of insects (O'Neill and Taylor 1989). If food biomass is determining the abundance of a bat species then the biomass of insects in the size range eaten by this species should be correlated with their numbers present at different sites. This was the basis on which the analysis of the data was undertaken.

### Methods

Bats were captured using harp traps placed along flyways (see Taylor and O'Neill 1986). Insect populations were assessed from light trap samples (see O'Neill and Taylor 1989). Because the activity of both bats and insects are influenced by weather any nights with rain were excluded. The dates of sampling, locations of the five sites and the vegetation types present are given in Taylor and O'Neill (1986).

The three largest species *(F. tasmaniensis, N. timoriensis* and *C. gouldi)* were excluded from the analyses as they were caught too infrequently. The main components in the diet of bats were moths and beetles. The size ranges of these groups eaten by the different bat species was known from the work of O'Neill and Taylor (1989). The sizes of moths and beetles eaten by a bat species differed. Ranges of other groups of insects eaten were unknown. Biomass of insects was calculated by using the equation:

Weight (mg dry weight) = $\text{length}^{2.4}$
(Gowing and Recher 1984).

The relationship between the bats and insect populations was investigated using correlation analysis. Due to the small number of sites it was not possible to use principal components analysis to reduce the number of variables relating to insect numbers and biomass.

## Results

The mean, standard deviation and range of sizes of coleoptera and lepidoptera eaten by bat species included in this analysis are shown in Table 1. The following correlations were calculated:

- Total captures of bats Vs total numbers and biomass of lepidoptera, coleoptera, other orders and all insects.
- Numbers of each species caught for *Vespadelus vulturmus, V. regulus, V. darlingtoni, Nyctophilus geoffroyi* and *Chalinolobus morio* Vs numbers and biomass of lepidoptera, coleoptera, other orders and all insects within one standard deviation of the mean of the size of insects eaten by that species and within the total range of sizes of insects eaten.

The size ranges for the other orders and all insects were taken as the lower and upper end of the grouped data for sizes of lepidoptera and coleoptera eaten. These correlations involved examining the influence of insect numbers and biomass in determining absolute differences in the numbers of bats between sites. However, it is possible that differences in the relative numbers of insects of different sizes and orders at different sites could be influencing the relative abundance of different bat species at a site rather than their absolute abundance. To investigate this the following correlations were calculated:

- Percentage of total captures for each species at a site Vs the percentage of the total numbers and biomass of lepidoptera, coleoptera, other orders and all insects within one standard deviation of the size range eaten.

This represented a total of 152 correlations.

The following correlations were significant:

| | | |
|---|---|---|
| Total captures of bats | Vs | Total numbers of coleoptera |
| ($r^2$ = 0.96, $p$ <0.01) | | |
| Total captures of bats | Vs | Total biomass of coleoptera |
| ($r^2$ = 0.92, $p$ <0.01) | | |
| Captures of *V. vulturnus* | Vs | Number of coleoptera within one standard deviation either side of the mean size eaten |

($r^2$ = 0.95, r = <0.01) and similarly for coleopteran biomass ($r^2$ = 0.96, r <0.01)

| | | |
|---|---|---|
| Captures of *V. vulturnus* | Vs | Number of coleoptera within the size range eaten |
| ($r^2$ = 0.82, $p$ <0.05) | | |
| % of captures that were *C. morio* | Vs | percentage biomass of coleoptera within one standard deviation of the mean size eaten |
| ($r^2$ = 0.97, $p$<0.01). | | |

## Discussion

For the number of correlations undertaken it is expected that seven or eight would be significant at the p <0.05 level and one or two at the p <0.01 level by chance alone. Six correlations were significant at the p <0.05 level with five of these also being significant at the p <0.01 level. All of these correlations involved the numbers or biomass of coleopterans. There is thus weak evidence to support the hypothesis that the coleopteran population has an influence in determining the numbers and, possibly also the composition, of the bat population at a site.

Stronger support for the contention that bat populations are influenced by the insects (= food) available may well have been obtained with more accurate data on the insect and bat populations. The sites were trapped at different times over the spring and summer. However, changes in bat and insect activity or population levels will probably have occurred over this period, decreasing the comparability of data from the different sites. Weather also strongly influences activity of bats and insects. An effort was made to minimise this effect by excluding the results from rainy nights. Harp traps were used to assess bat populations. The trappability of bats may well vary in vegetation types with different structure. This would also have influenced the results.

To undertake an adequate assessment of the influence of insect populations on bat communities it would probably be necessary to monitor both bats and insects for a full 12 month period, or at least over the full spring and summer period. Use of ultrasonic detectors in conjunction with harp traps should also improve the estimate of species abundance. A greater number of sites than used in the present analysis (i.e. 5) would also be of benefit to the statistical analysis of the data.

de Jong and Ahlem (1991) have shown that the availability of insects is the main factor determining the abundance and species richness of bats in different habitats in central Sweden. Further more detailed work on this question in Tasmania could also reveal a similar situation to exist.

**References**

de Jong, J. and Ahlem, I. (1991) Factors affecting the distribution pattern of bats in Uppland, Central Sweden. *Holartic Ecology* 14 : 92-96.

Gowing, G. and Recher, H.F. (1984) Length-weight relationships for invertebrates from forests in south-eastern New South Wales. *Australian Journal of Ecology* 9 : 5-8.

O'Neill, M.G. and Taylor, R.J. (1989) Feeding ecology of Tasmanian bat assemblages. *Australian Journal of Ecology* 14 : 19-31.

Taylor, R.J. and O'Neill, M.G. (1986) Composition of the bat (Chiroptera: Vespertilionidae) communities in Tasmanian forests. *Australian Mammalogy* 9 : 125-130.

Taylor, R.J., O'Neill, M.G. and Reardon, T. (1987) Tasmanian bats: identification, distribution and natural history *Pap. Proc. Royal Society of Tasmania 121 : 109-119.*

<u>**Table 1**</u> Mean, standard deviation and range of sizes of coleoptera and lepidoptera eaten by bats (from O'Neill and Taylor 1989).

| Species | COLEOPTERA | | LEPIDOPTERA | |
|---|---|---|---|---|
| | $x \pm SD$ | Range | $x \pm SD$ | Range |
| *V. vulturnus* | 6.8 ± 1.3 | 4.3 ± 11.2 | 5.6 ± 2.9 | 2.9-11.0 |
| *V. regulus* | 7.0 ± 2.1 | 0.8 ± 15.9 | 7.6 ± 2.9 | 3.8-13.7 |
| *V. darlingtoni* | 8.3 ± 0.2 | 4.9 ± 10.1 | 8.4 ± 2.9 | 4.7-14.6 |
| *C. morio* | 8.8 ± 0.9 | 4.9 ± 13.6 | 9.6 ± 3.9 | 4.7-19.1 |
| *N. geoffroyi* | 10.1 ± 1.7 | 3.7 ± 16.5 | 12.0 ± 4.4 | 4.7-19.1 |

## *A RECORD EXTENDING THE RANGE OF BECCARI'S MASTIFF-BAT MORMOPTERUS BECCARII PETERS, 1881 (CHIROPTERA: MOLOSSIDAE) IN THE NORTHERN TERRITORY.*

***L.E. Conole, 2/147 Noble Street, Newtown 3220 Victoria.***

***G.A. Baverstock, RMB 1350 Noyes Road, Lethbridge 3332 Victoria.***

### Introduction

Beccari's Mastiff-bat *Mormopterus beccarii* has only been confirmed as a member of Australia's tropical bat fauna for a comparatively short period, and prior to that was thought confined to the Moluccas and New Guinea (Koopman 1984). Published information on the distribution of *M. beccarii* in Australia varies considerably. Winter and Allison (1980) recorded the species on the Cape York Peninsula in Queensland, and Hill (1983) mentions two localities south-east of the Tropic of Capricorn in that state. Kitchener and Vicker (1981) list 22 specimens of *M. beccarii* from Western Australia's Pilbara region. Strahan (1983) in interpreting the available data on the species has extrapolated to suggest a range from Darwin in the Northern Territory through Queensland to north-east New South Wales. Walton (1988) considers *M. beccarii* to occur across the whole of tropical Australia. Thomson (1991) summarises available Northern Territory data to suggest a restricted range in the Territory's section of the Gulf of Carpentaria east of Borroloola.

In this paper we describe the capture of 2 *M. beccarii* near Pine Creek in the north-west of the Northern Territory in 1983, thus extending the confirmed range of the species in the territory to a point some 650 kilometres north-west of the nearest known records.

### Methods and Site Data

A series of 20-25 triplines of monofilament (10 kilogram breaking strain) were installed at one end of a large dam (tank in local vernacular) located at the intersection of Frances Creek Road and Jabiru Road, *circa* 5 kilometres north-east of Pine Creek, Northern Territory (13 48S 131 51E). Trapping took place between 19:00 and 22:00 hours on the evening of 20 May, 1983. Conditions were clear, cool-mild, calm and with bright moonlight. Forest bats appeared to be exhibiting lunarphobic behaviour, and little activity was evident around the dam. The habitat in the area has been characterised as open woodland of White Gum *Eucalyptus alba*, Whitebark *E. apodophylla* and Darwin Box *E. tectifa*, with Kangaroo Grass *Themeda triandra* being the dominant ground cover (Pettigrew *et al* 1986).

### Results

Three microchiropteran bats were captured, identified and measured, and were as follows:

| | | |
|---|---|---|
| *Scotorepens cf. greyii* | ♀ | forearm 32.6 mm |
| *Mormopterus beccarii* | ♀ | forearm 37.6 mm |
| *Mormopterus beccarii* | ♂ | forearm 37.1 mm<br>weight 12 g |

Brief notes taken at the time included the observation that the dark grey colour of the bare skin on the face and ears of *M. beccarii* was a marked contrast to the familiar flesh-grey coloured *M. planiceps* of south-eastern Australia. Thomson (1991) notes the dark skin colour as a diagnostic feature of Northern Territory examples of *M. beccarii*.

### Conclusion

The record of *M. beccarii* described in this paper confirms the presence of the species in the western part of the Top End of the Northern Territory, and extends its confirmed range in the territory *circa* 650 kilometres north-west of the range suggested by Thomson (1991). Although regarded as widespread in the Australian tropics by Walton (1988), and "...Common, widespread. Possibly underestimated..." by Strahan (1983), Thomson (1991) regards the species as localised and possibly rare in the tropical Northern Territory. *M. beccarii* appears to exhibit wide ecological tolerance, occurring in wooded habitats from woodland to rainforest (Walton 1988), and so its capture in open *Eucalyptus* woodland near Pine Creek in the Top End is consistent with other data for the species.

**Acknowledgements**

Protected species of bats were handled in accordance with conditions laid out in a permit issued by the Conservation Commission of the Northern Territory.

We would like to take the opportunity to thank Les Hall for the invitation to participate in the Ghost Bat field trip, during which the above observations were made, and for subsequent encouragement and advice.

**References**

Hill, J.E., 1983, Bats (Mammalia: Chiroptera) from Indo-Australia, *Bull. Brit. Mus. (Nat. Hist.) Zool.* **41**:275-278

Kitchener, D.J. & Vicker, E., 1981, *Catalogue of Modern Mammals in the Western Australian Museum 1895 to 1981*, W.A. Museum, Perth.

Koopman, K.F., 1984, Taxonomic and distributional notes on tropical Australian bats, *American Museum Novitates* 2778:1-48

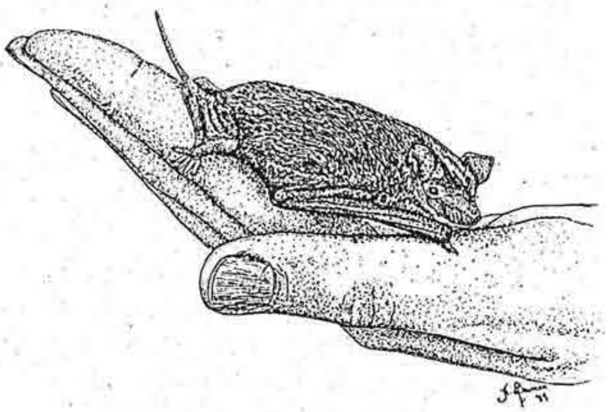
Pettigrew, J., Baker, G.B., Baker-Gabb, D., Baverstock, G.A., Coles, R., Conole, L.E., Churchill, S., Fitzherbert, K., Guppy, A., Hall, L.S., Helmann, P., Nelson, J.,Priddel, D., Pulsford, I., Richards, G.C., Schulz, M. & Tidemann, C.R., 1986, The Australian Ghost Bat *Macroderma gigas* at Pine Creek, Northern Territory, *Macroderma* **2**(1):10-19.

Strahan, R., 1983, *The Australian Museum Complete Book of Australian Mammals*, Angus & Robertson, Sydney.

Thomson, B.G., 1991, *A Field Guide to Bats of the Northern Territory*, Conservation Commission of the Northern Territory, Alice Springs.

Walter, D.W. (Exec. Ed.), 1988, *Zoological Catalogue of Australia. Volume 5. Mammalia.*, Commonwealth of Australia, Canberra.

Winter, J.W. & Allison, F.R., 1980, The native mammals of Cape York Peninsula - changes in status since the 1948 Archbold Expedition IN Stevens, N.C. & Bailey, A. (Ed's), *Contemporary Cape York Peninsula*, Brisbane.



***MICRO BAT RESCUE***

***Julie Spence***

My voluntary work as an authorised Rescuer and Foster-carer with the New South Wales Wildlife Information and Rescue Service Inc. (WIRES) is varied and interesting. WIRES was founded August, 1985. It is an independent, non-profit organisation operating under licence from the NSW National Parks and Wildlife Service. The aims of WIRES are the rescue, rehabilitation and release of the injured, sick, orphaned or misplaced native animals. WIRES also provides an education service for the general public.

On 15th December, 1992, a maternity colony of insectivorous bats required relocation as their roost site was being demolished. These small echo-locating bats were roosting under the corrugated iron roof of an old dwelling at Badgery's Creek in western Sydney. The colony, numbering 78, contained:-

| SPECIES | ADULT MALE | ADULT FEMALE | ADULT FEMALE WITH YOUNG | YOUNG FEMALE | YOUNG MALE |
|---|---|---|---|---|---|
| *Chalinolobus gouldii* (Goulds Wattled bat) | 1 | 17 | 8 | 16 | 16 |
| *Scotorepens orion* (Eastern Broad-nosed bat) | 1 | 4 | 2 | - | - |
| *Mormopterus planiceps* SP. 1 or 2? (Little Mastiff bat) | - | 1 | - | - | - |

The youngsters attached to the nipple of their mother were not detached to determine sex. Enough stress had already occurred to the group and minimal handling was of the utmost importance. From the above table, it is obvious that many females had flown from the roost at the time of the initial disturbance. However, on rescuing the animals, one or two flew out from under the iron roof.

Estimate ages of the young varied from newborn (pink - no fur visible) to 40 days (?). Varying fur cover was observed from a light 'peach fuzz' to a thicker covering.

Relocation was urgent for survival. The original roost was demolished the day of rescue. Within hours an old stable was located 4km from the original roost site. Asuitable 'release cage' was prepared containing hollow logs and loose bark. The animals were carefully transfered and the "cage" hung from a timber beam in the stable. With the disturbance of the original roost and the subsequent relocation, it was realised that some young would be left behind. Youngsters not able to 'free fly' and those originally abandoned would remain.

The group was left undisturbed for two and a half days giving them time to relocate to an alternate roost site. A check of the cage revealed 28 animals remaining:

| SPECIES | ADULT MALE | ADULT FEMALE | ADULT FEMALE WITH YOUNG | YOUNG FEMALE | YOUNG MALE |
|---|---|---|---|---|---|
| *Chalinolobus gouldii* (Goulds Wattled bat) | 1 | - | - | 11 | 14 |
| *Scotorepens orion* (Eastern Broad-nosed bat) | - | - | - | 2 | - |
| *Mormopterus planiceps* SP, 1 or 2? (Little Mastiff bat) | - | - | - | - | - |

These were collected, assessed and the decision made to attempt hand-rearing. Estimated ages ranged from 5 to 30 days and weights from 2 to 8 grams. Each animal required oral rehydration using Lectade as the choice of rehydration therapy. After raising from torpor, and using 1 ml glass syringe and 1 ml glass eye dropper with extremely fine epidural tubing and gastric feeding tube attached, between .2 to .8 mls of fluid was administered to each youngster. When all had been rehydrated they were then fed between .5 to 1.0 ml of Wombaroo Bat Milk Replacer. Many of the young actually suckled on the artificial nipple. This initial assessment, rehydration and first milk feed took myself and co-worker, Cheryl Howarth nine man hours to complete!

During the next twenty-four hours, ten WIRES authorised foster-carers were contacted and the young distributed in groups of 2 or 3 depending on estimated age and size. To simulate the natural roost the emergency housing required humidity. A glass fish tank was placed on a heating pad with a piece of damp sponge placed directly onto the glass bottom in one corner. Paper towel covered the remaining base area and loose bark placed on the paper towel. A slide with air holes covered the tank.

Monitoring the humidity was difficult, to achieve a suitable environment observation of the build up of moisture was required. Too much condensation on the glass, that is, droplets of water running down inside of glass indicated the sponge was too moist. Less moisture on the sponge and slight opening of the lid for air circulation finally gave the correct environment. Air temperature in the tank was approximately 28 to 29 degrees celsius. One carer placed two of the orphans in a humidicrib, however, both young died 4 and 5 days later.

Initially, the young required feeding four or five times daily using Wombaroo Bat Milk Replacer. All equipment used for feeding was sterilised in infant anti-bacterial sterilising solution. Emphasis was placed on the management techniques for these tiny mammals. Cleanliness was very important. After feeding and toileting each baby, it was carefully cleaned with a damp cotton bud to remove any traces of milk formula, urine and faeces. A very soft brush was used to lightly stroke the fur to simulate the mother 'cleaning' the fur and stimulate the young to evenutally self-groom.

During the first few days of adjusting to captive rearing, it was recognised that the youngsters required additional fluid. Once an acceptable level of humidity was reached and routine feeding pattern established, additional oral fluids were no longer required.

However, a very small, shallow water vessel was placed in each tank. One carer left foliage lightly mist-sprayed with water and observed the animals licking the moisture. Unfortunately, the first 14 days saw one baby euthanased (severely debilitated on initial assessment) and nine died in care.

As the weeks progressed, they were introduced to mealwork innards combined with Wombaroo Small Carnivore Mix, a nutritionally balanced food supplement. The weaning process from milk to solids was carefully monitored. A constant check was made on the faeces of each individual to determine how the digestive system was coping. The youngsters were gradually introduced to whole mealworms and natural insects. The mealworms were taken from the bran medium and placed in a 'feeding medium' of Wombaroo Small Carnivore Mix and high protein baby cereal at a ratio of 3:1. This ensured a nutritious meal for the young. Water was always available. By late January all young were weaned and instinctively retrieving mealworks from their tails.

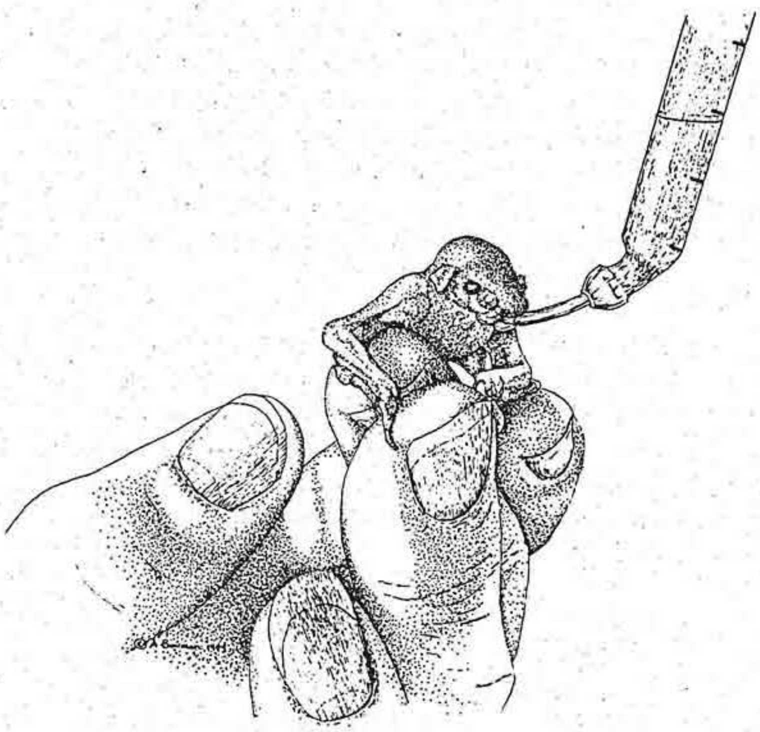
Learning to fly and echo-locate was another important factor to be considered.

The youngsters were encouraged to flap their small wings and become airborne. This was done gradually over a period of weeks as they developed their strength and agility. It was fascinating to watch our little charges learning to echo-locate in our own lounge room! In no time they could manouvre around corners and fly without colliding into walls.

The humidity required by these tiny animals to survive is quite remarkable. Not knowing when to "turn off" humidity was a test. Late December saw extremely high air temperatures and carers experimented with the humidity levels. Animals housed in non-humidified tanks late December sustained obvious thinnning of fur within days of humidity being ceased. When humidity was re-applied fur thickening was evident within days. Animals housed in constant humidity to end of January showed no signs of fur thinning.

During the month of January 1993, one youngster was enthanased (this animal was under observation as elbow appeared to be injured when initial assessment made). February 1993, a further two died.

The next concern was the actual presentation for release. Fourteen animals were recalled on 12th March:-



| SPECIES | ADULT MALE | YOUNG FEMALE | YOUNG MALE |
|---|---|---|---|
| *Chalinolobus gouldii* (Goulds Wattled bat) | 1 | 5 | 7 |
| *Scotorepens orion* (Eastern Broad-nosed bat) | - | 1 | - |

Each bat was weighed; forearm measured and colour marked (with Gentian Violet) for identification purposes and placed in a specially designed bat box. Recall weights ranged from 8 to 14 gms and forearms 40.65 to 45.20 mm. (The Eastern Broad-nosed bat weighed 12 gms and forearm 36.70 mm). To encourage acceptance of their new roost the box was scented with their own excreta, and hung in a "bat cage" in my back garden.

The cage required certain modifications - some 23 metres of shade cloth meticulously lined the internal walls, ceiling and floor rendering the cage escape proof. One quarter of the roof of the cage was covered by corrugated iron for some weather protection. The door was sealed using "velcro". Three large sections of shade cloth were removed and small wire inserted to allow insects to be attracted to the special insect light hung from the ceiling. Wire was pressed to within ¼ of an inch of the globe to protect the bats from the heat. An external viewing window was also inserted and a spotlight fixed to one side wall. This gave ample light while working in the cage during the evenings.

The initial benefit for the choice of shade cloth was cost factor and ease in application. However, it was evident that the choice was more beneficial for the bats. The cloth "softened" their landings and the weave made it easier to manouvre while scrambling around.

Time was required to allow the bats to adjust as a group. They needed to combine their echo-locating and flying skills and hopefully, encourage their instinctive skills of "feeding on the wing".
At dusk, the insect light was turned on - insects buzzed around the light. Within 14 days, 4 bats were obviously "feeding on the wing". Supplementary hand-feeding of mealworms was carried out each night. To encourage self-feeding, mealworms were left in small feeding cups hung high on the walls. Live insects were caught and offered to each animal. Water was also available. A large branch of callistemon was hung from the ceiling and lightly mist-sprayed each evening. This appeared to attract insects as well as supply a more natural source of moisture for the bats.

During the following months the hand-feeding was gradually decreased and currently (May 1993) approximately 200 mealworms are left in the feeding cups each second evening.

Eleven juveniles and one adult are roosting in the bat box and all appear to be coping well. Two of the original group placed in the cage have died (one male in April, one male in May).

As winter approaches time does not allow release and their own successful selection of a roost site. Therefore, the decision to hold the group over winter has been made.

When the feeding cups are replenished with mealworms every second evening, a brief check is made by observing via the bottom slit in the box. The animals are no longer handled. Winter torpor is obviously taking place as reduced activity is observed in the cage. Once a week I carefully insert my hand into the bat box and find the animals are quite cold to the touch.

The time and effort given to caring for these tiny creatures is tremendous. Painstaking hours have been devoted to feeding, grooming and exercising. The foster-carers are to be commended for taking on this task.

This total exercise has been extremely valuable for myself and the carers involved. These tiny and initially helpless animals have obvious natural instincts. We as foster-carers have encouraged the development of these instincts. To catch prey in the tail, echo-locate and fly was not shown by our example! With their growing independence so developed their aggressiveness towards humans - to bite the hands that fed them.

Hopefully, our rehabilitees will survive the cold months and will look forward to a release in Spring. We will return to the environment a group of ecologically important creatures - our insect eating micro bats.

I wish to acknowledge the WIRES carers involved in rearing the orphans: Sue

Brookhouse, Kay Brooks, Devona Fraser, Sandra Lesslie, Kevinn Paull, Gwen Peh, Sharon Redman, Iris Selby and Bronwyn Traverne. To Cheryl Howarth, Margaret and Ken Hewitt and Ku-ring-gai Bat Colony Committee for ongoing support and assistance.

A personal thank you to the following Bat Researchers for their assistance with information: Dr Chris Tidemann, Ray Williams, Harry Parnaby and Linda Gibson.

Without the assistance and guidance of the above-mentioned, raising the orphans and co-ordinating the program would have been difficult.

Should any subscribers to the ABS Newsletter have any information regarding hand-rearing micro bats or advice on streamlining techniques adopted for the rearing of this group, please contact:
Julie Spence, 12 Kastelan Street, Blacktown NSW 2148. Telephone: (02) 622 6106.

The third ABS Newsletter can only follow if we receive sufficient papers, articles and anecdotes from subscribers. So, please send in any flying-fox or insectivorous bat information to either:-

**Phil Towers, Editor** or **Jillian Snell, Secretary**

Because this newsletter provides a bat information network it can't function if articles are either delayed or insufficient.

Looking forward to an exciting, crammed third newsletter!

Jillian Snell
Secretary