The Australasian Bat Society Newsletter

Number 16 March 2001

Lesser-long-eared bat drinking – photo by Nick Birks

- Instructions for contributors -

The ***Australasian Bat Society Newsletter*** will accept contributions for the Newsletter under one of the following two sections, Research Papers, and all other articles or notes. There are two deadlines each year: **21st February** for the March issue, and **21st September** for the October issue. The Editor reserves the right to hold over contributions for subsequent issues of the Newsletter, and meeting the deadline is not a guarantee of immediate publication.

Opinions expressed in contributions to the Newsletter are the responsibility of the author, and do not necessarily reflect the views of the Australasian Bat Society, its Executive or members.

For consistency, the following guidelines should be followed:

- Emailed electronic copy of manuscripts or articles, sent as an attachment, is the preferred method of submission. Manuscripts can also be sent on 3_" floppy disk preferably in IBM format. Faxed and hard copy manuscripts will be accepted but reluctantly!! All submissions are to be sent to the Newsletter Editor at the email or postal address below.
- Electronic copy should be in 11 point Arial font, left and right justified with 1.6mm left and right margins. Please use Microsoft Word version 97 or earlier.
- Manuscripts should be submitted in clear, concise English and free from typographical and spelling errors.
- Research Papers should ideally include: Title; Names and addresses of authors; Abstract (approx. 200 words); Introduction; Materials and methods; Results, Discussion and References. References should conform to the Harvard System (author-date).
- Technical notes, News, Notes, Notices, Art etc should include a Title; Names and addresses of authors. References should conform to the Harvard System (author-date).
- All pages, figures and tables should be consecutively numbered and correct orientation must be used throughout. Metric units and SI units should be used wherever possible.
- Some black and white photographs can be reproduced in the Newsletter after scanning and digital editing (consult the Editor for advice). Diagrams and figures should be submitted as "Camera ready" copy, sized to fit on an A4 page, or electronically as TIFF, JPEG or BMP image files. Tables should be in a format suitable for reproduction on a single page.
- Research Papers are not being refereed routinely at this stage, although major editorial amendments may be suggested and specialist opinion may be sought in some cases. Articles will generally undergo some minor editing to conform to the ***Newsletter***.
- Please contact the Newsletter Editor if you need help or advice.

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- Editorial -

Flying fox conservation has dominated the agenda for the Executive and many members over the last few months. In this edition of the Newsletter, there are several reports and articles that will bring you up to date with the issues and what the ABS have been doing about them. A few years back there was a push from the membership for the Society to take stronger advocacy role for the protection of bats. The proposed culling of flying foxes at the botanic gardens in Melbourne, and resistance to the nomination of grey-headed flying foxes for federal and state listing as a threatened species, has propelled the Society headlong into this advocacy role. As you read the reports herein, you will begin to appreciate as I have, that there has been tremendous energy and time put into these issues by several members. I believe that the Society has performed very well in this new advocacy role and we have learned a great deal along the way. So congratulations and thanks to all those involved.

A hearty thankyou to all those who have contributed to this Newsletter - may I make a plea for more articles and especially some notes about what you are up to. And also photographs (preferably as electronic images). I apologise too that our preoccupations with the unfolding events in Melbourne resulted in some delay in getting this edition to you on time.

Hope to see you at the Financial Annual General Meeting in May.

Terry Reardon

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Albino southern bentwing bat from Bat Cave, Naracoorte – photo by Lindy Lumsden

- *Australasian Bat Society: business and reports –*

President's report

The ABS has had a particularly busy time since the last newsletter, with much of the attention going to flying foxes, both in Melbourne and the Wet Tropics of Cairns where a lesser known, but equally dramatic circumstance has now been identified for the Spectacled Flying Fox. Numbers of this species appear to have declined by some 90% over the last 10 years (!!) and the ABS is now lending its expertise to develop a well argued case for both the Queensland Government and the Commonwealth to list the species as Endangered. Virtually all of the hard work in gathering data and presenting the basis of the arguments for Spectacled's has been done by Olivia Whybird, Sandy and Chris Clague, Jenny Maclean plus numerous other ABS and non-ABS people in the Cairns area. Our job in compiling the summary to strengthen the final presentation has been a relatively simple task, thanks to these people.

Meanwhile, as Greg has mentioned in his report, the ABS has appointed Nicki Markus as a spokesperson for the Grey-headed Flying Fox issue at the Melbourne Botanic Gardens. She has been doing a fantastic job and has really helped the ABS lift its game as far as advocacy is concerned in this very high profile issue. In a strategic sense, I believe that we need to work hard to get both of the above species into the Commonwealth threatened species legislation since the EP&BC Act does provide a very powerful incentive for decision-makers to act responsibly whether action is taken under the Act or not.

In the world of micro-bats, it's good to see that the New South Wales National Parks and Wildlife Service have published a 'Strategy for the Conservation of Bats in Derelict Mines'. The strategy provides guidelines for the collaboration of NSWNPWS and the NSW Department of Mineral Resources in identifying and protecting old mines with significant bat colonies. Congratulations to the ABS members and others who were instrumental in bringing that strategy to fruition. In Queensland, our work to protect bats in mines in the far north of the State is continuing with 50,000 NHT dollars now allocated to the task from the last round of Commonwealth funding. A less formal Bats and Mines strategy was endorsed by the Queensland Parks and Wildlife Service some 16 months ago but has been difficult to implement due to various restructures which have seen the complete disbanding of the State's Department of Mines and Energy!

Following my visit to the USA to examine their Bats and Mines programs, I have been asked by the Australian Minerals and Energy Environment Foundation to write a Bats and Mines handbook for Australia. They want to publish it by July this year!! I will be looking to involve the ABS subcommittee plus others with an interest in this topic, in the development of the publication. We need to see the other states gearing up to address this issue and I am hopeful that the Bats and Mines Handbook might act as a catalyst.

I recently visited Jenny Maclean in Atherton and while there, we had a quick meeting with other ABS people to discuss the next ABS Conference. The planning is going well and the venue looks excellent so I hope members are mindful that it will be happening around Easter next year (which is not that far away). The rainforest and reef are well worth visiting, so make it a worthwhile event and spend some time! More information about the conference will be published in the Newsletters as planning progresses.

Bruce Thomson

Secretary's report

It has been a very busy 6 months or so since the last newsletter, and much to inform you about. First cab off the rank is our activities in regard to the current issue with the Grey-headed Flying Fox colony at the Melbourne Botanic Gardens.

A number of members of the Executive attended two meetings on the 24th of January to provide expert advice. At the first meeting we presented to the Victorian Scientific Advisory Committee the case for listing the Grey-headed Flying Fox as "Rare" in the state legislation. The SAC accepted the case for listing this species in Victoria under the Flora and Fauna Guarantee Act and made this recommendation to the Minister. However, for the first time in the history of the Act the minister rejected the recommendation. Flying fox politics raises its ugly head again! What is most disconcerting is that we were told at this meeting to consider the status of the Grey-headed Flying Fox only within the boundaries of the state of Victoria, yet the final decision related to the species' status at a national level. Hmmmm!

The second meeting that day included senior staff from the Melbourne Botanic Gardens and discussed the problems that were occurring at their site. We were told by the Director that we were not to consider any other management strategies apart from total removal of the colony. I for one was extremely upset at this attitude, especially since Les Hall and I were making progress with the Sydney Botanic Gardens colony, which has relevance to the management of problem colonies everywhere.

This progress (SAC decision in Victoria and the trial of non-lethal options for the MBG) has bearing on the next matter to report. At the last AGM a motion was proposed that called for the ABS to write a letter of censure to the Melbourne Botanic Gardens and to the Victorian Government, over the fiasco with the euthanasia of the flying fox colony that was current at the time (April 2000). The minutes of the AGM that I published in the last newsletter indicated that the motion was not passed, and I received a number of responses advising the contrary. In view of this, the Executive was surveyed for their opinion, and it was not clear what had actually happened. Some recollections were that the motion was passed, others were sure that it wasn't, and others were certain that discussion about it hadn't been completed.

I take full blame for this mess, and sincerely apologise. If I can offer an excuse, probably the best one is that, at the time, my brain was still reeling from making such a huge commitment as the new Secretary, and my minute-taking is always very poor because I would rather be involved in discussions!

One of the outcomes of this mess is that at future meetings we will formally appoint a dedicated Minutes Secretary, and will also run a tape recorder so that we can produce meeting outcomes with more accuracy, and certainly greater reliability!

The Executive has decided by unanimous vote that we should re-visit this motion and firm up the membership's desires concerning the Melbourne issue. Whether it is right or wrong in the rules of the ABS and societies in general, it is felt that the AGM motion should be re-visited to formally obtain clarity with the result. In this newsletter you will find a loose sheet that deals with this problem – it should be returned as soon as possible. Your vote can be mailed or faxed, or emailed, and we will allow 4 weeks from the date of mailing of the newsletter to give everyone an opportunity to vote. If the affirmative prevails, the result will be actioned by the President. This is the fairest way that I can try and redeem my mistake.

In all honesty, some Executive positions can be almost full-time, especially when a big issue hits us, and it can sometimes be difficult to produce results that the membership expects. At this time of year, when many members of the Executive are in the field, efficient communication can be difficult. We have rectified this problem by purchasing portable email systems that can be used anywhere in

Australia.

Over the last 12 months we have dealt with the rapid decline of the Grey-headed Flying Fox and have prepared submissions in all states and Federally, and we expect success in all of them. You will note from the minutes of a November 2000 email meeting that our most exciting decision was to appoint a dedicated publicity/advocacy person to deal with flying fox issues

Nicki Markus has offered to spend one day each week for the next three months to promote Grey-headed Flying foxes and provide advice in relation to the Melbourne issue. Those who know Nicki will appreciate her extensive knowledge, diplomacy and 'take no crap' qualities which, combined with her network of people in the media, will be of great assistance to the ABS. Nicki has established liaison with major NGO's who are providing extensive advise and support (see report elsewhere in this newsletter).

The decision to spend membership funds in this area, where there is an obvious desire from members and an urgent need, has also prompted the Executive to establish a Flying Fox Fighting Fund. The FFFF is outlined in a separate article in this newsletter, and will give us specifically-dedicated resources to continue our actions re the MBG, and to extend our actions to other flying fox species and issues. The bottom line is that we will not function efficiently as a totally voluntary organisation, and need to cover the increased costs that are above and beyond our current financial resources.

Some ABS members (Len Martin, Olivia Whybird and myself) are formally involved in trying to halt the huge problem with lethal methods that are used against the Spectacled Flying Fox in north Queensland. This issue has not been as 'public' as the Melbourne one, but is in fact far more serious. There is evidence that this species has declined by as much as 90% in the last few years, an amazing reduction from approximately 820,000 to 80,000 in a very short time. Three-quarters of a million of this species that is integral to wet tropics rainforest ecosystems are missing. Although the ABS has not been formally involved, you can be certain that a number of us have been working hard on this problem as well.

That's about it for now …… Greg Richards

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Education Sub-Committee Report

Microbat leaflet

Following the circulation of the draft microbat leaflet to members in the last newsletter, I have had two requests for the leaflet to be adapted for local groups. This has been done at the request of Joan Hills for Wildlife Carers Network - Central West Inc which is based at Mudgee, NSW, and at the request of Kay Brooks for WIRES in Sydney. Thank you Greg Richards for checking a list of bat species for the Central West NSW group.

Flying-fox Mini Posters

Have you been able to look at the mini posters illustrating pollination and rainforest seed dispersal by flying foxes? These were created by Janet Hutchinson with assistance from Marjorie Beck - both ABS members. They can be downloaded and used by your local bat group for educational purposes. They can be found on the ABS website at http://batcall.csu.edu.au/abs/ghff/ ….please let me know if you use them and have any comments about them.

Microbats in buildings and artificial roosts

Rob Gration has contacted me regarding a leaflet on this topic. When he next gets a break from work he will produce a draft for discussion. If anyone wants to contribute to the content please send your ideas along to me.

Other educational activities

Many members of the ABS are active in education under the umbrella of their local group. For example, Ku-ring-gai Bat Conservation Society Inc. displayed flying foxes and photographs of bats in the shopping centre at Gordon in Sydney recently. We continue to give talks to scouts, in schools and for environment organisations. The 'education flying foxes' are the main attraction at these events. Donations for talks finance their care.

Marg Turton and I were the leaders for a 'bat weekend' at Barren Grounds Bird Observatory located near Jamberoo in NSW at the beginning of March.

The Ku-ring-gai Bat Conservation Society put on a microbat detection workshop at Gordon and Barrenjoey Headland in Sydney in February. The experts for this technical workshop were Michael Augee and Nathalia Valez from the University of NSW. Thanks to them and the organiser, Denise Ford, sixteen people have increased their knowledge of microbats and call analysis.

What is your group doing? A brief note about your educational efforts on behalf of bats would inspire and encourage others. Do you have materials which could be placed on the education section of the ABS website? Do you know anyone keen enough on bats, with skills in setting up websites who would be willing to manage an education page on the ABS website?

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Notice of the Financial Annual General Meeting of the Australasian Bat Society Inc. 2001

The 2001 Financial Annual General Meeting of the Australasian Bat Society Inc will be held at University of New South Wales at 9:30am on Saturday 26th May. All members welcome.

The meeting is scheduled to run until 5pm and apart from the usual business, we will include invited speakers to report on current issues. A draft agenda follows:

DRAFT AGENDA.

1. Welcome
2. Minutes from previous meeting
3. Business arising from the Minutes
4. Correspondence
5. Business arising from the Correspondence
6. Treasurer's Report
7. Other Executive Officers' Reports:
   - President
   - Secretary
   - Membership
   - Vice Pres - 2000/2002 Conferences
   - Sub committees
8. Election of a new Vice President
9. General Business

- Requested Reports
  - on the state of play re the status of Grey-headed flying fox - states and federally
  - on the situation at the Melbourne Botanic Gardens
  - on the status of Spectacled flying-fox
  - on the conservation of microchiropterans
  - on IUCN criteria?

END OF MEETING

Please write to the Secretary if you wish to add any items to be added to the agenda.

There will be an informal dinner in the evening and a social get together on the Sunday.

There is no formal registration but if you intend to come to the FAGM and/or the social get togethers, please register your interest by contacting Kerryn Parry-Jones. Kerryn will forward details of where the meeting will be held, any costs involved (minimal) and possible accommodation options.

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Flying fox fighting fund

The Executive has decided by unanimous vote that we are too under-resourced, both financially and with personal time, to mount the type of campaigns to promote flying foxes at the level that the membership would expect. Devoting time to major issues becomes more and more difficult at this time of year, which is the peak season for field research, and it is difficult to coordinate our efforts beyond the requirements for day to day ABS administration.

As an example of what can be required of us at times, submissions to and consultation with the NSW Scientific Committee re the listing of the Grey-headed Flying Fox required one person full time for about 4 weeks, 9 people for at least 1-2 weeks full time, and out of pocket expenses would have totalled somewhere around $2000. It was fantastic that the effort for this issue was so huge, and we hope that we have achieved our desired result.

As a consequence, and considering that we have issues in Melbourne and North Queensland that are current, we have decided to establish a Flying Fox Fighting Fund (FFFF) within the ABS financial structure. This will help us to support a dedicated Public Relations person with an excellent knowledge of these animals and an appropriate network.

WE NEED DONATIONS!!!!!!

Your personal donation will be most welcome, and can be sent to the ABS Secretary at PO Box 9, Gungahlin, ACT 2912. These funds will be maintained in a separate financial area of the ABS administration, and an annual report on their usage will be published in the ABS newsletter at appropriate times.
We can also offer the option of deposit by regular direct debit into this special account – contact the Secretary for details.

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- Research papers -

Normal blood values for *Pteropus poliocephalus* and *P. scapulatus*

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Monitoring health and diagnosing pathology of flying foxes presents difficulties due to the lack of standard normal values for pathology laboratories to use when testing blood from Australian flying foxes (Genus ***Pteropus***, suborder Megachiroptera).

Fresh venous blood was collected from normal healthy Grey-headed and Little Red Flying Foxes in captivity at the University of Queensland. Samples were analysed at the Research and Diagnostic Laboratory of the University's Department of Veterinary Pathology. Recommendations for normal ranges in the Table are based on mean ±2 s.d. (red blood cell parameters) or mean ±1 s.d. (all other parameters).
Most parameters were similar to other species. The small MCV, high PCV and high alkaline phosphatase are shared with other ***Pteropus spp***. (Heard and Whittier 1997).
During pregnancy the females of both species studied displayed microcytic erythrocytes indicating an enhanced requirement for iron during that stage of reproduction.

	Grey-headed Flying Fox ***P. poliocephalus***	Little Red Flying Fox ***P. scapulatus***
Haemoglobin (g/L)	157 - 199	151 - 207
RBC Count (10^{12}/L)	8.2 - 9.4	9.0 - 11.5
PCV (L/L)	0.435 - 0.555	0.461 - 0.556
MCHC (g/L)	344 - 376	303 - 407
MCH (pg)	18 - 22	15 - 20
MCV (fL)	54 - 59	44 - 56
WCC (10^9/L)	11 - 22	10 - 16
Neutrophils %	33 - 45	43 - 63
Lymphocytes %	49 - 58	19 - 43
Monocytes %	3 - 10	2 - 13
Eosinophils %	3 - 6	3 - 12
Basophils %	0 - 3	0 - 1
Sodium (mmol/L)	119 - 145	136 - 146
Potassium (mmol/L)	4.8 - 6.8	4.8 - 6.6
Chloride (mmol/L)	103 - 109	105 - 113
AST (U/L)	41 - 73	197 - 373
ALT (U/L)	1 - 28	9 - 47
Alk. Phos. (U/L)	549 - 1564	32 - 2390
CPK (U/L)	105 - 194	122 - 359
Protein (g/L)	73 - 77	74 - 87
Albumin (g/L)	44 - 49	46 - 53
Globulin (g/L)	25 - 33	27 - 36
A/G	1.3 - 2.0	1.3 - 1.8
Urea (mmol/L)	1 - 3	2 - 4
Creatinine (mmol/L)	40 - 56	15 - 61
Glucose (mmol/L)	2 - 6	5 - 8

References

Heard DJ and Whittier DA 1997 ***J. Zoo. Wildl. Med.*** **28:** 464-470.

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Roost ecology and conservation of insectivorous bats in suburban Brisbane: An assessment of natural roost habitat of the White-striped Freetail-bat (*Tadarida australis*), and artificial roost habitats (bat boxes) for insectivorous bats in Brisbane.

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Introduction

With more than 80 species, bats (Mega- and Microchiroptera) comprise more than 30% of Australian native mammals (Strahan 1995). More than half of Australian microchiropterans roost in tree hollows (Strahan 1995) yet relatively little is known about their roost ecology (e.g. Johns 1985; Tidemann and Flavel 1987; Taylor and Savva 1988; Hall 1990; Lunney ***et al***. 1988, 1995; Lumsden and ***et al***. 1993, 1994). This is particularly true for the largest tree hollow roosting species in Australia, the White-striped Freetail Bat (***Tadarida australis***) (Hall and Richards 1972, Kitchener and Hudson 1982, Reardon and Flavel 1991; Strahan 1995; Churchill 1998). Smaller Australian Microchiroptera roost in large mature, dead or declining trees as roosts (Tidemann and Flavel 1987; Taylor and Savva 1988). The abundance of these types of trees is being rapidly reduced as forest logging and suburban development progresses. These trees may be crucial for bats but are also essential for the survival of other native hollow-dependent arboreal mammals and birds (Smith and Hume 1984; Law 1996). At present, very little is known about the availability of such tree roosts, or of the conditions required or preferred by the animals that use them. Larger bat species may require different roost features as they generally have faster, less manoeuvrable flight than smaller bats, which might restrict them to taller, more open tree roosts (Robert M. R. Barclay and Martin P. Rhodes, pers. comm.).

My study aims to assess the availability, usage and characteristics of tree roosts within the Brisbane metropolitan area by ***T. australis***, and the effects of urbanisation on the roosting ecology of this species. In addition I will assess the acceptance of artificial roosts by microchiropterans. The project will obtain basic natural history information for poorly studied species and will be of relevance to their conservation and retention within suburban environments.

1. Roosting Ecology of *T. australis*

In South-East Queensland 22 insectivorous bat species, various birds (e.g. parrots, lorikeets, cockatoos), marsupials (gliders, possums) and insects (wasps, bees) use tree hollows as day/night roosts and/or colonies. The factors associated with production of hollows in trees are large size, over-maturity, death, rot, fire and insect attack (Mackowski 1984; Taylor and Savva 1988). These requirements are only found in old stands. As an example, hollows suitable for vertebrate fauna roosts in ***Eucalyptus pilularis*** (Blackbutt) form only after about 200 years (Mackowski 1984). Few old trees that may provide suitable roosts for bats and other arboreal vertebrates are available in suburban areas due to vegetation clearance on private land, and trimming of old trees on public and private land (Holmes 1996). Brisbane, the capital city of Queensland, and the greater Brisbane region, covers some 3000 square kilometres and contains one of the largest and fastest growing urban areas in the world (Poole 1995) with the fastest rate of population growth of any region in Australia (Catterall and Kingston 1993).

Tadarida australis (family Molossidae) is distributed throughout Australia apart from the northernmost regions and Tasmania. This species is endemic to Australia, where its conservation status is common to uncommon in numerous habitats (Strahan 1995). ***T. australis*** are large bats (25-40g) and are

described in the literature to roost in trees either alone or in groups up to 20 individuals (Reardon and Flavel 1987; Strahan 1995; Churchill 1998). Recent research in Brisbane shows ***T. australis*** to roost in hollows in old eucalypt trees, especially in Forest Red Gums ***(E. tereticornis***) and in Grey Gums ***(E. propinqua)*** with colony sizes up to 300 individuals (Martin P. Rhodes, pers. comm., own observations). Some of these mature big trees with ***T. australis*** colonies are found in suburbs, especially in Brisbane City Council parklands. Such trees have an estimated tree age of up to 600 years (Borsboom ***et al***., ***in prep.***).

1. Bat boxes

Nest boxes have been used as an important wildlife management tool in situations where hollow availability can limit population levels. Thomas ***et al.*** (1979) showed that nest boxes were successful in increasing the populations of insectivorous birds in European forests in order to control outbreaks of insect pests. In North America, nest boxes have successfully maintained populations of several species of squirrels, waterfowl, kestrels, owls and martins in farmland or urban environment (Schemnitz 1980). In Australian suburbia where old tree stands are limited, nest boxes may be the only source of hollows for wildlife populations and therefore could provide habitat that is essential for these species to persist in the area. On the other hand, nest boxes can be a tool for research into the biology of hollow-using species, as they allow access to nests otherwise inaccessible (Menkhorst 1984). In many countries, especially in Europe and in the United States of America, bat boxes have been shown to provide suitable roosts for many bat species, where roost sites became scarce (e.g. Tidemann and Flavel 1987; Stebbings and Walsh 1991; Tuttle and Hensley 2000). In Australia however, the use of bat boxes to provide roosts is at an early stage and literature and information about other bat box usage in Australia is virtually non-existent (Bender and Irvine 1995, 2000a,b).

In this study I installed a number of bat boxes (70) in suburban Brisbane to monitor the acceptance of artificial roosts by bats. This was repeated at different locations, such as Brisbane City Council parklands, and residential (private) properties to compare acceptance with differing land tenure. At the end of my three year project I should be able to determine which bat species in metropolitan Brisbane will adapt most readily to bat boxes as artificial roosts.

Methods

1. Roost sites of *T. australis*

I will determine the location of ***T. australis*** colonies in suburban Brisbane. To examine the importance of tree-hollows for this species in suburban Brisbane, I intend to use radio-tracking to study bats' use of tree-hollows for day and night roosts. I will examine tree-hollow use during several seasons in a period of 2 years. To examine bat activity and foraging behaviour I will use Anabat bat detectors.

I will radio-track bats with light-weight radio-transmitters to locate their roosts, and determine the distance between roosting and foraging areas (food and water resources) and distance to other roost-sites. I will collect data on roost hollows, roost trees and surrounding habitats and characterise them as suggested by Crampton and Barclay (1996).

To find out more about seasonal use of roosts, I intend to observe the tree roosts (visual monitoring). ***T. australis*** fly-outs can be easily observed using the ambient light, as found for other species (reviewed in Barclay and Bell 1990). The numbers of exiting ***T. australis*** can be counted by observing bats using ambient light, especially at dusk (Thomas and La Val, 1990). Anabat detectors will be used to confirm identification. ***T. australis*** produces very distinct echolocation signals of around 11kHz, well within the human hearing range. This makes observations and counts much easier and the flight path can be readily followed by listening to the loud and audible echolocation signals. I will examine roost emergence behaviour through the night by filming at roost exits with an infra red camera and video recorder.

I also will examine activity and foraging behaviour of this species simultaneously with Anabat detectors at defined study sites to get a complete picture of suburban use by bats. This will allow examination of

the number of roosts used, and duration of use, by ***T. australis*** in suburban areas during different times of the year.

2. Bat boxes

One part of this study focuses on the acceptance of artificial roosts (bat boxes) by insectivorous bats in suburban Brisbane. For this part of the study one bat box design (Stebbings and Walsh design) used successfully by bats in the Organ Pipe National Park in Victoria, Australia (Bender and Irvine 1995, 2000a,b), was installed in more than 30 gardens. The boxes have a bottom entrance slit of 15 mm (the Organ Pipe Bat Boxes had a high acceptance of bat boxes with 15 mm entrance slits). If more than one box was installed in the same area, an identical bat box with an bottom entrance slit of 12 mm, was installed close to the first bat box. This ensures roosting habitat for smaller species, such as ***Vespadelus sp***. (Bender and Irvine 1995, 2000a,b).

In the second part of this study I erected different sized bat boxes with a range of entrance slits and internal volumes to find out more about roost requirements of different bat species. I predict that different sized bat species use different roost habitats, including bat boxes. Six bat boxes with a range of measurements were erected at five study sites. The boxes were installed on six tall trees that are not more than 400 m apart. This ensures that variables such as vegetation types, distance to open water, etc. are the similar for each bat box.

Every bat box (residential area and study sites) was installed 5 m above ground, on a tree trunk clean of branches or other obstructions (as recommended by various bat box builder books). Every bat box was mounted facing east for two reasons: at Organ Pipe N.P. in Victoria, only boxes facing west or east contained bats. Additionally, Brisbane experiences subtropical weather conditions and monsoonal rainfalls during summer (November until March). It also enables the boxes to face the morning sun but avoid the very hot afternoon sun.

Initial Results (May 2000 – March 2001)

1. Roost ecology of *T. australis*

Roost occupation:

I monitored each of the seven known roost trees monthly from May 2000. Only one of these had a ***T. australis*** colony initially. The roost occupation did not change until mid September, when all except one roost became occupied. The numbers increased steadily each month, with up to 200 individuals now in some colonies. By walking in parks at dusk I was able to locate another three roost trees with ***T. australis*** in low numbers (one or two individuals) during the winter months. The size of two of the roosts found in winter remained at one or two individuals, while the third roost increased in number to seven individuals.

Roost cohabitation:

Two of the colonies containing large numbers ***of T. australis*** each have one female and infant Common Brushtail Possum (***Trichosurus vulpecula***), cohabitating the same roost. The bat colonies do not seem to be negatively affected by this as continuing observation showed that both ***species (T. australis and T. vulpecula***) leave the roost at about the same time without any aggressive behaviour evident towards each other.

One known roost tree used by ***T. australis*** in recent years had all roost exits occupied by birds (Sulphur-crested Cockatoo (***Cacatua galerita***), Scaly-breasted Lorikeets (***Trichoglossus rubritorquis***) and by a colony of the introduced European Honeybee (***Apis mellifera***). It is not clear at this stage if the bats left due to the presence of other species, or if the other species used unoccupied tree hollows, but this is the only one of seven known roost trees which has not been occupied this season. Since November 2000 I noticed an increase in Indian Mynah (***Acridotheres tristis***) numbers on all sites. Luckily until now no Indian Mynah has occupied the known ***T. australis*** roosts. The future will show if this introduced pest species (known for its aggressive behaviour in occupying natural tree hollows in large groups) will be

any threat to ***T. australis*** colonies. Continuing observation during the next years will allow me to make a judgement about roost competition between ***T. australis*** and other animal groups.

Emergence time and behaviour:

The emergence time at each colony is 30 to 45 minutes after sunset. Although the emergence times vary from colony to colony, each colony has a specific time when they emerge, which is consistent with the sunset each day. Usually loud social calls can be heard (audible calls) at least 5m away from roosts during the summer season. These "social roost calls" are very different from any echolocation calls produced during flight (search calls) and are very distinctive.

Emergence behaviour:

Short echolocation sequences (inaudible) can be recorded with a bat detector from individuals shortly before leaving the roost. Usually one individual is scanning the area from the roost exit before leaving by moving its head from side to side, emitting echolocation signals at the same time ("orientation calls"). When exiting, ***T. australis*** appears to not use echolocation calls if ambient light is available. During full moon or dusk they switch off their sonar system completely while exiting and find their way presumably with the help of vision. Each individual drops up to 4m down from the exit and flies straight to the closest open area (usually gaps, football ovals, etc.) and starts to circle slowly high upwards using their sonar system again ("search calls"). Each bat seems to stay around their roost area for about 1 to 2 minutes before leaving the area altogether. In darkness echolocation signals can be heard from shortly before exiting until leaving the roost area. In this case observations can be made easily by listening to their loud audible echolocation calls and with the help of an Anabat detector.

Echolocation behaviour:

Search phase echolocation calls from ***T. australis*** have been described by A. Herr and N. Klomp in the Australasian Bat Society Newsletter, March 1997, Issue 8. Additionally I found a range of vocal behaviour produced by this species, which seems to change during the year.

Loud 'chirping' audible social signals are produced in the late afternoon until the colony exits the roost. I call these the "social roost calls". These calls consist of an ongoing background noise different to the pulses of signals produced in search flight. They are both audible AND able to be recorded with Anabat detectors.

In summer (late December until end of February) this type of constant background noise keeps going for hours. Additionally, bird-like calls (sharp "tschi-tschi-tschi" calls) can be heard from individuals in the roost ***and*** free flying individuals close to the roost. During this specific type of vocal behaviour ***T. australis*** were found to come back to the roost (landing on the roost exits) after just 30 min while other individuals were still heard from inside the roost. My hypothesis is that this might have to do with giving birth in late December/start of January and this might be a social component of the contact between juvenile and adult individuals. Next season I hope to get more information while capturing and radio-tracking individuals and monitoring the roosts with infra red cameras. This behaviour started end of December and ceased end of February while the 'normal' social roost call behaviour is still observed.

At the moment I am in the middle of analysing the above described call behaviour. The inaudible signals were recorded with Anabat detectors and will be analysed with Anabat software while I simultaneously recorded audible calls with a Sony Walkman Professional and a directional Sennheiser microphone. I intend to analyse the audible call behaviour ***of T. australis*** with the bioacoustic software Canary.

2. Bat Box Project in suburban Brisbane

In September and October 2000 I launched a media appeal through the following channels: three radio stations (ABC news, 4KQ, CRB); the leading state and local newspapers; newspapers of Griffith University and University of Queensland; and four newsletters of naturalist organisations. I

sought people interested in being involved in a long-term bat conservation study by purchasing their own bat box for AUS$ 30 to locate on trees in their property. I received more than 110 calls of interested people in the metropolitan area in the first three weeks. The high interest led to more offers for boxes than I could cover in my monitoring. 40 boxes have been installed in more than 30 gardens: 28 type 1 and 12 type 2 "Stebbings and Walsh" design boxes (see below for more details).

In the second part of this study I erected different sized boxes to find out more about roost requirements of different bat species. I am receiving logistical support from Brisbane City Council to access study sites on BBC land and 30 boxes have been now installed in five different study sites. Each study site has six bat boxes varying in size, volume, compartments and entrance slits (measurements in millimetres):

Type 1: 170H x 120W x 98D with 15 mm bottom entrance slit.
Type 2: 170H x 120W x 98D with 12 mm bottom entrance slit.
Type 3: 430H x 205W x 98D with 18 mm front entrance slit.
Type 4: 360H x 205W x 98D with 18 mm bottom entrance slit.
Type 5 (double compartment): 430H x 205W x 50D per compartment and with 15 mm bottom entrance slit.
Type 6 (double compartment): 430H x 205W x 50D per compartment and with 12 mm bottom entrance slit.

The checking and monitoring of the 70 bat boxes started in January 2001. Although I wasn't lucky enough to find any bats in any of the bat boxes, I found in at least five boxes bat scats (positively identified by Dr. Steve Van Dyke, Qld Museum, 28/02/2001). One box had bat scats inside twice in a period of just 4 weeks (see Table 1).

Table 1: Bat box number, type, date, location where bat scats were found, and date of mounting

Bat box number	Bat box type	Location	Date scats found	Date of box mounting
T III	3 18mm front entrance	Toowong Cemetery, free standing tree next to road	10/01/01	12/12/00
6	3 18mm front entrance	Park at Oxley Creek, Graceville. Free standing tree 10m away from Oxley Ck. Box facing the creek.	15/01/01 06/02/01	17/10/00
17	1 15mm bottom entrance	Norman Creek Catchment area. Largest tree in immediate area, about 5m away from 2 joining creeks.	21/02/01	24/10/00
2	1 15mm bottom entrance	Front yard, tree next to street in suburb Kenmore. Box placed parallel to street.	06/02/01	17/10/00
33	1 15 mm bottom entrance	Backyard, leafy garden, suburb Warner. Tree overlooking a slope with box facing the open area.	27/02/01	17/11/00

Box competition:

Some of the bat boxes have been used by ants as convenient sites for colonies (***Pristomyrmex*** sp, 3 different ***Polyrhachis*** species, and at least four other unidentified ant species). I removed these colonies by hosing the boxes out with high water pressure and "ant proofed" the boxes by applying

waterproof 'boat/marine grease' on the spacers between the box and the tree trunk. So far this method seems to work. Even after torrential rain the grease repelled ants from getting into the boxes.

Various other species were found to inhabit the boxes: Several huntsman species: Grey Huntsman Spider (***Holconia immanis***), Giant Green Huntsman (***Tyostola*** sp.), Brown Huntsman Spider (***Heteropoda jugulans***), one Hedge grasshopper (***Valanga irregularis***), several cockroach species: Barred Cockroach (***Cosmozosteria subzonata***), German Cockroach (***Blatella germanica***), Australian Cockroach (***Periplaneta australasiae***), American Cockroach (***Periplaneta americana***), and one gecko (***Gehrya dubia*** or ***Hemidactylus frenatus***).

Except for the ant colonies I do not consider the other species as box excluders or competitors so I do not remove them from the boxes.

Conclusions

My PhD study of natural roost habitat of ***T. australis***, and artificial roost habitats (bat boxes) for insectivorous bats in Brisbane is the first study on urban microchiropterans in Australia. By combining the results at the end of my three year study I aim to provide recommendations for bat conservation and management in suburban areas. As ***T. australis*** is widespread in Australia, conservation issues resulting from my research in Brisbane may be applied to other suburban areas in Australia, especially the more populated cities such as Sydney and Melbourne.

Acknowledgements

I would like to thank a range of people who helped me so far: My supervisors Dr. Darryl Jones and Dr. Grant Wardell-Johnson (Griffith University/Gatton College, UQ). Dr. Les Hall (University of Queensland) for support, advice and equipment. All the participants in the bat box study, especially Mr. and Mrs Johnson in Lota for the hint with the 'boat/marine grease'! Frank Box from the ***Australian Nestbox Company*** for building and mounting the bat boxes. Dr. Steve Van Dyke, Vertebrates Curator at the Queensland Museum, for identifying bat scats. John Holt and Prof. Dr. R. Kitching (Griffith University) for ant identification. All volunteers and helpers: Martin Rhodes, Tom Nealson, Irma Feuser, Nicki Markus, Rachel Griffith, Peter Howard, Cornelius Hemmers and many others. Dr. Geoffrey Smith and Luke Hogan at the Department of Natural Resources for help and support. Dr. Ian Gynther (QPWS), Terry Reardon (South Australian Museum), and Lindy Lumsden (Arthur Rylah Institute) for advice.

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Roost ecology and conservation of insectivorous bats in suburban Brisbane: VOLUNTEERS and INFO NEEDED!!!

As described above in the above article, my study relies on a lot of field work during the next 2 years. As I need keen volunteers in Brisbane who might even have an interest in bats (and maybe background knowledge) I thought of asking for help through the ABS.

For the coming field season I need volunteers helping me checking bat boxes in June, September and December. This involves a whole day of bat box checking (I have six day trips per month to do). The vacated roost hollows will be checked with a hollow-scope in the winter months (June-August). As tree climbing and usage of the ladder is required I need volunteers who help me with all the equipment and the filming of the hollows. Also for the radio-tracking I need helpers willing to spend a night or two radio tracking these hard-to-follow bats.

While checking the bat boxes in the last 2 months I came across a lot of scats. Some of these have been identified as bat scats. Others were quite suspicious: One contained a lot of insect parts, but also some other material (wood pieces). Could it be that a bat has eaten a moth, such as wood burring moth which just had a 'wooden' meal? If so it would make sense that the indigestible gut contents of that moth will be found in a bat scat together with indigestible insect parts. Did somebody ever come across bat scats with wooden pieces in between insect parts?

Also I found a "scat" which under the dissecting microscope contained only unprocessed insect parts and hairs, mainly spiders parts. I heard of ***Nyctophilus*** species spitting out unprocessable insect parts such as wings (Terry Reardon, pers. comm.). Can somebody help me in that question as well?
Scats also have been found on top of the boxes, mostly from plant eating mammals. Steve Van Dyke thought they could be from Feathertail Gliders or other small mammals. Has anybody experience in identifying those scats?

And last but not least I need many more ***Tadarida*** roosts in suburban Brisbane. If anybody knows or discovers a used (either year-round or just in summer) or abandoned tree roost used by the White-striped Freetail Bat, could he/she contact me please?

I am grateful for any help and suggestion. Please contact Monika Rhodes at Griffith University, Nathan (Brisbane) on (07) 3875 6567 or on e-mail: m.rhodes@mailbox.gu.edu.au.

Thanks!

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Bat boxes at Organ Pipes National Park

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The project

Organ Pipes National Park is 25 km. north-west of Melbourne, most of it comprising a fragment of the valley of Jackson's Creek (which further downstream joins with Deep Creek to become the Maribyrnong River) with a wide alluvial flat, covered with regrowth eucalypt and acacia forest. The Friends of Organ Pipes (FOOP) initiated a project to experiment with artificial bat roost boxes in April 1992. We installed 10 of them, made from 19mm hardwood, on trees in the riparian flat south of the Pipes, over an area of about 6 hectares. Bats were first observed occupying the boxes in October 1994, after a wait of two and a half years. These boxes had entrance slits of 24 to 34 mm. This turned out to be a mistake – the entrance slits were too big – but it has produced interesting results anyway.

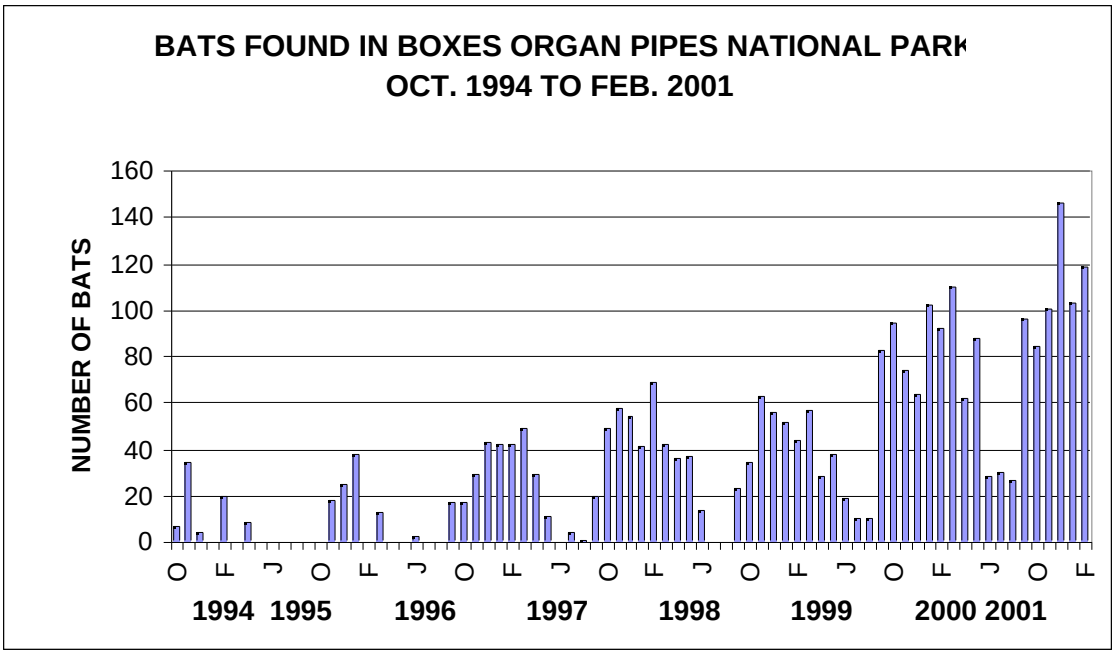
Box	Height mm	Width mm	Depth mm	Volume m^3	Entrance mm
C 1	280	155	100	0.0043	25
C 2	265	152	110	0.0044	30
C 3	270	152	100	0.0041	24
C 4	261	155	109	0.0044	25
C 5	275	150	102	0.0042	25
C 6	269	151	100	0.0041	34
C 7	275	158	98	0.0043	26
C 8	271	154	100	0.0042	27
C 9	270	153	104	0.0043	24
C 10	260	155	101	0.0041	30

Since November 1994 there have been fairly regular monthly inspections of all boxes, very regular since October 1996. 70 inspections have been conducted to February 2001 by a medley of Friends' members and Natasha Schedvin, who has conducted a banding project, mainly with Gould's Wattled Bats since November 1994.

Year	1994-5	1995-6	1996-7	1997-8	1998-9	1999-0	2000-1	Total
Inspections:	8	9	10	12	11	12	8	70

Goals, old and new

Our goals over the 6_ years since the banding project have changed and developed. Our initial goal was just to provide homes for insectivorous bats in a regrowth forest lacking natural hollows, in the hope that a substitute could be found, well over a century before natural hollows could be expected to emerge in the Redgum and Manna Gum overstorey (Irvine and Bender 1995). This has been a great success. Gould's Wattled Bats were first found inhabiting some of the boxes in October 1994 and through that summer a colony of about 35 bats was observed on our monthly inspections of the boxes. This has now grown until in the summer of 2000-1we found up to 147 bats at the seasonal peak in late summer. Most of the bats recruited to the colony have been the young of resident female bats, but a few have immigrated from elsewhere. So most of the increase is the natural increase in the colony from successful breeding.



Competitors, large and small

The error in making the entrance slits too large meant that some larger hollow-dwelling animals were able to enter. There were Sugar Gliders, European Rats, and in April 2000 a Ringtail Possum squeezed into the box with the largest entrance slit, seemed to make it home for several months, then later moved to another box. The gliders occupied each of the first 10 boxes at some time, some boxes very regularly and others only intermittently.

Box	Total Gliders
9	37
8	13
4	11
1	10
6	6
10	4
5	3
3	2
7	2
2	1

This problem was apparent in the first year of the banding project, 1995, and since then we aimed to install boxes that would exclude these larger animals by constructing boxes with smaller entrance slits of <20mm.

Box	Height mm	Width mm	Depth Mm	Volume m^3	Entrance Mm
C 13	227	148	101	0.0034	18
C 14	230	145	102	0.0034	20
C 15	235	148	100	0.0035	16
C 16	235	150	100	0.0035	17
C 17	233	150	100	0.0035	18
C 18	241	139	900	0.0030	13

These were a great success and bats started using them almost immediately, in contrast to the 30-month wait for the first boxes to be used.

Bees, ants and wasps

Nesting boxes installed at other places such as Tower Hill State Game Reserve have had a serious problem of colonisation by feral honeybees (Wood & Wallis 1998) and this has also been a problem with the Sugar Glider nest boxes set up at Organ Pipes NP (Laila Sadler pers. comm.). So we were much concerned to see whether this became a problem with the bat boxes. Each swarming season we have observed scout bees inspecting the bat boxes and once or twice have found one or two bees inside boxes, but there has never been any sign of hives being established, although some boxes are attached to trees which also have Glider boxes which have attracted large bee swarms. Sugar Gliders tried gnawing at these smaller entrance slits to make them large enough for glider chests to squeeze through. They succeeded with one box (C14), which has had a glider colony ever since (total bats 35 to Feb. 2001), so this box is unavailable for bats. But they seem to have failed with the other newer boxes.

The bats show a strong preference for these boxes with smaller entrance slits that exclude competing larger hollow-dwelling animals. But the bats still use the older boxes quite a lot, so they are still prepared to use boxes that are less than ideal.

On three occasions small single-chambered wasp nests have been found inside two boxes, and these have been removed. No wasps have been seen at our monthly inspections.

Of much greater concern have been ants of ***Chrysogaster*** species. These have started colonies in the lids of several boxes, taken over completely a few boxes and even managed to fill the entrance slits so as to make the interiors into totally enclosed spaces. Generally, boxes occupied by ants have had no bats, or even bat droppings inside, so there seems to be some mutual intolerance. We have tackled this by liberally sprinkling talcum powder around the box rims and lids, a technique learned from David Lindenmayer, who seems to have picked it up from Dan Harley, both of whom have experimented with nest boxes for Leadbeater's Possum (Lindenmayer and Harley, pers. comm.) This is very effective in ridding boxes of ants. Boxes covered in talcum powder have soon be reused by bats.

Winter roosts

We soon noticed two gaps in our data. One was that no bats seemed interested in our boxes through the coldest winter months, so the number of bats we found plummeted to zero each June, as can be seen on Graph 1.

Winter roost boxes, made of much thicker timber, to alter the insulation characteristics of the box, are commonly used in northern hemisphere bat roost box projects. Stebbings and Walsh (1996) refer to boxes of 100 mm. timber, but in our milder winters, 17-20° closer to the equator, we opted for 45 mm. In October 1998 we installed 3 boxes made from 45mm pine as an experiment. Through their first winter, in mid-1999, 10 Gould's Wattled Bats, born the previous summer, remained in these boxes June to August, while the remaining young and the older generations went off to find winter roosts elsewhere. Encouraged by this success, we installed 4 more in September 1999.

Box	Height mm	Width mm	Depth mm	Volume m^3	Entrance mm
C 28	275	100	100	0.0028	15
C 29	280	100	100	0.0028	15
C 30	255	140	110	0.0039	15
C 31	298	100	100	0.0030	15
C 32	298	100	100	0.0030	15
C 33	298	100	100	0.0030	15
C 34	302	100	100	0.0030	15

The next winter found 26 bats stayed through June to August, some using thinner-walled "summer" roosts in June, but almost exclusively the thicker-walled boxes in July and August, the coldest months. At present, the ratio of winter to summer boxes is 7:25. Shifting this more in favour of winter roosts may alter the proportion of bats overwintering in the boxes.

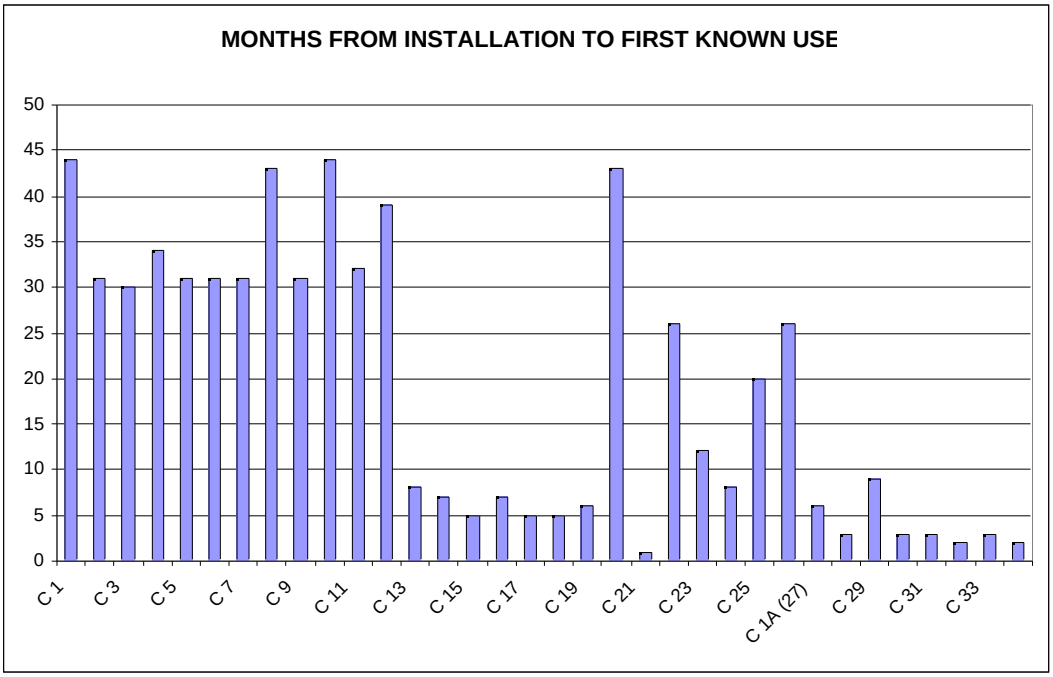
Boxes without bases

In the USA, boxes with no base, open to the air, have been much used by bats. We have had three of these, each with 2 or 3 compartments, in place for some years, but recently removed them, as the internal compartments were narrow and awkward for removing bats at our monthly inspections. The two earlier ones were little used over 5 years, but a group of 12 was found in one early in 2001. The third was on the same tree as the most popular box, and once had about 25 bats in it – a lot of data lost as it was not possible to capture these bats. So the design has had some success in attracting bats, but the boxes have been unsuitable for research work.

Broadening the range of species using the boxes

The other major gap in our data has been that only one species was ever found using the boxes over the first two years: Gould's Wattled Bats. This was so although 6 species are regularly caught in our annual harp trapping in March, and the White-striped Freetail bat is regularly heard flying above the canopy. The second batch of boxes, with entrance slits between 13 and 20 mm. still attracted almost exclusively Gould's Wattled Bats, although a few Large Forest Bats appeared in some of these newer boxes from March 1997 (and never in the older 10 boxes with very large entrance slits). We tried installing boxes with smaller internal volume, and very small slits, to exclude the relatively large Gould's Wattled Bats, and provide space for the smaller Forest bats. 7 boxes with slits of 8 mm were put up in 1997. These proved to be too small, and excluded all but grasshoppers, spiders and crickets, and a few perhaps juvenile bats with skulls and chest cavities not yet grown to full adult size. 6 of these boxes were taken down and the slits enlarged to 12mm in July 1999, and the 7th a few months later. Since then the Forest Bats (***V. darlingtoni*** and ***V. regulus***) have used almost exclusively these 12mm boxes, some boxes being used much more frequently than others***. V. regulus*** has always been found with ***V. darlingtoni***, though ***V. darlingtoni*** often appears in boxes without accompanying ***V. regulus***.

Box	**15**	**16**	**17**	**18**	**19**	**21**	**23**	**24**	**25**	**28**	**29**
Slit	**16**	**17**	**18**	**13**	**8**	**8**	**8**	**8**	**8**	**15**	**15**
Pre-widening	1	1	1	3	3	3	2	0	0	1	0
Post-widening	0	0	1	1	7	4	2	6	1	1	1



On one occasion a Chocolate Wattled Bat, and several times a few Southern Forest Bats, have been found, and in the summer of 1999-2000, a solitary male White-striped Freetail Bat on two occasions was found in the same box. So at this stage, 5 of the 7 species known from the trapping program have been found in our boxes. In late 2000, a ***Mormopterus*** female was found on one occasion, so another species has been added to the list of species known to use that bit of Jackson's Creek valley

The program of installing a range of box sizes seems to be successful, although well over 90% of all bats found continue to be Gould's Wattled Bats. Only the Lesser Long-eared Bats and Small Forest Bats have shown no interest in using our boxes, so perhaps we are not yet meeting their needs, and further experiments with modified designs are needed. There are three other tree-hollow-dwelling species with distribution maps showing they are likely to be in the area: Eastern Falsistrelle, Gould's Long-eared and Yellow-bellied Sheathtail. These species have not used the boxes or been captured in traps. But there may be surprises to come.

Installing artificial roost boxes in valley regrowth forest close to a creek has been a success, as shown by over 6 years of monitoring, with the original colony of Gould's Wattled Bats increasing in numbers several-fold. Experiments with modifying the box characteristics have yielded results in a wider range of species and wider range of seasons during which bats use boxes, and very successful breeding by at least 3 species (Gould's, Large and Southern Forest bats).

Box maintenance and cost

The initial boxes cost about $30 each, but this has increased with the price of timber and the addition of the GST in 2000, so they now cost about $50. Our oldest boxes have now been in place for 8 years, some of them have fallen off and needed replacing or repair, and even some of the more recent ones have been damaged by water-logging or warping of the timber. But the main problem has been adaptation to allow for tree growth, which tends to push the boxes off their nails or screws. Spacers between tree and box help. The expected life of a box seems to be less than 10 years, so if a project like ours is to be maintained for many decades, all boxes would need replacement several times and the eventual cost would be quite large. This could be a problem with large-scale attempts to re-introduce bat colonies to big areas of regrowth forests.

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Towards defining adequate bat survey methodology: why electronic call detection is essential throughout the night

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Abstract

The method for identifying free-flying bats by their species-specific echolocation calls is one that has become standard in the last decade. Detection systems can be automated to commence call detection at dusk in the absence of the operator, and will operate for an entire night. However, many bat surveys are still conducted by manually operating a detector, and over the last few years it has become apparent that some of these surveys are deficient.

This paper analyses data taken from over 50 sites in three bioregions where calls have been recorded throughout the night, or at least over a major portion of the bat activity period. The proportion of the total site species was averaged in consecutive half-hour blocks, and these points were fitted with a polynomial regression. Only two-thirds of the species that were present were recorded in the first hour of detection, with just over half being recorded in the first half-hour period after dusk. It took nearly 3 hours to accumulate presence data for 90% of the site species, and all night to record all of them.

When data was extracted for species listed in the NSW Threatened Species Conservation (TSC) Act, or species listed nationally under IUCN categories, varying detection times were observed. At some sites it took at least one hour, and on several occasions three hours, to record threatened taxa. The situation was somewhat different in tropical Northern Territory and Queensland.

The implications of the data concerning species listed as threatened in NSW is extremely important when attempting to establish standards for bat fauna surveys and assessments. Considering that many bat surveys carried out for Environmental Impact Assessments are known to be relatively brief (less than one hour) and many researchers do not use Anabat delay switches or laptops, it can be confidently stated that many past bat surveys would have certainly missed species that are listed in the Threatened Species Conservation Act.

Introduction

The method for identifying free-flying bats by their species-specific echolocation calls is one that has become standard in the last decade, and the Anabat system (Titley Electronics, Ballina) has received world-wide acceptance as a valuable sampling method. An advantage of the Anabat system is its automation, either by using timers or delay switches to commence call detection at dusk in the absence of the operator. This allows multiple sites to be sampled on the same night. Laptop computers are now being used in place of delay switches because they can be set through software controls to only record ultrasound (Chick and Lumsden 1999, O'Farrell 1998; O'Farrell and Gannon 1999; O'Farrell ***et al*** 1999).

However, many bat surveys are still conducted by manually operating a detector, whether it is an Anabat system or not. Over the last few years it has become apparent that some surveys are deficient, through a short time period of detection and a consequently low number of recorded passes and species numbers.

This paper analyses data taken from field surveys in three bioregions where delay switches have allowed the recording of calls throughout the night, or at least a major portion of the bat activity period.

Methods

Data was obtained from personal surveys, or from associates who had also used delay switches controlling Anabat detectors. The delay switch records the time of each bat pass, which allows bat activity patterns to be determined. When data from sampling sites were analysed the number of calls of each species were allocated to half hour periods, commencing at dusk.

This provided a data matrix of species activity over time, but the salient data for this study was the number of species recorded in each half hour time block. This enabled a species accumulation curve to be created for each sampling site.

Because some sites in the tropics had many more species than did temperate sites, the data was assessed as the cumulative proportion of the total number of species recorded each night at a site, through the half hour time periods. For example, 15 species may have been recorded at a site in the Top End of the Northern Territory, 5 in the first half hour after dusk, another 5 in the 2nd half hour and another 5 in the third half hour. The cumulative proportions would therefore be 0.33, 0.67 and 1.00. In comparison, temperate sites usually had about 8 species recorded, and with the pattern of species accumulation was 4, 5 and 6 species in the first three time blocks, the cumulative proportions would be 0.5, 0.63 and 0.75, and finally reaching 1.0 later in the night. By using proportions, sensible comparisons could be made between bioregions with different complements of bat species.

As well as obtaining data on all species, analyses were also conducted to determine during which half hour time period threatened species were recorded. This was considered important because some species with apparent large home ranges such as the Yellow-bellied Sheathtail Bat (***Saccolaimus flaviventris***) were recorded late in the night during past surveys (e.g. CSIRO 1996), and appeared to be covering large home ranges.

Results

The proportion of the total site species that were recorded in consecutive half-hour blocks was averaged for a total of 52 sites where delay switches had been used. These averages are plotted in Figure 1, and the points are fitted with a polynomial regression.

It can be seen that only two-thirds (0.68) of the species that were present were recorded in the first hour of detection, with just over half (0.57) being recorded in the initial half hour period after dusk. It took nearly 3 hours to accumulate presence data for 90% of the site species, and all night to record all of them.

The basic pattern of species accumulation was that common species were recorded first, and rare species were recorded later. This was shown when data was extracted for species listed in the NSW Threatened Species Conservation Act or species listed under IUCN categories in the national Bat Action Plan (Duncan ***et al*** 1999). These data are shown in Table 1, classified according to bioregion and species.

The results show that in NSW, species listed in the Threatened Species Conservation Act can take varying times to detect. Species such as ***Chalinolobus picatus, Myotis macropus, Mormopterus norfolkensis*** and ***Miniopterus schreibersii*** were recorded at some sites within the first half-hour. However, at other sites it took at least one hour and on several occasions three hours to record these species. Of significance is that it took at least two hours of recording, and sometimes as much as three to four hours, to record ***Saccolaimus flaviventris***. The average time taken to record NSW threatened species is shown in Table 2. The overall average for the 25 sites at which such species were recorded was 94 ± 64 minutes.

The situation was somewhat different in tropical Northern Territory and Queensland, where three species listed in the national Bat Action Plan were recorded from at least three sites. ***Hipposideros diadema inornatus*** and ***Rhinonicteris aurantius*** were both recorded within the first two half hour time blocks, and a species assumed to be ***Taphozous kapalgensis*** was recorded between the first 30 and 120 minutes of detecting.

Discussion

The implications of the data for NSW threatened species is extremely important when attempting to establish standards for bat fauna surveys and assessments. Considering that many bat surveys carried out for Environmental Impact Assessments are known to be relatively brief (less than one hour) and many researchers do not use delay switches or laptops, it can be confidently stated that many past bat surveys would have certainly missed species that are listed in the NSW Threatened Species Conservation Act.

This is particularly the case for ***S.flaviventris***, which as well as being rare appears to have a large home range and may only pass a detection site once or twice during a night, as indicated by its long average detection time (163 ± 38 minutes), and minimum detection time of 120 minutes.

The situation appears to be different in the Top End of the Northern Territory, where most threatened species were detected within 30-60 minutes at approximately half of the sites examined. However, because their average detection times ranged between 40 and 80 minutes, many of the records obtained for this study would have been missed if detection time was in the order of half an hour.

It appears that future bat studies should incorporate devices that operate detectors throughout a night at each sampling point assessed, especially in studies that are intended (or required) to target threatened species. As the longest time period to record a NSW threatened species was 240 minutes, it is recommended that four hours from dusk be set as a minimum detection time in future bat surveys. was also made by Law ***et al*** (1998) who showed that some species have a burst of activity at dawn whereas others don't, so to compare activity at different sampling sites then full-night surveys are essential.

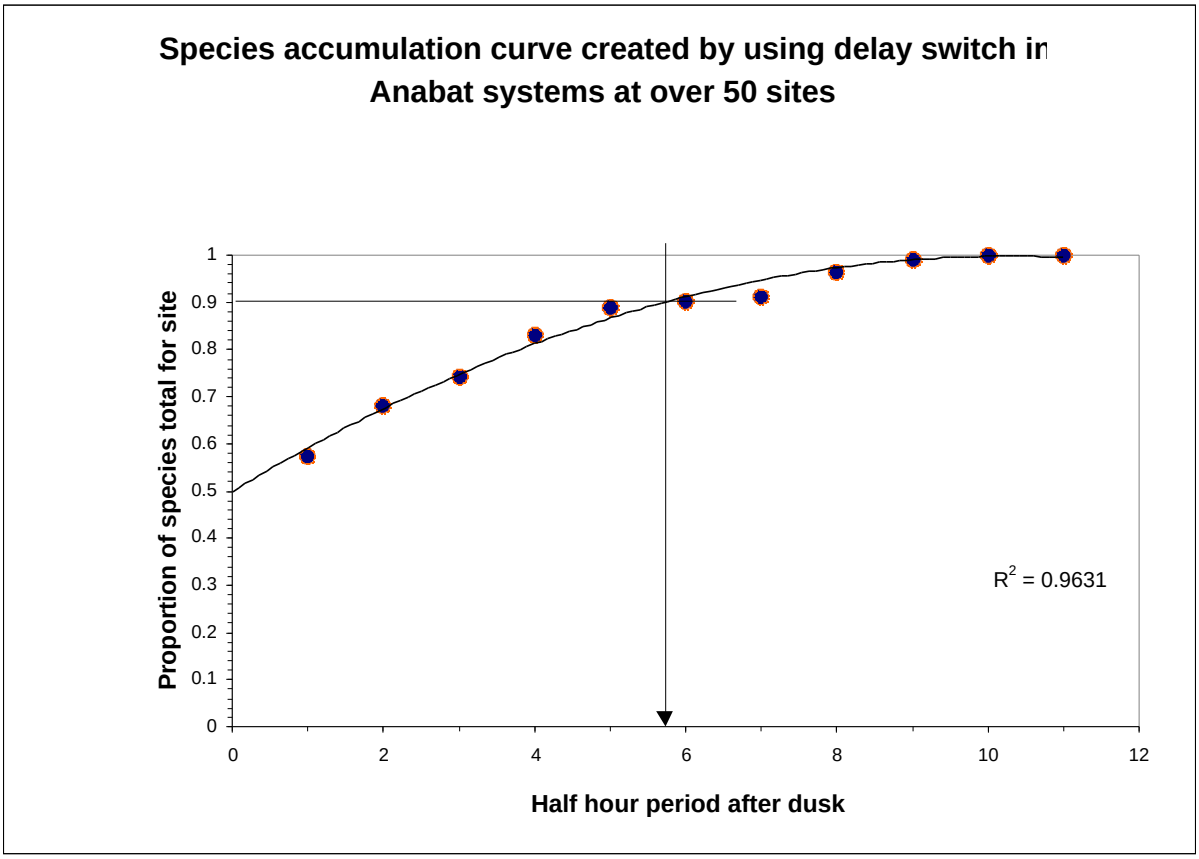
Table 1: Time periods that species listed in the NSW Threatened Species Conservation Act or in the national Bat Action Plan were recorded during surveys with the Anabat delay switch.

Bioregion Species	No. of sites	Half hour time block with first record 1st	2nd	3rd	4th	5th	6th	7th	8th
Temperate NSW									
Chalinolobus picatus	6	-	1	4	-	-	-	1	-
Myotis macropus	4	1	1	2		1	-	-	-
Mormopterus norfolkensis	3	2	1	-	-	-	-	-	-
Miniopterus schreibersii	5	1	1	2	-	-	1	-	-
Saccolaimus flaviventris	7	-	-	-	3	1	1	1	1
Scoteanax rueppellii	1	-	1	-	-	-	-	-	-
Vespadelus baverstocki	1	-	1	-	-	-	-	-	-
Top End NT									
Hipposideros diadema inornatus	3	2	1	-	-	-	-	-	-
Rhinonicteris aurantius	3	1	1	1	-	-	-	-	-
Saccolaimus saccolaimus	2	-	-	-	-	1	1	-	-
Taphozous kapalgensis	3	1	-	1	1	-	-	-	-
North and central Queensland									
Hipposideros diadema reginae	1	1	-	-	-	-	-	-	-
Mormopterus sp.6[1]	2	-	1	-	-	-	-	-	-
Rhinolophus philippinensis	2	-	1	1	-	-	-	-	-
Saccolaimus saccolaimus	1	-	-	1	-	-	-	-	-

[1] As in Adams ***et al*** (1988)

Table 2: Average time for threatened species to be recorded during surveys with the Anabat delay switch. Only species recorded from 3 or more sites are analysed.

Species	No of sites recorded	Average "time to first record" (minutes)	SD
C.picatus	6	75	53
M.macropus	4	45	17
M.norfolkensis	3	40	17
M.schreibersii	5	90	56
S.flaviventris	7	163	38
H.d.inornatus	3	40	17
R.aurantius	3	60	30
T.kapalgensis	3	80	46



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The trouble with trip-beams

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Abstract

Tracking population changes over time (i.e. monitoring) provides vital information to managers. Not surprisingly, a great deal of attention has been paid to finding accurate, precise and efficient methods for monitoring biological populations. Trip-beams using near-infrared (near-IR) wavelengths (circa 750 to 1000 nm wavelength) are particularly attractive as a low-cost monitoring method for cave-roosting bats because the are thought to be invisible to bats and cause no other impacts on the subjects. However, trip-beams inherently undercount bats ie counts form them are "negatively biased". The nature of this inherent bias is investigated using a simple computer simulation model.

Introduction

One of the most significant needs of conservation planners and managers is to understand the relationship between population size and environmental factors including many that are subject to human control. Tracking population changes over time (i.e. monitoring), provides vital information to managers. Not surprisingly, a great deal of attention has been paid to finding accurate, precise and efficient methods for monitoring biological populations. (Accurate methods provide sample means that lie close to the true or expected population value. The difference between the sample mean and the true or expected population value is termed bias. Some methods consistently underestimate the true value and are said to be "negatively biased". Those that overestimate the true value are said to be "positively biased". Precise methods provide minimal spread of results around the sample mean – in other words, sample variance or standard errors are small. An ideal measure is one that is very accurate and very precise.)

Cave-dwelling bat species present an ideal opportunity to count the size of populations given that all, or a significant portion, of the population regularly gathers in one place and enters and leaves the roost using relatively narrow and well-defined entrances. A number of methods have been employed to count colonial specise including cave-dwelling bats and large fruit-bats. These include various mark-release-recapture methods (Thomas and LaVal 1088), within-roost photographic counts (Thomas and LaVal 1988), direct visual, photographic or video counts at emergence (Thomas and LaVal 1988, Sabol and Hudson 1995). Trip-beams have also been suggested from time to time (Thomas and LaVal 1988). Together with visual and photographic/video counts, trip-beams have the advantage of causing minimal disturbance or distress to bats because capture is avoided. Trip-beams using near-infrared (near-IR) wavelengths (circa 750 to 1000 nm wavelength) are particularly attractive because the are thought to be invisible to bats and cause no other impacts on the subjects (Hill and Clayton 1985, Wilson 2000). (Near-infrared wavelengths are too short to be sensed by mammals as radiant heat.) The electronic components needed to make a near-IR trip-beam are also very easily and cheaply available. A near-IR trip-beam is therefore a very appealing option for counting cave bats.

However, there is a problem with all visual, photographic/video and trip-beam methods and that is the problem of clutter and shading. This leads to an undercounting of individuals or negative bias because some proportion of the population is shaded from view by individuals closer to the viewpoint. Intuitively, this shading effect will increase as the density of animals within the field of view increases, a fact mentioned only briefly by Thomas and LaVal (1988).

With this inherent problem due to the shading effect we are left with the question of how to reveal the nature of the bias, and whether the degree of bias changes as the density of bats increases. We could seek answers to these questions in one of two ways. First, we could conduct a sequence of field

trials and compare trip-beam counts with an independent, hopefully more accurate and less biased "gold standard" count (Lewis ***et al***. 1991, St Laurent 1998, Thompson ***et al***. 1998). However, there are limits to the usefulness of this approach (Thompson ***et al.*** 1998). The most significant one is that we cannot reproduce trials easily, so accumulating evidence to reveal the true nature of the problem with trip-beams is not likely using this approach. Also, identifying a "gold standard" method to use as a benchmark is difficult – obvious choices such as photographic or video counts are feasible, but time-consuming and are not reproducible further compounding the impact of the first limitation. Unfortunately, they are likely to suffer to some unknown extent from the same negative bias that we trying to investigate.

The second approach is to use a simple simulation model that faithfully reproduces the real-world trip-beam method, but allows many replications of trial counts and infinite adjustment of several key parameters such as the density of bats or the length of the trip-beam. We also do not need an independent gold standard since we know the true number of simulated bats to pass the through the simulated trip-beam. Simple simulation models have been used effectively on a number of occasions to investigate vertebrate survey methods (eg Watson ***et al***. 1969, Gates, 1969, Hone 1986). For these compelling reasons, I chose to simulate the counting of bats using a simple computer model of the trip-beam counting process. This paper presents the results of this investigation.

Methods

A virtual space was defined by a matrix or grid with up to 25 rows representing "flight levels" and 250 columns representing horizontal position in a segment of a stream of emerging bats (Figure 1). A randomly selected number of virtual "bats" between 2 and 200 was then placed at random within this space.

The effect of this segment of a flight-stream passing through an infrared trip-beam was simulated by sequentially incrementing a column counter from 0 to 250 thereby stepping through each horizontal position as though the flight-stream segment was moving past an infrared trip-beam detector. For each value of the column counter, the column was scanned to see if any cell in that column was occupied by a virtual "bat", thus representing an interruption to the counter beam. This first encounter in a column incremented a "bat count" variable in the same way that the interrupted beam of an infrared trip-beam detector would advance a counter. Scanning of a column stopped at the first encounter so that no "bats" shaded by the first were "seen" by the simulated trip-beam. This simulated the shading effect experienced with real trip-beams.

The process, from initialising an empty virtual space to counting "bats", was repeated 1,000 times. For each repeat the following information was written to a data file for later analysis: the run number, the true or actual number of "bats" used in that run, and the number of "bats" counted by the simulated infrared trip-beam. The size of the virtual space was fixed, and the rate at which the "bats" flew past the detector was also fixed. Therefore, the true number of bats placed in the virtual space at each run is a direct index of both the density of bats (numbers per cubic metre) in the simulated segment of a flight-stream, and rate of flux (bats per second) passing through the simulated infrared trip-beam.

The model was programmed by the author using ***Borland Turbo Pascal version 6*** running under ***MSDOS version 6.22***. A copy of the program (as both source and executable code) is available from the author on request.

Data generation and analysis

The model was run with 5, 10, 15, 20 and 25 flight levels. This provided a data set that would allow any effect due to the number of flight levels to be detected. In a real-world implementation, this parameter would correspond to the gap between receiver and transmitter in a trip-beam.

To examine whether a constant proportion of the actual number of bats was detected or counted, a plot was made for each run of the proportion counted versus the actual number present. If the proportion counted is approximately constant, this plot should show a distinct horizontal band.

Results

Figure 2 presents the results of 1,000 simulations for 25 flight levels, and is indicative of all the results. The effect of the density-dependent negative bias anticipated on theoretical grounds is clearly evident. When numbers of "bats" are low, the number counted equals or very nearly equals the true number. However, as density increases, the number counted steadily falls below the true number, and the variability in the number counted also increases.

All plots of the proportion counted versus the actual number present where very similar. Figure 3 presents this plot for the simulation run with 25 flight levels.

Discussion

The results of the simulation clearly demonstrate the existence of the density-dependent negative bias predicted on theoretical grounds and alluded to by Thomas and La Val (1988). We may conclude from these results that accuracy of counts in infrared trip-beams decreases non-linearly with increasing density due to the presence of a density-dependent negative bias effect. And, we may conclude that the precision of the counts decreases as density increases. That is, their variability around the average value of the number counted increases steadily in a non-linear way with the true density of bats in the flight stream.

A strong positive correlation between mean and variance suggests that counts from near-IR trip-beams have a statistical distribution related to either the Binomial or the Poisson distribution. In its simplest form, the Poisson distribution has the mean equal to the variance, in the binomial distribution the variance is less than the mean (Zar 1999).

Does the presence of this density-dependent bias and precision matter? In other words, do these effects reduce the usefulness of the method?

Before attempting to answer this question, it is useful to make a distinction between methods that provide estimates of the true size or density of a population (ie estimates of absolute abundance or density) and those that provide an index that is presumed to be correlated with the absolute abundance or density of a population.

An index of abundance can be used if all that is required is a measure of change and direction of change in a population. A reliable or useable index method must ensure that the same proportion of the population is counted on each occasion (Bart and Schoultz 1984, Thompson ***et al***. 1998). Index methods are very widely used in vertebrate studies (Bibby ***et al***. 1996, Thompson ***et al***. 1998). Their popularity stems from their efficiency and ease of use, and the belief that standardising their implementation will ensure that the constant proportionality requirement is met (Thompson ***et al***. 1998). However, only by developing calibration curves relating indices to actual abundance can we be sure that this fundamental condition is being met. This is rarely attempted in wildlife management situations (Thompson ***et al***. 1998) but it is essential if accurate and precise inferences about population size and trend are to be made (Caughley 1977, Thompson ***et al***. 1998). Without this level of understanding, it is not possible to tell whether the range of values will fall in the near-linear portion of a non-linear calibration relationship (Caughley 1977) or how accuracy and precision vary with the index value.

Falling precision with increasing density for the kind seen in this study means that the ability to discriminate between real changes in population size and measurement error decreases as population size increases. This can be compensated for to some extent by providing many more samples, but this tends to mitigate against using a trip-beam as a simple indexing tool. Indexes of abundance are meant to be easy, low-cost measures of reasonable accuracy and precision that serve as surrogates for more complex and costly, but highly accurate and precise estimates of population parameters (Thompson ***et al***. 1998).

The problems presented by trip-beams are not unique, for similar density-dependent bias effects have been noted before in vertebrate survey methods. For example, the impact of habitat clutter has been known to cause a negative bias in estimates of bird species abundance (Bibby and Buckland 1987). A similar effect has also been documented in bird censuses relying on call detection with accuracy falling (ie increasing negative bias) as the abundance of target species increases (Bart and Schoultz 1984). Another example is provided by Southwell (1994) who documented a density-dependent negative bias effect in walked line transects used to estimate macropod density.

The shading phenomenon demonstrated in this study seems an unavoidable side-affect no matter what distance is spanned by the trip-beam. Intuitively, one might expect that the clutter or shading effect could be mitigated by ensuring that the counting equipment is set to count across the shortest possible distance. This would allow the fewest opportunities for one bat to shade several others as they pass through the counter beam. Surprisingly, however, the model predicts that there is virtually no difference due to the distance between the transmitter and receiver (ie in the size of the gap spanned by the counter beam). In the model this was represented by the flight level parameter.

Several additional factors or variables were not considered in this study. These include the optimal spacing of beams to span a wide roost exit and its relationship to the wingspan of the bat species to be counted, and the potential for the existence of a minimum separation distance between bats. Parameters such as these would affect the degree of clumping or overlap between adjacent bats in three dimensions. However, they would not affect the fundamental results of this study.

The results of this simulation study strongly suggest that without extensive calibration of a given trip-beam configuration, it is not possible to relate number of counted bats to actual numbers of bats in a sample with precision. Unless it can be shown, or reasonably assumed, that densities are low enough to lie in the near-linear portion of the calibration curve for a given detector configuration, this method cannot be recommended when estimates of absolute abundance are required.

As a monitoring tool, a counter system based on infra-red trip-beams has initial appeal because it is a simple, rugged, low-maintenance method with low power requirements. It also causes minimal disturbance of the subject animals. However, as this study has shown, it undercounts bats. Also, the results show that trip-beams fail the fundamental measure of a good index method – as the actual density of bats increases, a progressively smaller proportion of the population will be counted, and accuracy and precision of the counts falls as the number counted rises. It seems wise therefore to restrict the use of infra-red trip-beam counters to providing indices of abundance, that is measures of relative abundance, ***within*** a given study provided the configuration used remains constant and a calibration curve is available.

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Figure 1: Representation of the virtual flight-stream used in the simulation model. A cell filled with a black square indicates a cell or position in the flight-stream filled by a virtual "bat". In this representation, columns 3 and 5 would result in one increment of the bat counter each. That is, the second bat in Column 5 is not "seen" by the infrared trip beam resulting in under-counting.

Column (Horizontal position in flight column)

	1	2	3	4	5	6	…	249	250
1			g						
2					g				
3									
4					g				
5							…		
. . .						. . .		. . .	. . .
24							…		
25							…		

Figure 2: Results of 1,000 runs of the simulation model with 25 flight levels and the number of virtual "bats" randomly selected to be between 2 and 200. The straight line in this graph represents the situation where the number counted equals the true number of virtual "bats" in the simulated flight stream.

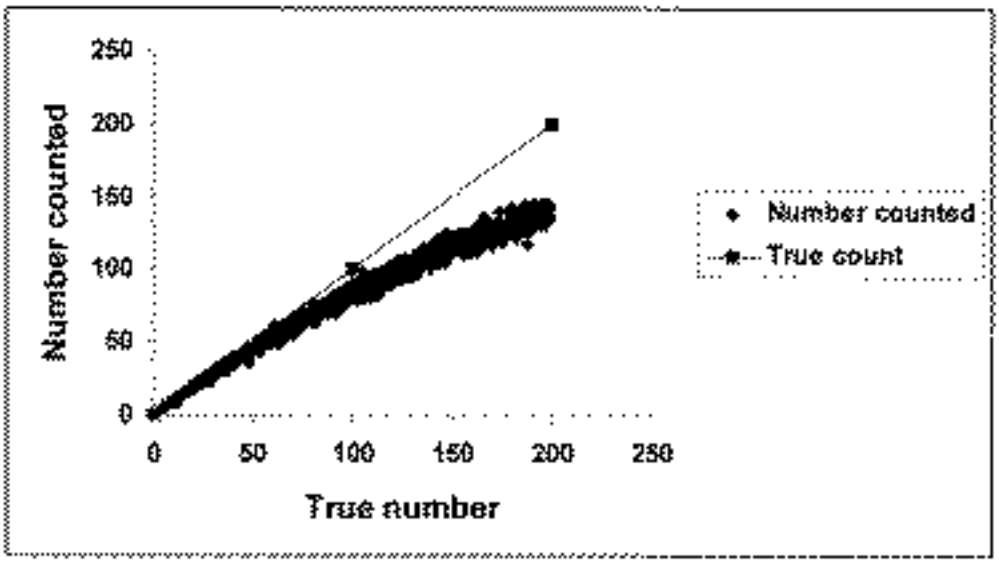
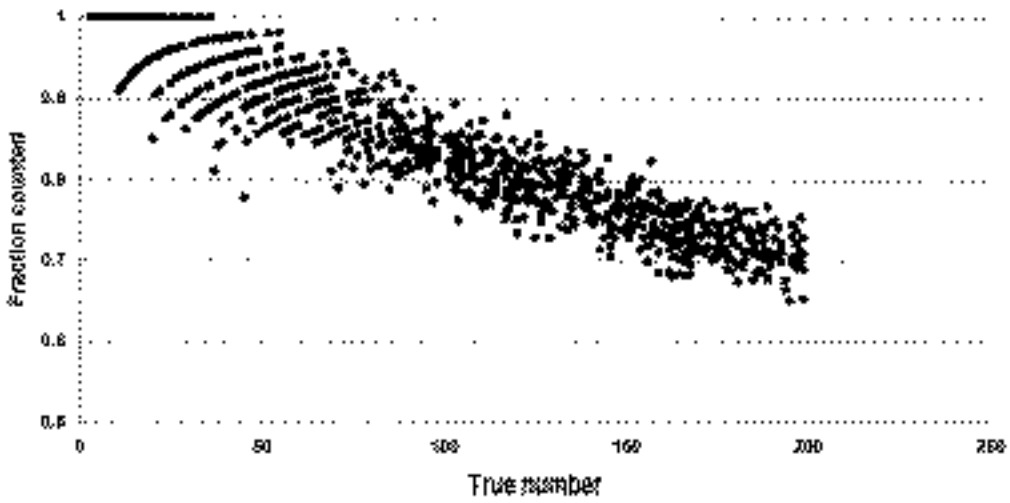


Figure 3: Plot of fraction or proportion of the actual number present in the simulated flight-stream counted. Data from the 25 flight level simulation is plotted here. All other runs of the model showed the same pattern. The contour effect (most clearly seen in the left of the plot) is caused by the constraint that both the true and counted numbers of bats must be integer values.



- Reports and viewpoints -

An update on nominations for listing Grey-headed Flying Foxes as Vulnerable, 30 March 2001

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Summary
The case for listing the Grey-headed Flying Fox (GHFF) as a threatened species in Australia has been carefully reviewed and accepted by three separate committees of scientists: the Editorial Panel of the Bat Action Plan 1999, the NSW Scientific Committee 2000 and the Victorian Scientific Advisory Committee 2001. Pending is the Commonwealth's decision, expected soon; and a Queensland inquiry has begun.

Introduction

Nominations for listing Grey-headed flying foxes as Vulnerable have been submitted and are currently being considered under several pieces of threatened species legislation. It is timely to review the current position.

Four threatened species Acts affect GHFF – the ***Commonwealth Environmental Protection and Biodiversity Conservation Act 1999***, the Queensland Nature Conservation Act 1992, the New South Wales ***Threatened Species Conservation Act 1995***, and the Victorian ***Flora and Fauna Guarantee Act 1988***. Each considers the status of the species within a different geographic area (state legislation usually only takes into account plants and animals that occur within the state boundary – making it difficult to define state populations of migratory species); and each uses different definitions and standards to assess threatened status. In order to achieve increased protection for GHFF and their habitat throughout their range, the species must be listed as threatened under each of the three state Acts. In order to maximise funding for protection, the species must be listed under the Commonwealth Act. It must be nominated separately in each jurisdiction and a new case argued each time.

The process for determining the status of species varies between jurisdictions. Generally, a committee of scientists established under a threatened species Act reviews nominations, determines whether there is sufficient evidence for a decision to be taken and decides whether listing should proceed. While each committee is likely to be mindful of the deliberations and determinations of their counterparts in other jurisdictions, their decisions are autonomous. Usually, the public is invited to make submissions about nominations at some stage in the process. Under some legislation the decision of the committee is final, under others the recommendations of the committee must then be accepted by the Minister for Environment.

NSW: The Grey-headed flying fox was nominated for listing as Vulnerable in NSW in November 1997. It was the first nomination to be lodged. The Scientific Committee announced their Preliminary Determination to list the species as Vulnerable in November 2000. The committee spent three years considering the evidence, and several times requested further information about the nomination. The length of the process was due in part to the need for further data to be collected, and in part to the need of the committee to carefully consider objections to the nomination made by some bat experts. Ultimately, a workshop of experts was held, giving the Scientific Committee an opportunity to question individuals directly. Seven people attended the workshop. Unfortunately, none of the three who opposed to the listing attended. (The ABS has published the proceedings at http://batcall.csu.edu.au/abs/ghff/ghffproceedings.pdf.) Having considered past submissions, the evidence presented at the workshop, and the written submissions of those unable to attend, the Scientific Committee made a Preliminary Determination to accept the nomination as valid and list

GHFF as Vulnerable in NSW. Under the terms of the TSC Act, the committee then advertised their determination and called for public comment. The committee received over 400 submissions (I have it on good authority that they usually receive less than five). It is in the process of responding to each submission it received. If the submissions contain sufficient new evidence to alter their determination, the Scientific Committee will not proceed with a Final Determination and the species will not be listed. Otherwise, a Final Determination will be announced in the near future.

Victoria: Threatened species in Victoria are listed in two stages. Initially, experts in the Department of Natural Resources and Environment (NRE) assess the status of each species of plant and animal in the state and draw up an interim list. GHFF have been listed as Vulnerable by NRE for several years. In the second stage, species are nominated for listing under the Act. Evidence for listing is gathered and considered by the Scientific Advisory Committee. A nomination to list GHFF was lodged with the SAC at the time of the initial culling in the Royal Botanic Gardens Melbourne. A moratorium on culling was put in place until the case was determined. The Scientific Advisory Committee received and considered several submissions on the listing, including objections by some experts. The committee chaired a meeting of experts, similar to that in NSW. Both sides of the debate were represented at this meeting. Having considered the arguments and evidence, the SAC determined that GHFF meet the criteria for listing as Vulnerable under the FFG Act and recommended to the Victorian Minister for Environment that the listing proceed. The Minister did not accept the recommendation of the SAC. It was the first time since 1988 when the FFG Act was enacted that a Minister for Environment did not accept the recommendation of the Scientific Advisory Committee. In her announcement of her decision, the Minister indicated that should the listing under Commonwealth legislation proceed, she would reconsider the recommendation of her committee.

Queensland: The Queensland Environmental Protection Agency commenced their review of the status of GHFF under the Nature Conservation Act in February 2001. They have approached several experts for comment and are yet to receive and review the responses and evidence.

Commonwealth: Grey-headed flying foxes are listed as Vulnerable in the ***Action Plan for Australian Bats,*** published by Environment Australia in 1999. For most species in Australia, listing in an Action Plan results in listing under the Commonwealth Act. However, objections to listing GHFF as Vulnerable were received by Environment Australia. A nomination for listing the species was lodged several months ago and the Threatened Species Scientific Committee of the Act has invited and received comment on the nomination from several experts. It is unclear how long it may be before a decision is taken. The TSSC will then make a recommendation to the Federal Minister for Environment.

Comment

Stay posted. This is an exciting phase in the development of intelligent management of GHFF, and indeed any bat, especially migratory species.

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Flying foxes in the Royal Botanic Gardens Melbourne

History:

(The following is an approximate chronology of flying foxes in the Royal Botanic Gardens Melbourne (RBGM). It is intended to give an indication of developments at the site.)

Grey-headed flying foxes were first recorded in Melbourne in the late 1800's.

Summer 1981 - The species began to use the RBGM as a summer and autumn roost. Since 1995 the site has been occupied continuously with a minimum winter population of approximately 1200. Significant influxes of animals have occurred irregularly.

Late 1990's – Directors and managers at the RBGM decide to reduce the numbers of bats in the gardens, hiring two flying fox experts as advisors. They commence trials of deterrents such as noise and smoke.

November 1999 – Humane Society International nominates GHFF for listing as threatened in Victoria under the Flora and Fauna Guarantee Act (FFG Act)

Autumn 2000 – RBGM announces decision of Directors and advisors to cull flying foxes in the Gardens. A 'giga' harp trap, designed for the site, is installed and culling of captured flying foxes commences.

Autumn 2000 – Scientific Advisory Committee of the FFG Act makes Preliminary Recommendation to list GHFF as Vulnerable, and Victorian Minister for the Environment halts the cull until a Final Recommendation is made.

24 January 2001 – the Scientific Advisory Committee makes a Final Recommendation to list GHFF as Vulnerable.

25 January 2001 – a program of relocating flying foxes from the RBGM to a roost at Mallacoota is announced and tenders are called.

6 March 2001 – fly-out count confirms significant influx of animals into RBGM roost

9 March 2001 - the Victorian Minister for Environment announces that she has not accepted the recommendation of the Scientific Advisory Committee to list the Grey-headed flying fox as threatened. [It was the first time since the inception of the Act in 1988 that the Minister did not accept a recommendation of the committee to list a species.]

15 March 2001 - the Minister announces that the relocation trial is too expensive and animals will instead be culled

27 March 2001 – Philip Moors, Director RBGM, announces the cull of flying foxes will commence in the next few days. The animals will be captured in the harp trap and killed by injection or CO2 gas; or they will be shot in the trees using low velocity ammunition and a silencer. There will be no independent observers and the numbers of animals culled will not be made public.

27 March 2001 – fly-out count indicates numbers in colony have dropped by 35% since 14 March. The decrease coincides with flowering of Spotted Gum on NSW south coast, decreases in camps in Sydney, and increases in camps on the NSW south coast.

30 March 2001 - Humane Society International seeks an injunction in the Supreme Court of Victoria to stop the cull.

If you are concerned at the decision to kill Grey-headed flying foxes in the Royal Botanic Gardens Melbourne, you can voice your concern by writing to:

Steve Bracks
Premier of Victoria
Parliament House
Spring St.
Victoria 3000
steve.bracks@parliament.vic.gov.au

Ms Sheryl Garbutt
Minister for Environment, Conservation & Women's Affairs
Ministerial Office
Level 17, 8 Nicholson St
East Melbourne
Victoria 3002
Fax: 9637 8920
sheryl.garbutt@parliament.vic.gov.au

Victor Perton
Shadow Minister for Environment Conservation
Parliament House
Melbourne
Victoria 3000
victor.perton@parliament.vic.gov.au

Dr. Philip Moors
Director, Royal Botanic Gardens Melbourne

Birdwood Ave
South Yarra
Victoria 3141
PMOORS@rbgmelb.org.au

Ms. Michonne Van Rees
Manager Parks, Flora and Fauna
Department of Natural Resources and Environment
240 Victoria Parade
East Melbourne Victoria 3002

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Bats in mines

Amelia Hurren, Project Officer (Recovery Planning), Biodiversity Management Unit
Andrew Fay, Ranger, Northern Rivers Region

There are over 20,000 mineral localities throughout NSW many of which support derelict workings ranging from complex systems of horizontal tunnels to deep vertical shafts concealed by overgrown vegetation. A number of these occur on lands managed by the NPWS and while some are popular sites for cavers, others pose a serious safety risk to NPWS staff, park visitors and ground-dwelling fauna—mostly from concealed shafts and mines collapsing with age.

The Department of Mineral Resources (DMR) is addressing these safety issues through the NSW Government's Derelict Mined Lands Rehabilitation Program. Under the program, an inter-agency committee assesses and prioritises derelict mines across NSW for rehabilitation. Current rehabilitation practices include sealing the entrance to a mine, collapsing a mine, or fencing to exclude people and animals.

While rehabilitation work is important for public safety and pollution prevention, the sealing or collapsing of mines has potentially serious impacts for bats using the mines as habitat. There are 31 known insectivorous bat species in NSW, and at least seven of these use mines as habitat. Four other species use natural caves and may also use mines. Of these 11 species, eight are listed as threatened species under the ***Threatened Species Conservation Act 1995*** and all 11 are protected species under the ***National Parks and Wildlife Act 1974***.

In March 1999, the NPWS established a Bats in Mines Working Group to address the problem of conserving bats and bat habitat while still ensuring public safety and landscape rehabilitation. The Working Group consists of representatives from the NPWS, DMR, State Forests of NSW, Queensland Parks and Wildlife Service and bat experts.

The working group has recently completed the Strategy for the Conservation of Bats in Derelict Mines. The goal of the Strategy is the conservation of bat habitat through the appropriate management and protection of derelict mines while still achieving public safety and environmental protection goals. Some outcomes of this strategy include the establishment of procedures for the survey of derelict mines (including safety guidelines), the development of management options for bats in derelict mines, such as gating, fencing or partial flooding, and the establishment of a training course to assist in the implementation of the strategy.

A significant outcome of the work to date is that the NPWS will nominate mines for rehabilitation under the Derelict Mined Lands Rehabilitation Program. The Bats in Mines Working Group is developing a state-wide database to keep track of derelict mines both on and off park and to enable nomination of mines for rehabilitation. Mines on land managed by the NPWS that should be considered a priority for rehabilitation are those which pose a risk to public safety, such as open shafts, and those where high levels of disturbance, such as high visitation, natural collapse or vandalism, are impacting on the bats.

Why mines are good bat habitat

Bats use caves and mines during different phases of their life cycle. During the winter months they gather together, sometimes in large numbers, and enter a state of torpor. This behaviour, known as 'overwintering', is a response to cooler temperatures and the reduced availability of insects. Long mine adits with constant temperature and humidity provide ideal habitat for overwintering.

Female bats also congregate in their thousands during spring and summer to give birth and raise young. Maternity sites must meet specific temperature and humidity requirements and bats often travel large distances to gather at certain sites each year.

Because of their use as overwintering and maternity roosts, it is important that derelict mine sites are protected and that bats using these sites are not disturbed. Unrestricted access for surveys, caving, tourism and other activities can have dire impacts on bats and can potentially cause the abandonment of roosts and the death of adults and young.

Some of the species that rely on derelict mines include the eastern horseshoe bat and the threatened little bent-wing bat, large bent-wing bat and large-eared pied bat. For the eastern horseshoe bat, the only currently known maternity site in south-eastern NSW is a derelict mine. The large bent-wing bat is known to travel up to 300 kilometres to reach maternity sites, where females congregate in numbers of up to several thousand. Its dependence on specific sites, including derelict mines, makes it particularly vulnerable to disturbance and habitat loss.

For more information, or to provide details of derelict mines for inclusion in the database, contact Amelia Hurren by email on amelia.hurren@npws.nsw.gov.au or on 9585 6878

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Extension to the known range of the Eastern Cave Bat *Vespadelus troughtoni* (Kitchener, Jones and Caputi 1987) into the Brigalow Belt South Bioregion in New South Wales.

Murray Ellis
NSW National Parks and Wildlife Service, Western Directorate
P.O. Box 2111, Dubbo NSW 2830

The genus ***Vespadelus*** (formerly ***Eptesicus***) has been unstable taxonomically for many years. Diagnosis of species has developed from genetic studies but development of suitable field characteristics for identification has been limited (Churchill 1998, Parnaby 1992). This has resulted in the published distributions of these species being based on limited data and being confused by old identifications that do not reflect more recent splits of species.

During the summer of 1999/2000 the opportunity arose to conduct preliminary regional fauna surveys in the Southern Brigalow Belt. This region covers the eastern parts of the western plains of New South Wales, north of Dubbo. The area is contained within the sheep wheat belt and as such has been extensively cleared. The initial surveys concentrated on the large remaining areas of vegetation, consisting of Goonoo State Forest and nearby smaller forests, and the Pilliga Scrub consisting of a series of State Forests and Pilliga Nature Reserve (NPWS in press). Sixteen species of bats were recorded during these surveys (Table 1.). All trapping results from these survey are available from the NPWS Wildlife Data Unit in Sydney.

Analysis of the initial trapping results showed that the fauna of these areas has strong Bassian ties with some influence from the inland (NPWS in press). ***Vespadelus troughtoni*** is an example of this.

This species was captured at the eastern edge of the junction of Pilliga Nature Reserve and East Pilliga State Forest. This area still retains most of its native vegetation and has a number of rocky outcrops containing caves. This places the species about 175km north west of the reports to the National Parks and Wildlife Service of its presence in the Liverpool Ranges (Fig. 1). A specimen from these surveys was lodged with the Australian Museum (registration M34673) for future reference and to confirm the identification. These records place the animal on the western slopes and plains of NSW whereas the previous data available to the NPWS only placed it on the coast and tablelands. This region contains a series of isolated remains of the Great Dividing Range and the Warrumbungles and has the potential for additional suitable areas with caves to exist.

This extension to the known range of a threatened bat species once again highlight the paucity of detailed knowledge about species over much of inland New South Wales. Additional surveys of the western plains over the next few years by the National Parks and Wildlife Service, State Forests and Department of Land and Water Conservation will hopefully help to redress this problem, but only to a limited extent.

Acknowledgements

The field team instrumental in getting these surveys done consisted of David Paull, Chris Turbill, Rebecca Drury, Jeremy Little, Mark Fitzgerald and Matt Ryan.

References

Churchill, S. (1998) ***Australian Bats***. New Holland Publishers, Sydney.

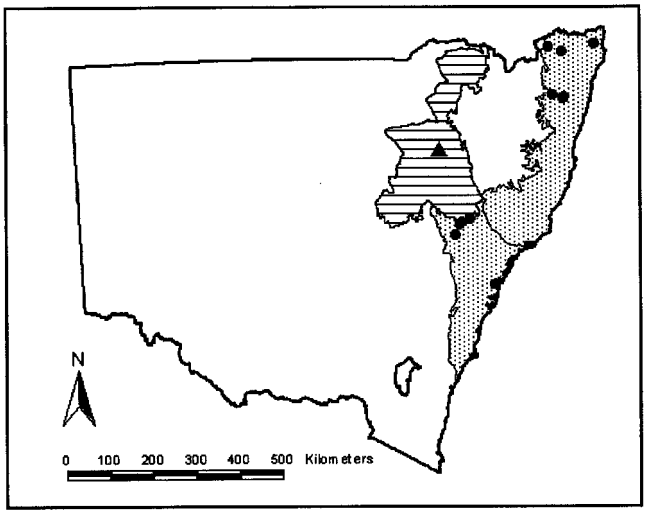
NPWS (in press) ***Preliminary Fauna Survey - Brigalow Belt South Regional Assessment***. Department of Urban Affairs and Planning,Sydney.

Parnaby, H. (1992) ***An Interim Guide to the Identification of Bats in South-eastern Australia***. Technical report of the Australian Museum 8. Australian Museum, Sydney.

Table 1: Species captured during the survey and number of records supplied to the NSW NPWS Wildlife Data Unit

Family	Scientific name	Common name	Legal status	Records
Emballonuridae	***Saccolaimus flaviventris***	Yellow-bellied Sheathtail bat	V	3
Molossidae	***Mormopterus sp.*** big penis	Southern Mastiff bat	P	10
Molossidae	***Mormopterus sp.*** small penis	Inland Mastiff bat	P	13
Molossidae	***Nyctinomys australis***	White-striped Mastiff bat	P	1
Pteropodidae	***Pteropus scapulatus***	Little Red Flying-fox	P	8
Vespertilionidae	***Chalinolobus dwyeri***	Large Pied Bat	V	24
Vespertilionidae	***Chalinolobus gouldii***	Gould's Wattled Bat	P	324
Vespertilionidae	***Chalinolobus morio***	Chocolate Wattled Bat	P	3
Vespertilionidae	***Chalinolobus picatus***	Little Pied Bat	V	4
Vespertilionidae	***Vespadelus troughtoni***	Eastern Cave Bat	V	2
Vespertilionidae	***Vespadelus vulturnus***	Little Forest Bat	P	313
Vespertilionidae	***Nyctophilus geoffroyi***	Lesser Long-eared Bat	P	67
Vespertilionidae	***Nyctophilus gouldi***	Gould's Long-eared Bat	P	72
Vespertilionidae	***Nyctophilus timoriensis***	Greater Long-eared Bat	V	83
Vespertilionidae	***Scotorepens balstoni***	Western Broad-nosed Bat	P	72
Vespertilionidae	***Scotorepens greyii***	Little Broad-nosed Bat	P	44

Figure 1: Locations of ***Vespadelus troughtoni*** reported to the NSW National Parks and Wildlife Service (circles) and the new record (triangle). Stippling shows the bioregions the bat has been previously reported in while hatching shows the Brigalow Belt South Bioregion.



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Bat Banding as a Method

Elery Hamilton-Smith
elery@alexia.net.au

Legitimate concern has been expressed about the extent to which bat banding may cause undue disturbance to a bat population or even lead to significant wing damage. Concerns of this kind demand at least two tests:

What is the accuracy of the claims?

The extent of, and impacts resulting from, disturbance is often difficult to judge. Personal experience suggests that the Australian ***Myotis*** are, even without banding relatively sensitive to human disturbance, while species with a fixed maternity site, e.g., ***Miniopterus, Rhinolophus,*** will persist in loyalty to a site even when exposed to extensive disturbance. ***Macroderma*** does not appear to be disturbed by people who behave in a reasonable way - in fact, they seem to evince a remarkable curiosity about the strange things that people do. In one instance, while surveying a cave, I was followed closely and observed by a family group of five bats for a period of some 7 hours.

However, damage as a result of banding can be systematically assessed. It may result from poor quality or unsuitable bands, careless handling and fitting of bands, or, even of the bander has operated with all caution some species may still bite at the bands and cause damage.

The bird bands which were initially utilised in Australia proved quite unsuitable, as even with careful handling, their rough finish was always likely to lead to injury. When the change was made to purpose-designed bat bands of monel metal, these caused little or no significant injuries in most bats (Dwyer 1965). However, in ***Rhinolophus*** the injury rate was still undesirably high, and in due course resulted in the prohibition of banding ***Rhinolophus***.

So, given the possibility of disturbance or wing damage…

What is the justification for the use of banding and what knowledge may result?

Banding has proved valuable in establishing seasonal movement patterns, mapping the normal range boundaries of a population, and studying development and survival patterns of a species. These objectives are difficult to achieve without individual marking, and banding is currently the most convenient and serviceable method for this. Moreover, the are fundamental to understanding the bionomics of a species.

So, banding might be subject at this point to a cost-benefit analysis. The costs in potential disturbance and wing damage can well be compared to the outcomes in new knowledge. One probably should also recognise that a proper banding study will be costly in experimenter time, and if this is not taken into account at the beginning, the potential outcomes may well fail to be achieved.

Thus, to fully justify banding, there must be a properly planned research design and timetable to ensure that the desired results are actually delivered.

Planning the research design

This commences with the clear definition of objectives, then a careful assessment of potential methods to ensure that the methods chosen are the most appropriate and have the least possible undesirable impacts.

If banding is chosen:

> in the case of previously banded species, the extent of injury or disturbance should be investigated before commencing
>
> in the case of species not previously banded, a pilot study with an adequate level of follow-up recovery should be carried out to assess the likelihood of problems.

When banding proceeds, there must be a planned recovery program so as not to lose an undue amount of potential data. Experience shows that although leaving recovery to chance worked well with migratory birds, it is just not good enough when working with bats and it is a waste of time and effort to band a population unless sufficient recoveries are made.

Wherever possible, and this may be difficult with forest species, bats should be banded as juveniles during the narrow window of opportunity between weaning and independent flight and the day of dispersal from the maternity site. This would mean that all banded bats are of known age, enabling a more adequate demographic analysis of recovered samples to be gained and greatly increasing the potential knowledge to be extracted.

Moreover, and most importantly, prior to being forced to give up my own research at the end of the 1960s, I had moved to juvenile banding. I never found a single example of wing damage in animals banded as juveniles, even in ***Rhinolophus.*** This probably demands a more thorough study, but I believe that we would find that given this practice, we could safely band ***Rhinolophus.***

So, as a principle, I argue that whenever possible, banding should be carried out with juvenile animals only.

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Response to request for volunteers

Patrick Prevett and Andrea Solly,
University of Ballarat, Mt. Helen, Victoria

Early in December I received an E mail from Lindy Lumsden indicating that 'Maria' from Uni of Wollongong desperately needed support in her postgraduate fieldwork at Kioloa in NSW. Here in Ballarat we could not resist the temptation to escape the summer chill and sample the delights of the famous NSW mid north coast and the cool forests. We, (Andrea and I) immediately volunteered and away we went intent on seeing how another post grad did her stuff. Andrea and I have both signed on for Ph Ds in bat ecology and the similarities between Maria's and my projects were intriguing. We are both interested in insects, bats and forest silviculture. Andrea, far more sensibly has decided to study bats of the semi-arid zone in far western NSW where the bat fauna is poorly known.

Having arrived in Kioloa we were provided with excellent cheap quarters for the few days we were there, a very happy Maria to have our help and masses of gear to make the project go. We spent the next few days in forests with quite a different feel to them compared to those in Victoria and with the prospect of seeing some new bats. Highlights included dodging hurtling lead 'bullets' attached to leader lines designed to get ropes over high branches. These 'bullets' frequently returned at high speed and landing at Maria's feet with the cool explanation, 'Oh, that was close,' or similar comment in a foreign language. Unravelling endless km of rope required to hoist insect traps and Anabats to the tops of unbelievably tall trees, (so pleased my study is in the mallee commented Andrea), and trying to capture elusive bats. In between all this it was great to be part of the frustration and success of a project with a student determined to make it work. Great for Andrea to see what a well-designed was all about and terrifying for me to experience the hurtling lead bullets soon to be my fate in Victorian forests.

As we wound our way back to Ballarat I reflected on the recent experience. Surely this is an important part of what science (and bat ecology) is all about. Formal seminars and presentations at conferences have their place but nothing could replace the learning opportunity we had experienced. University of Ballarat is a small regional university with a lot of dedicated people but opportunities to collaborate interstate have been limited and must be grasped when they are offered. Bat research is not a big pool of people and like our forest habitats we are fragmented too. Projects such as Maria's not only provide an important stepping-stone for others intent on learning new skills but provide an excellent learning opportunity for the researcher as well. Organisational skills and communication do not feature strongly in the curriculum yet they too are important attributes of good science.

Thanks Maria for the opportunity.

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Longevity record for a Southern Bent-wing Bat *Miniopterus schreibersii bassanii*.

Lindy Lumsden and Paul Gray
ARI, 123 Brown St., Heidelberg 3084; 25 Crawley St, Warrnambool, 3280.

Starlight Cave, Warrnambool, Victoria, is one of only two maternity sites used by the Southern Bent-wing Bat ***Miniopterus schreibersii bassanii***. As part of the current re-assessment of the population status of bent-wing bats in south-eastern Australia, we trapped bats exiting this cave on 26 January 2001. A single banded bat (20-62772) was amongst the 1,676 individuals caught. The ABBBS database revealed that this individual was banded by Fred Shirrefs at Starlight Cave, 20.5 years earlier, on 4 July 1980. This individual was an adult female, who although not lactating at the time it was recaught, showed signs of having bred earlier that season. With a weight of 18.1 g (slightly above the average for other adult females caught) her good condition showed no signs of her advanced age. The band, although old and stained, was in perfect condition and there was no evidence of any band injury.

As far as we are aware this is the oldest ***Miniopterus schreibersii*** record in Australia. In 1998, another female (20-60449) that had been banded by Fred Shirrefs was caught at Starlight Cave, 18 years after initial banding. Purchase (1982) reported a pregnant female banded in 1963, which was also recaptured 18 years later (pregnant again!). Outside Australia, longevity records of up to 15.5 years have been recorded (Tuttle and Stevenson, 1982), with van der Merwe (1989) suggesting that 13 years may be the maximum life expectancy for ***M. schreibersii natalensis*** in South Africa.

This exciting result added an unexpected bonus to an excellent nights trapping, and we would like to thank Ken Baker, Belinda Cardinal, Ryan Chick, Angela Duffy, Chelsea Fry, Tony Mitchell and Rachael Scott Smith for their assistance, great company and for lugging all that gear up and down the cliff! Thanks also to Amelia McCulloch, ABBBS, for delving through the old banding data.

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Van der Merwe, M. (1989). Longevity in Schreibers' long-fingered bat. South ***African Journal of Wildlife Research*** 19: 87-89.

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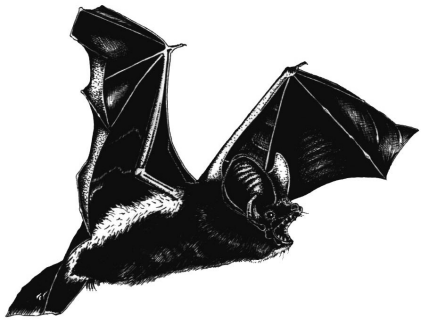
- Contacts, Networks, News, Announcements -

Book Notices

Key to the bat calls of south-east Queensland and north-east New South Wales



by Linda Reinhold, Brad Law, Greg Ford and Michael Pennay

ISBN 0 7345 1752 1
66 pages

Published by the Queensland Department of Natural Resources and Mines, March 2001

This technical report describes the calls of the 32 species of micro-bats occurring in south-east Queensland and north-east New South Wales.

To produce this key, 700 Anabat reference calls were pooled from the collections of the Queensland Department of Natural Resources and Mines, State Forests of New South Wales, the University of Southern Queensland and the New South Wales National Parks and Wildlife Service.

The key is available from the Queensland Landcentre Service Centre (cnr Main and Vulture Sts, Woolloongabba) for $25.30 (incl. GST). Phone 07 3896 3216 to purchase your copy. Visa, Mastercard, Bankcard and Amex accepted. The Department does not accept purchase orders for values less than $100.

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Flighty Friends

by Hans-Peter Stutz.. Illustrated by Toni Ungerer. Zurich: Verbole Foundation 1998.

This is probably one of the most remarkable books on bats ever published. It combines good science, a very strong conservation message, the author's sense of poetry and Toni Ungerer's famous sense of humour. I thoroughly recommend it.

Even better, it is free from:

Verbole Foundation
Postfach
CH-8022 Zurich
Switzerland.
Fax 0015 411 283 7500

Elery Hamilton-Smith.

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The Bat Roost Box Kit

by the Latrobe Valley Field Naturalists Club Inc

A joint project by the Latrobe Valley Field Naturalists Club Inc, Latrobe City and West Gippsland Catchment Management Authority, November 2000, 24 pages, comb-bound

This book arose out of a project initiated by the Latrobe Valley Field Nats in 1999. They were concerned that the vast areas of regrowth forest in Gippsland lacks roost sites for bat species that normally roost in tree hollows. They decided a kit describing how to design and construct bat roost boxes, how best to place them in regrowth forests, and how to monitor their success, may be a good basis for starting a widespread movement to erect such boxes in forests around Gippsland.

The team, led by Rob de Souza-Daw, gathered information from various sources, including Lindy Lumsden of Arthur Rylah Institute, Terry Reardon of SA Museum. George Paras of Latrobe Uni. Wildlife Reserves and me. They proceeded to develop a kit of design drawings, lists of bat species found in Gippsland and their body sizes, advice on box construction, siting and maintenance, and sample recording sheets. The West Gippsland CMA undertook to finance the publication project and now has copies available for free distribution. They hope many conservation groups will start bat roost box projects using their kit.

There are useful sections on bat life cycles, meticulous construction guidelines for summer and winter roost boxes, illustrated with photos by Dale Simmons of the CMA who co-ordinated the publication end of the project, details on how to select trees and how to attach boxes to them. A page on box maintenance, a sample map (recommended as a basic tool to be drawn by any group setting up the recommended 10-15 boxes to start a field project), a sample data sheet recording box dimensions and orientation, a sample data sheet for recording periodic monitoring results, and two excellent draughtsman's drawings to aid construction by carpenters.

There is a brief bibliography of books on the bats of Australia and several photos by Lindy Lumsden.

This excellent little publication should be of great value to anyone wanting guidance on how to start a roost box project. It expresses the hope of starting a network of people involved in such projects, who could exchange ideas, design improvements and results, especially as so many of Gippsland's 21 species of insectivorous bats have wide biogeographic ranges, well beyond Gippsland.

Free copies may be obtained from the co-ordinator Dale Simmons at dales@wgcma.vic.gov.au. A membership application form for the Australasian Bat Society is enclosed with each copy.

Review by Robert Bender
Friends of Organ Pipes National Park

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News from around the traps

New South Wales

David Gee has been active bothering bats in the citrus again. This year he is radio tracking bats to determine their activity patterns in the citrus orchards and native tree remnants in the New South Wales Sunraysia area with the assistance of his wife April. Throughout the year he plans to trap and tag bats to determine the population size in the citrus area. Preliminary results show that the bats do indeed forage in citrus orchards and in the vineyards.

Victoria

from Tony Mitchell and Ryan Chick

Ryan Chick of the Dept. Natural Resources & Environment (NRE) is completing microbat surveys of vegetation remnants on the Gippsland Plains around the township of Bairnsdale in Victoria. These grassy woodland remnants are dominated by Forest Red Gum (***Eucalyptus tereticornis***). This project is part of a long-term program to monitor biodiversity values and the environmental health of the Plains which have been largely converted for agriculture and urban expansion over the last 150 years. The aim of these surveys is to obtain baseline data on insectivorous bats utilising patches of remnant vegetation of varying size. These patches have experienced various past management activities and will have different strategies, including restoration and enhancement works, applied to them in the future. It is anticipated that the species composition and activity levels of insectivorous bats will assist in determining biodiversity indices for the Plains remnants for comparison over time. Surveys have already been conducted for vascular plants, invertebrates, arboreal mammals, and birds. Other projects in the program include assessment of eucalypt dieback, revegetation survivorship and overall habitat condition.

A total of 36 sites will be surveyed for two nights, with two harp traps and one ultrasonic detector unit each night. The detector units consist of an Anabat detector, ZCAIM and laptop computer running Anabat software in 'monitor mode' to record calls over the whole night (see Chick & Lumsden 1999).

Analysis of detector calls has not yet commenced but the species trapped so far have been ***Vespadelus vulturnus, V. regulus, V. darlingtoni, Chalinolobus morio, C. gouldii, Nyctophilus geoffroyi, Tadarida australis*** and ***Mormopterus sp.***(eastern form). The most frequent captures have been of ***V. vulturnus*** and ***N. geoffroyi*** thus far. Although the human-audible calls of ***Tadarida australis*** have revealed their presence at the majority of those sites visited at night, the capture of two at one site and eight at another were unexpected events as these critters typically fly above canopy height and so evade capture. The tops of the traps at both sites where they were captured were well below the top of the canopy and were overhung by several branches.

Ryan has been ably assisted in the field by several other Department staff and volunteers. The monitoring program is part of a large-scale revegetation and remnant protection project funded

by the National Heritage Trust. NRE Flora & Fauna at the Arthur Rylah Institute, Melbourne, have provided equipment and funding for this microbat component of the program.

Chick, R.R. & Lumsden, L. (1999) Monitor mode: a new Anabat software feature that automatically saves bat calls to computer. ***The Australasian Bat Society Newsletter*** 13:16-19.

Over the past summer we have been participating in the ***Miniopterus schreibersii oceanensis*** maternity site monitoring program. At Narguns Cave, we have been attempting to estimate the population size using a video camera with infra-red lights and a mark recapture exercise, the former more successfully than the latter. There are still some problems for us to overcome at this site but results so far are encouraging.

A joint project with the Victorian Speleological Association (VSA) documenting sea-caves used by bats on the coast around Mallacoota was recently completed and our attention has moved further west. A preliminary trip to Wilsons Promontary has confirmed the presence of ***Miniopterus*** in sea-caves there and shows great promise for more sites.

A significant number of Grey-headed Flying Foxes visited Victoria this summer. Whilst this apparently caused consternation to some it was welcomed in East Gippsland. A project is currently underway to monitor occupation at the Dowell Creek camp near Mallacoota, which is the only regular Grey-headed Flying Fox camp known in Victoria other than Melbourne. Located in a remote gully in Croajingolong National Park little information has been gathered on this camp in the past.

South Australia

Ken Sanderson, School of Biological Sciences, Flinders University

Bat activity in the Adelaide Hills is widespread, and can often be seen from houses which adjoin bushland. As we (Ken & Janet Sanderson) were invited to a New Year's eve party in such a location in Eden Hills, we took along a bat detector and let it run in the backyard from about 9:15-11:15 pm. Most of the party was outside (with outside lighting), it was a mild evening and we got 5 species of bats in the 2 hours: ***Chalinolobus gouldii***, ***C. morio***, ***Mormopterus planiceps***, ***Vespadelus darlingtoni*** & ***Tadarida australis***. (We find property owners are usually rather interested to discover how many different sorts of bats visit them).

Queensland

Hi Terry,

I have only had a couple of spectacled babies this season, and have worked to protect our local colony of reds (which have set up home in the huge trees in the council public park) I keep telling everyone they are only there for a "while" and will move on of their own accord soon ! I don't know if you get news of the spectacles that are sent down from north for our care, if not - I can certainly write a spiel for you - I will try scanning some photos into the tale, if you like,

Let me know.

Sandy Cooper

ACT

Hi Terry,

No newsletter contribution, just a note to let you know that I am now based in Canberra at the Australian Bureau of Statistics. Michael Vardon

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Package prices to attend the Malaysia Bat Conference 2001

I have finally received enough information to create some discounted packages to attend the 12th International Bat Research Conference at Kuala Lumpur, Malaysia to be held 05-09 August 2001.

The Conference is going to be held at The Equatorial Hotel Bangi, which is very close to University Kebangsaan (the National University) so the package will include accommodation at the hotel:

Package Cost:	AU$990.00 + airport tax per person (based on 2 people travelling together)
	AU$1150.00 + airport tax per person (based on a single person travelling)
Pre-registration Fee:	USD150.00
Student Pre-registration Fee:	USD100.00
Banquet:	USD25.00
T-shirt:	USD15.00

Package Cost includes:

1. Economy class return airfares with Malaysia Airlines departing in low season, ex East Coast Australia (contact me for package cost departing from other cities)
2. 5 nights accommodation at The Equatorial Hotel Bangi (5-star resort)
3. Daily buffet breakfasts

I am also willing to handle all the pre-registration forms and fees. All you need to do is to fill in the forms (downloadable via the Internet site or I can forward it to you) and provide me with the payments by the due date. This will enable me to allocate sharing of rooms for single people if they so desire. I can then forward all these to Professor Zubaid in bulk-form. I can also forward abstract forms for authors who are presenting however it is your responsibility to ensure that the forms are filled in accurately and that your presentation formats are as per the instructions on the Internet web-site.

Apparently, there will be pre or post conference bat-related field trips (as advised by Prof. Zubaid via e-mail) but at this stage the location is yet to be decided.

However, I can also add any other travel component you may be interested in, to the basic package (for example, some people have already enquired about going to Borneo after the conference) This can certainly be arranged for individual members concerned.

Depending on the final numbers I get, I may be able to add additional services such as airport/hotel transfers. As well, if there are enough people interested, I am more than happy to organize some small nature trip just for ABS members (if you are interested call me to discuss this)

I will advise members individually about payment due dates, payment form, any visa or passport requirements, travel insurance costs.

If you have any queries or are ready to make a booking, please contact me at:

Sirena Wan
J.W. Asean Travel Specialist
Tel: 02-9868-5199
Fax: 02-9869-7810
E-mail: jwasean@travelinfo.net.au

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Ghost bats – photo by Nick Birks

Table of contents