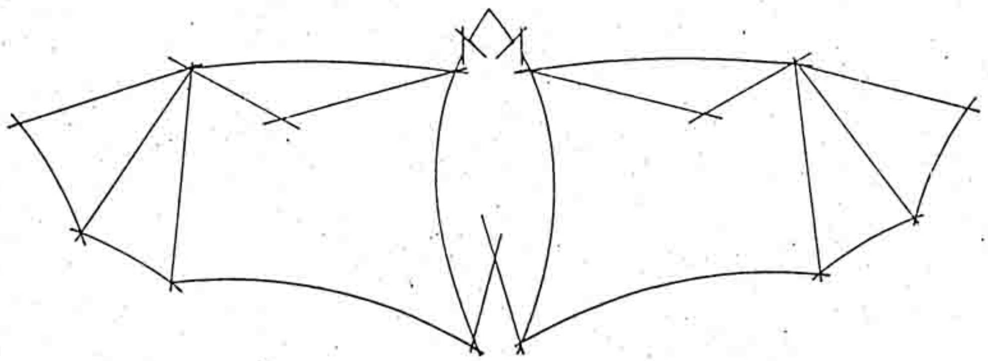
# Australasian Bat Society

# Newsletter

*Number 3 - May 1994*



# INSTRUCTIONS TO AUTHORS

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

***For Scientific Articles***

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

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

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

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

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

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

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

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

Manuscripts will usually be edited to conform to the newsletter.

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# ARTICLES

**News from the Great Northern Bat Camp by His Greyheaded Eminence, President Dr Len Poliocephalus [and increasingly glabrocephalic] Martin.**

Our heartfelt thanks to Matthew and Martin [and no doubt others] for the excellent job in organising the 6th Australian Bat Research Conference. A great venue with caffeine-fix facilities and multi-coloured dough-nuts that were out of this world - I personally pigged-out. Thanks also to all those who turned up to contribute to the meeting's success with the string of well-presented, interesting papers and as the large audience which provided much active discussion. Those who missed out on it all can read the abstracts in this newsletter.

Strong rumour places our next meeting in Northern Victoria in 199?, with Lindy Lumsden as prime organiser. So dear friends we have lots of notice whereby to organise ourselves for it. There will be no excuse for **not** attending. The consensus is that future meetings should **not** have any concurrent sessions. Also, I really would like to know what happened to the 5th ABRC, since there is the problem of how we should number the 199?th. Okay, so I'm a stirrer.

Greg Richards, Jack Pettigrew and myself were invited speakers [respectively on ecology, evolution and reproduction of flying-foxes] at the November 1994 joint Zoological Society of London/ Mammal Society Symposium on "Recent Advances in Bat Biology" organised by Paul Racey and held at the Regent's Park Zoo. It will be published later this year as one of the Zoological Society of London Symposia. I have copies of the abstracts if any one is desperate, but have written to Paul Racey asking for permission to publish them in this newsletter. You will note that, despite a presidential warning in our first newsletter concerning use of the term "fruit-bat" for "flying-fox" ["its use apropos Australian flying-foxes is prejudicial to their conservation and inaccurate in respect of their natural distribution and usual feeding habits"] GR has blotted his copy-book and is liable to have his gubernacula ceremoniously crushed.

We still have concern as to the nature of the "protected status" that flying foxes will enjoy under the new Queensland *Nature Conservation Act 1992*. It is still not in place, though this is promised for May 1994. Our previous Environment Minister, Pat Comben, had assured us that under the new act,

"Fruit bats [*sic*] will have a protected status... The...*Act*... provides for a number of categories of protective status for native... animals. I intend to establish a Scientific Advisory Committee, comprising... Government and non-Government scientists which will be commissioned under... the... legislation and... provide... scientific advice on the status of... animals... conservation status for Fruit bats [*sic*]... will... be dealt with by this committee. Your input... would be very welcome".

Well folks, times haven't changed since I first quoted Pat, and we still have a politically powerful Minister for Primary Industry who doesn't want to antagonise fruit growers. So, is the above assurance actually worth anything? I reiterate that we must emphasise to fruit growers that, while flying-foxes remain **unprotected**, no government agency will take responsibility for population management or research into cost-effective crop-protection. In the meantime, as we learnt at Lismore, protected status in NSW does not prevent large numbers of flying foxes being shot annually by growers.

I reported previously on Qld. Department of Heritage and Environment and Ipswich City

Council jointly purchasing one side of the valley of the Woodend Flying Fox Camp which is a **regular** summer camp for *P. scapulatus* and all-year-round camp for *P. poliocephalus* & *alecto*. The property purchased is a superb viewing site: the house will become a study centre cum viewing platform and the property a conservation park. Les Hall and I are on the management committee. Progress has been slow, but a management plan is evolving and the local grammar school already involved in projects. Half of the camp is on the property of the bat-loving Holman sisters and again the situation remains as reported previously, ie. they need to sell up. So, if there are flying-fox-fans wanting to live beside /within a flying-fox bat camp here is a superb opportunity. Sale of the Holman sisters' property to an *ad hoc* animal care group of doubtful antecedents and competence, featured recently on the ABC 7.30 report - the "flying-foxes" shown flying out were actually free-tail bats emerging from a cave in Texas, USA!

Like other camps in SE QLD and NE NSW, Woodend suffered greatly during the January heat-wave with large numbers of deaths. Alas we do not have accurate counts, but figures like 5000 were bandied about at a recent management committee meeting. Deaths among adult and young *P. poliocephalus & alecto* were exacerbated by the arrival of large numbers of *P. scapulatus* at the height of the heat wave. Jill Nelson and ONARR members collected 40 young for fostering from the edge of the camp and could see many hanging dead further in. They made the decision **not** enter the camp to rescue young because any disturbance would have increased the deathrate. Apparently some of the young ended up being fostered in the Queensland Times office, so we might expect an improvement in the image of flying-foxes promulgated by QT. A recent example appears in this newsletter.

Pamela Conder, artist and flying-fox enthusiast, is writing and illustrating a magnum opus on the beautiful beasties, which should be published next year. She sent me a couple of chapters for comment. Suffice to say that they were spot on and most enjoyable. I look forward to reading the whole book when it appears. Pamela described seeing flying-foxes drinking from the Brisbane River, and sent me a report from the Victorian Naturalist of Little-red flying-foxes flying down to dowse their breasts in water and returning to roost in trees and lick the water from their fur. This triggered what follows - a long-standing concern of mine about the dangerous and damaging mythology that flying-foxes do not drink and this led me to writing about other aspects of flying-foxes, including further fallacies. On reading my draft of this article, Les Hall reminded me that Francis Ratcliffe wrote a paper on flying-foxes drinking sea water.

"I hope that you emphasise that flying foxes <u>do</u> drink" I wrote to Pamela..... "There is a mythology around that they do not, and some people who rear and keep flying foxes do <u>not provide them with water</u>!". In our captive colonies, we once lost animals over a hot weekend because an animal technician [<u>not</u> my colleague Lorraine Little] failed to fill a water bucket. Forgive me if I go on at length about this, but I believe animals are being put at risk by the fallacy and my concerns have been heightened by the huge number of heat/dehydration deaths among wild populations in NSW and Queensland during the recent heat wave.

I believe that the basis for the non-drinking fallacy is the idea that the animals get all that they need from the **fruit** that they eat. There is also an element of the maternal "don't drink before you eat, dear, it will spoil your appetite". Mammals have specific feeding centres in the brain which deal with appetite for food and when to stop eating [hunger and satiety centres] and other quite separate centres which deal with control of water balance. When internal water is low, the latter centres activate the drinking drive [thirst] and secretion of anti-diuretic hormone - which increases water resorption by the kidney. To my knowledge, no specific research has been done on such centres in flying-foxes, but there is no reason to suppose that they are any different from other mammals in this regard.

Apart from breast-dowsing, another drinking-from-flight-behaviour that I have observed is always the same, and I suspect that it is wired-in [ie. innate, instinctive - not learned]. First the flying-fox flies down towards the water surface, flattens out, makes three - four measured wing-beats and then glides as the head goes down towards the water. I don't know if the muzzle goes in, if the long tongue is extended to channel water up and in, or whether they lap the water up with the tongue. Our captive animals certainly lap water from buckets with their tongues, though I have also seen them dip their wrist into a bucket, lift wrist to mouth, and, almost genteelly, lap from the pool in the wrist. Their long tongues are covered with elegantly-shaped backwards facing cornified scale-like papillae, even in the new-born, and one can see how tongue and papillae function in:

drinking; nectar & blossom-feeding - tongue movements are just like those of Lorikeets; compacting fruit & rupturing pollen against the transversely ridged hard palate; grooming; nipple attachment and milk-extraction in the new-born; sexual grooming of the female genitalia by males.

I have had a deep personal interest in the flying-fox tongue and its many uses ever since Helen Luckhoff's Emmy approached me one evening [I had been drinking white wine] sniffed and licked me as usual, then without warning, stuck her tongue right up my nostril - and I mean, **right** up. It was an unusual sensory experience, even sensual, and gave me a hint of what female flying-foxes feel.

Pamela mentioned the flying-foxes' hang-from-the-thumbs, urinate-and-defaecate, shake-their-posterior-and-back-upsidedown behaviour. This pattern develops in the young from about 6 weeks on and is so stereotyped that it is almost certainly an innate pattern ie. instinctive rather than learned behaviour, as a certain ABC personality would have it. This then reminded me of the common bush myth that flying-foxes have no anus but defaecate from the mouth - I was actually told this about three years ago by a bushy out near Moree! One can see how it arose: bats hang up side down, *ergo* they wouldn't want an anus in the usual place because they would soil themselves; flying-foxes, dimly-seen spitting out the residues of chewed-fruit, complete the picture of oral defaecation.

Pamela dealt briefly with thermo-regulation in adult flying-foxes and I immediately asked whether she dealt anywhere with thermo-regulation in newborn and infants, because I'd heard of some funny ideas going around the sticks - myths akin to the drinking one - and some pretty horrific practices, which I would hate to see promulgated. Thermo-regulation is one of my areas of expertise, so here we go. Forgive me if you feel that I am teaching grandma to suck eggs but....

Mammals, including bats, usually maintain a high and relatively constant body core-temperature. They do so by virtue of a high metabolic rate, which in turn requires a constant high input of fuel. In addition to resting metabolism, 75% of metabolic energy used to move muscles appears as heat - less than 25% appears as physical work. Thus in hot conditions, intense muscle activity can produce a massive heat load and overheating. In cold conditions, muscle activity is important for maintaining body temperature.

Heat energy always flows down a temperature gradient, ie. from hot to cold. Thus, in cold weather, heat tends to be lost from a mammal's body surface by radiation, conduction to another solid surface or convection to the air. The rate of loss is proportional to the area and temperature gradient between the animal's body surface and its immediate environment. The smaller the animal, the greater the ratio of surface-area to body-mass and the more difficult it is to maintain body temperature in the face of environmental temperature extremes.

The nerve centres which control body temperature are located in the same part of the brain as the feeding and water-balance centres mentioned above, *viz.* the hypothalamus. They contain thermostats such that, if body core-temperature rises above the set point, physiological and behavioural processes are brought into play which maximise heat loss and minimise heat gain. Thus an animal will seek shade and minimise metabolic rate. Surface blood vessels will dilatate to bring more blood to the body surface, so increasing surface temperature and heat loss by radiation, conduction and convection. An over-hot flying-fox will aid these processes by extending a wing to increase effective surface area and flap it to increase heat loss by convection.

If environmental temperature rises **above** body temperature, the animal cannot lose heat by the above processes, it can only gain it. In this situation, it can shed heat <u>only</u> by evaporative cooling - using body heat to evaporate water from its surface. Mammals achieve evaporative cooling variously by sweating, panting, or salivating or urinating water onto body surfaces [NB the exam question for this section is "which of these methods do flying-foxes use?]; again, movement of a wet body surface, such as wing flapping, speeds evaporation and cooling. Note also that the greater the environmental humidity, the less the animal can lose heat by evaporative cooling.

To survive extreme heat by evaporative cooling, the animal must have sufficient body water to meet the losses associated with the cooling process: if it doesn't, it will die from high body-temperature or dehydration. Which brings us back to why flying-foxes need to drink.

When body core-temperature falls below the set point, behavioural and physiological processes are brought into play which minimise heat loss from the body and maximise heat gain. Thus, when environmental temperatures fall, an animal will seek warmth or huddle to reduce exposed surface area. The blood vessels carrying blood to the body surface constrict, so reducing blood flow to the skin: this allows skin temperature to fall, so reducing the temperature gradient between skin and surroundings, and consequently the rate of heat loss by radiation, conduction and convection. Nerve impulses increase the thickness and insulative effect of fur by causing the hairs to stand erect. Heat generation is increased by voluntary and involuntary muscle activity [shivering] and in many small and newborn animals, by metabolising fat in specialised brown adipose tissue [BAT].

Newborn animals are at particular risk from extreme high and low temperatures because of their small size and high surface-area to body-weight ratio. Thus, even though human babies constrict their skin blood vessels to reduce heat loss, the manoeuvre is much less effective than in an adult, because of the neonate's much greater surface-area to body-weight ratio and relatively thin insulative layer of skin. Human neonates are well supplied with BAT and when body temperature starts to fall, BAT heat production [so-called non-shivering thermogenesis] increases before the infant starts to shiver [actually BAT heat production suppresses shivering - the movement would increase heat loss by convection].

It is not all that long ago that human premature babies were regarded as incapable of controlling their body temperature. They were regarded as cold-blooded or poikilothermic [variable temperature] creatures whose temperature followed that of the environment. From this it was reasoned that low temperatures were beneficial and it was the fashion to keep premature babies at temperatures well below 37°C. It is now known that this is not so and the mortality rate among premature babies has decreased greatly with the practice of maintaining them at temperatures close to 37°C - in the so-called thermoneutral zone where temperature stress is minimal and the infant has to do minimal thermal work to maintain a constant body core-temperature.

On one issue I did disagree with Pamela. She described flying-foxes as "crash landing" and "not the most graceful creatures when it comes to landing and tend to crash". Interestingly, that's how I <u>used</u> to view them. However, on further acquaintance I saw that flying-foxes manoeuvre superbly at low flight speeds and that, while they land in the only way possible, *viz.* by hooking their hind claws on to an appropriate branch, the branch is chosen with precision and hooked likewise. Clearly, this may not happen if the animals are panicked.

I was intrigued by one of Pamela's observations, *viz.* that of male flying-foxes apparently going out of their way to urinate upon me when I was in their cage explaining flying-fox behaviour on one of Queensland Wildlife Preservation Society's Batty Boat trips on the Brisbane River [Number 50 on March 27 1994]. Now while I have been shed upon from all heights by flying foxes and can see **why** they would want to do so, I certainly have had no reason to suppose that they actually went out of their way to do so as a general phenomenon.

On the other hand, I have long known that my arm-pit turns male grey-headed flying-foxes well and truly "on". I first became aware of this during a television interview for the University of Queensland Open Day "Batorama", many years ago. A young lady was interviewing me live on camera. I was spruiking flying-fox lore while holding one of Helen Luckhoff's tame males [Hiram, I think] with his feet just above my head level. He started to energetically nuzzle and lick my armpit - "after the salt", I thought [our captive animals love to lick the sweat from my brow]. Then I sensed that my interviewer's attention was wandering, her pupils were dilating. I looked at Hiram just as the interviewer turned to the sound-man with, "Oh Simon, imagine if yours was as big as....cut, cut, cut". Yes, Hiram was fully, fully-erect. Needless to say, that part of the tape has never appeared on public TV, though I understand it continues to amuse at Channel 7.

The follow-up, is that some time later, well out of the flying-fox breeding-season, [mid-August I think], I urgently needed a picture of an erect grey-headed flying-fox penis for a quite serious scientific poster on flying-fox reproduction for the Australian Society for Reproductive Biology. So off we went, photographer in tow, to Helen Luckhoff's, for me to flaunt my armpit at Hiram. Well, we worked at it and worked at it for a couple of hours. Hiram showed little interest - it was cool and I hadn't worked up the usual pheromone-rich sweat by push-biking to Uni. Eventually Helen invited us into the lounge-room for afternoon tea and it was there, on the settee, that Hiram finally came good. Snap, snap, snap - a roll of colour print film, all of Hiram at his very best. I needed the prints urgently. Kay took them to the one-hour processing shop at Indooroopilly Shopping Town. When she came to collect them, they were spread out across the counter because the assistant was "concerned at the quality of some of them" [yes, some were a little blurred]. Cool as ever, Kay swept them up saying that, "it is not always possible to get things in focus when photographing wild animals".

## TECHNIQUES & LOGISTICS OF REARING ORPHAN PTEROPUS IN NUMBERS FOR RELEASE TO THE WILD

**H.Luckhoff J.O'Shea L.Martin**

Indooroopilly Island, 6 km from the city centre, the largest of several camps of Pteropus around Brisbane may contain as many as 150,000 animals in the summer peak. In winter most of the colony disperses. From September to November pregnant females return to give birth. Most orphans come into care during this period. Numbers fluctuate greatly from year to year depending on weather and food available to mothers.

Young are raised and released using techniques which model as closely as possible what happens in the wild. Using a glass bottle and small soft teat, orphans are fed every 3-4 hrs with a 6-8 hr gap at night. The orphans are best fed on their sides, head lower than body and their legs extended. For security they will hook their claws onto the human feeding them. They feed enthusiastically until their bellies are well rounded. Nan baby formula 15g to 100ml water is palatable, well digested and gives growth rates comparable to those in breast fed young. For the first few weeks it is important to provide warmth, either a well protected electric heating pad or hot water bottle in a styrene esky. Young should lie belly down with feet extended slightly higher than the body. They manoeuvre themselves within the esky, stretching wings, grooming and behaving much as they would with their mothers. Johnsons Baby lotion wiped over fur and wings cleanses the body and keeps wing membranes supple. Except for a soft cloth draped over the head and shoulders they are not wrapped or restricted.

Some animals indicate their readiness to hang at three weeks; by 6-8 weeks all are hanging for long periods and start eating mashed soft fruit. Gradually bottle feeds decrease and fruit intake increases. At this stage animals with intestinal toxocaria spontaneously expel them. As bottle feeds cease full cream milk powder, 1-2 teaspoons per animal per day, is added to their food. All captive animals receive such milk supplement on their chopped fruit. At least three types of fresh fruit are fed daily from the wide variety suitable; apples are used sparingly at this time as in December they have been in cold storage for about 10 months.

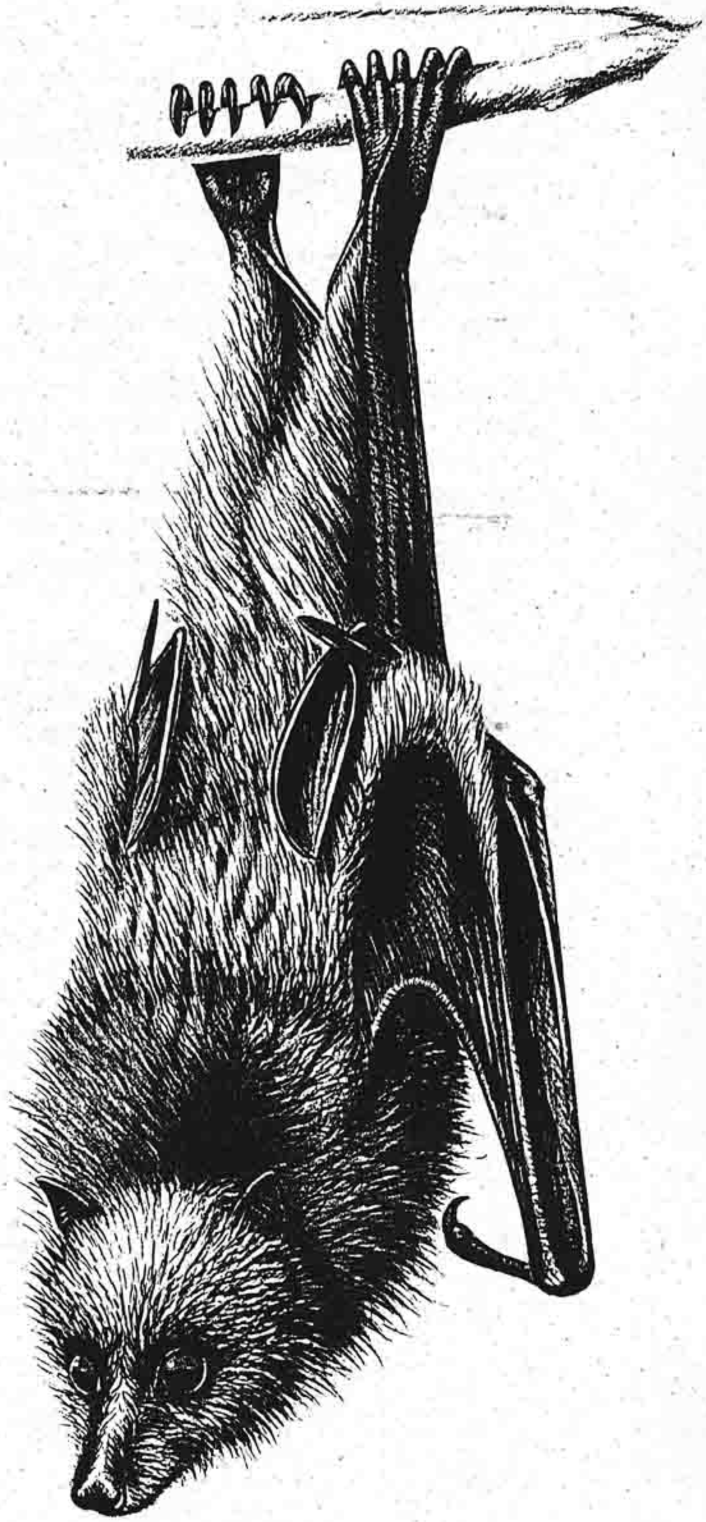
In February, orphans over 400g are placed into groups of 6-8 and housed in a roofed aviary closed on three sides. They are monitored closely for a few days. Those that feed well and integrate socially are then taken to the release site and placed in a 6m x 2m x 2m cage containing adult females. Part of the chain mesh cage is weather proof with hanging blankets for warmth. Males are excluded as they often harass unprotected immature females, (it is the start of the mating season). Adult females are usually very tolerant of the young. Within 1-2 weeks most young can be moved into an adjacent "open door" cage to join a free flying group comprising a continually changing population of wild and semi-wild animals. Some identifiable individuals have been visiting the cage periodically for seven years. Initially, fruit plus milk is fed to these young in mid-late afternoon to avoid competition from wild visitors arriving at dusk. Progressively later feeding allows the young to learn to compete. Gradually the young learn to forage nightly for their food and eventually join the wild pteropus when they return to the main camp. Young are not deprived of food to force them to leave. Most young have left for the colony by late May but about 10% remain over winter. These are usually young born after December or animals raised by non members and brought in too late. Sometimes these animals have to be rehabilitated before release.

The programme is labour intensive. This has led to the formation of the ONARR organisation, sponsored by the Brisbane West branch of The Wildlife Preservation Society of Qld. ONARR raises any wildlife orphan, but has a strong flying fox following.

The uncertain numbers of orphans coming into care requires members prepared to receive young at very short notice. Members undertake to keep records and to return animals for group release. In 1988/89 forty-two orphans were received, four died; a newborn from pneumonia, one overheated by the fosterer and two flying young taken by carpet snakes. Four apparently handraised young flew into houses around Brisbane and were delivered to the release site; another arrived from an hotel drunk after being fed fruit from cocktails for two days.

At present it is not possible to quantitatively estimate how many animals survive and integrate successfully into the wild breeding populations, although some identified females have returned to give birth in the release cage. One problem is thumb banding juveniles before thumb growth is complete. Some animals have been banded before release, but several have been found with the banded thumbs smashed. Subcutaneous transponders would be a better labelling method - if and when they can be read from a reasonable distance.

Most animals coming into care require only food and warmth. Occasional cases with pneumonia, broken bones, or toxaemia from feeding from a dead mother either die soon after arrival or are euthanased. Flying foxes do suffer from what appears to be akin to the common cold. They recover within a day or two without medication. Disease does not appear to be a problem among captive pteropus provided they are suitably housed and fed. Antibiotics are rarely used and then only for specific injuries. Animals returned to the wild must not be a health threat to the wild population.



## COMMUNITY INVOLVEMENT IN BAT CONSERVATION - PART

**Elizabeth Hartnell, Ku-ring-gai Bat Colony Committee Inc.**
**45 Highfield Road, Lindfield 2070**

Condensed from a paper presented at the Bat Research Conference 94 key words EDUCATION - HABITAT CONSERVATION - COMMUNITY LIAISON

Everyone at this conference has as their ultimate goal, achieving bat conservation in Australia and then throughout the world.

This means conserving a sufficient variety of habitats with sufficient geographical distribution so that no bat species becomes extinct through lack of food or a suitable place to breed - and that whole ecosystems do not collapse through decline of key-stone species.

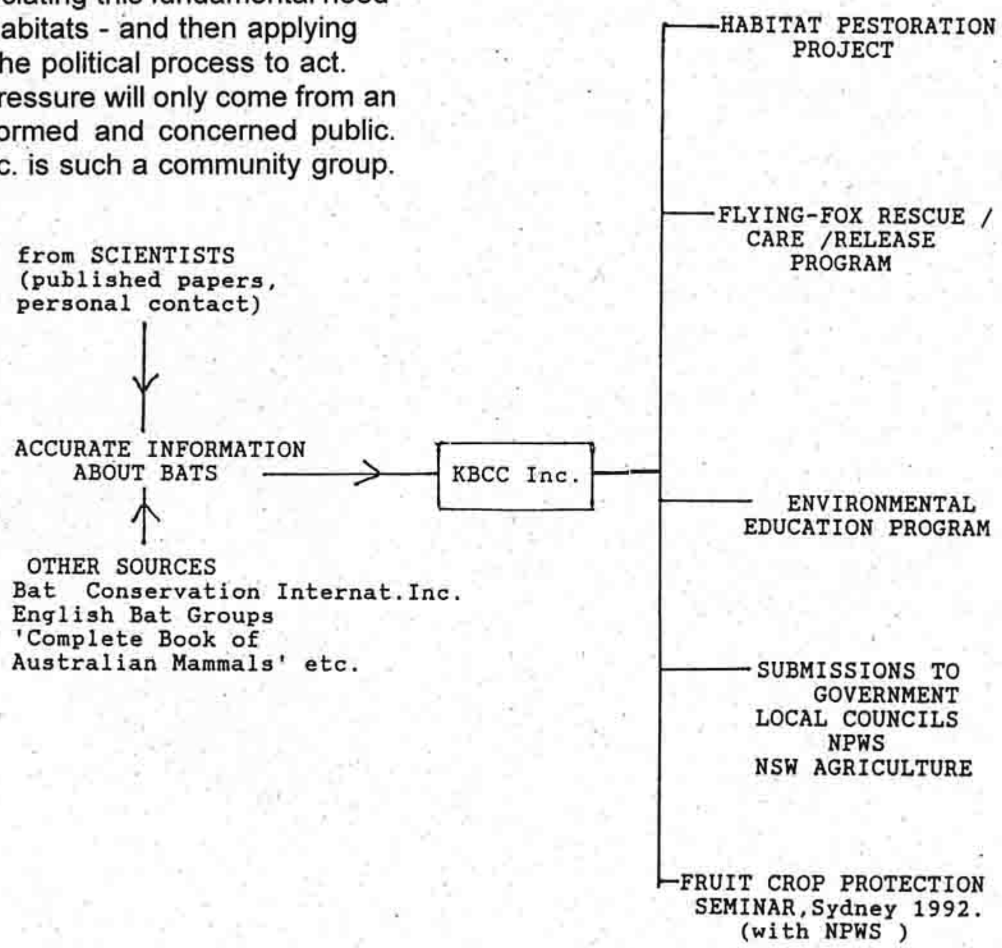
This can only be achieved by the community at large appreciating this fundamental need to conserve habitats - and then applying pressure for the political process to act. Grass roots pressure will only come from an educated, informed and concerned public. The KBCC Inc. is such a community group.

It wasn't always so. When we started, our knowledge of flying-foxes was very scant (with even less of other bats). It was more a gut feeling that these animals were getting a raw deal. We learnt as we went along. The Committee now believes that the path to habitat conservation is through education.

Today KBCC carries out a Habitat Restoration Project at the Ku-ring-gai Flying Fox Reserve, Gordon; it co-ordinates a flying-fox care and release program in the Sydney region; it conducts a community environmental education program and also makes written submissions to both State and Federal Governments, local councils and other authorities.

My paper outlines the Committee's activities in these areas through which we have spread a message for conservation into the community.

**FIGURE 1**



**ACCURATE INFORMATION ABOUT BATS** is essential if KBCC is to have credibility.

This comes from the scientists from their published research, and sometimes by communication prior to publication from articles written for our Friends of Bats Newsletter or from guest speakers at the Friends of Bats evenings.

Copies of papers are lodged in the Local Resources Centre of Ku-ring-gai Library for public reference. Selections are included in our 'Speakers' and 'Foster-Carers' training manuals.

Other sources of information are standard reference books for example 'The Complete Book of Australian Mammals' - also from Bat Conservation International Inc. USA and 'Bats' magazine, and from English Bat Groups including 'The Young Bat Worker'.

**FIGURE 2**

HABITAT RESTORATION PROJECT

1. THE WORKERS
   Trained Bush Regenerators
   Australian Association of Bush Regenerators.
   Volunteers - on site training
2. OTHER ENVIRONMENTAL GROUPS
   undertaking bush regeneration projects
   NSW NATURE CONSERVATION COUNCIL
3. IN TEACHING
   to TAFE. RYDE & PADSTOW
   as a field study
4. THE NEIGHBOURS
5. KU-RING-GAI COUNCIL
   Councillors
   Staff - bushland management
   Draft Plan of Management
6. ROYAL BOTANICAL GARDENS
   Botanists & bat problems

**THE HABITAT RESTORATION PROJECT** at the Ku-ring-gai Flying Fox Reserve, Gordon is a long term project, managed by the KBCC, to remove the overwhelming weed and to re-establish a healthy tree canopy for Flying-foxes supported by the natural understory, using standard bush regeneration methods.

It was started in 1987 and has been supported ever since by continuing grants from the State Government, Ku-ring-gai Council and public donations. A contract team and a volunteer team of bush regenerators work one day per week.

The people reached in this program are:

1. The Workers - everyone who works on the site gets hooked on grey-headed flying-foxes. All become well informed about these animals.

   The trained bush regenerators, both contract and volunteer, are members of the Association of Australian Bush Regenerators; their newsletter gives wide coverage to our functions. This is a group of people who well understands the importance of habitat conservation.

2. Other Environmental Groups - of which many are also engaged in bush regeneration projects in urban Sydney. Contact is fostered by two way site inspections. We also maintain contact with the projects at Wingham Brush and Bellingen Island.

   Environmental groups throughout NSW belong to an umbrella body, the Nature Conservation Council of NSW which act primarily as an environmental lobby. Contact is maintained between groups at an annual conference where resolutions proposed are endorsed by the conference and then become policy. KBCC has been responsible for policies on bat conservation.

3. TAFE is now conducting certificate courses in weed removal and bush regenration techniques at Ryde and Padstow - the classes come to Ku-ring-gai Flying-Fox Reserve as a field study. Before showing them our site, we have a 'Meet a Bat' flying-fox ecology session.

4. The Neighbours - are contacted on an individual basis when we are working their boundary. The response has varied from disinterest to enthusiasm.

5. Ku-ring-gai Council - KBCC has always had support from successive mayors and the required number of councillors to continue to receive funding.

   We have good relations with staff of the bushland management division - but there has been a fair turn-over in staff over the years. Those moving on should have a good knowledge of flying-foxes to take to their new employment.

   In 1993 KBCC was invited to assist Council and NPWS in the preparation of a Draft Plan of Management for the Ku-ring-gai Flying-Fox Reserve by GHD Consultants. This was recently on Public Exhibition for comment.

6. Botanists at the Herbarium identify plant species for us - we also have dialogue on colony life of grey-headed flying-foxes.

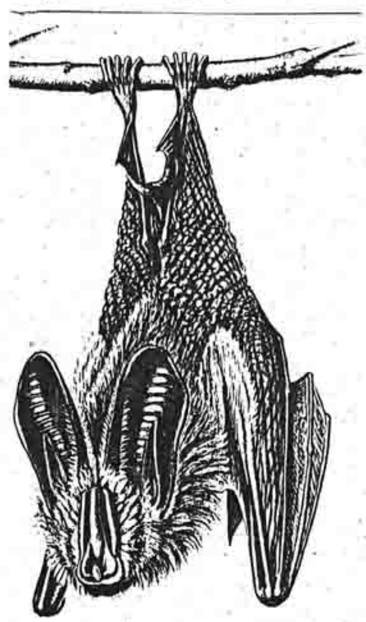


**FIGURE 3**

ENVIRONMENTAL EDUCATION PROGRAM

- BAT TALKS
  - Schools K to Year 12.
  - Pre-schools
  - Community Groups
- OPEN VENUES
  - ( non captive audience )
  - Agview
  - Australian Museum
  - Kukundi Wildlife Shelter
  - community fairs
  - NPWS 'Chase Alive'
  - KC 'People in Parks'
- 'FRIENDS OF BATS' NEWSLETTER
  - FOBS EVENINGS
- PHOTOGRAPHIC DISPLAY
  - for libraries etc.
- PHONE CALLS

AN APPLE FOR THE TEACHER

## ENVIRONMENTAL EDUCATION PROGRAM

KBCC has developed an environmental education program which uses Bat Talks, a newsletter, a photographic display and personal communication.

Bat Talks which are accredited by the Department of School Studies for presentation from Kindergarten to Year 12. A charge of $2.50 per head is now made for these talks, with a guarantee of an audience of 25 people.

A Bat Talk consists of a colour slide presentation suitable to the age of the audience followed by a close encounter with a hand reared flying-fox. It is this contact with the animal which leaves the lasting memory.

The talk opens with a brief description of the different types of bats in the world; insectivorous bats and vegetarian bats, then concentrates on the Grey-headed Flying-Fox.

Using this as an example, we aim to give the audience an understanding of the ecological inter-dependence of plants and animals, and so, of the importance of habitat conservation for the survival of species and ecosystems.

Three elements are needed for an effective presentation -

1. Clear photographs - We are always looking for donations of slides to improve and enlarge our set. We need good slides of other species of Australian Flying-Foxes.

2. Competent Speakers - The Committee trains its volunteer speakers, who work as assistants until they gain confidence. They provide their own transport. The Committee owns 2 sets of projection equipment.

   41 people were registered as Speakers in 1993. 23 have regularly helped.

3. The Education Flying-Foxes - must have a very placid temperament and enjoy human contact, as they are being touched by children as young as 3 years. They are hand-reared orphans unsuitable for release.

   They are housed ad cared for at the Kukundi Wildlife Shelter, Lane Cove National Park under a joint arrangement between NPWS and the Committee. The animals can readily be seen by the visitors to the Park - another form of education.

   Some groups of education bats are now established with wildlife care groups at Tweed Valley, Coffs Harbour and Port Macquarie and the Committee has supplied duplicate slide sets for talks in these districts.

Bat Talks are given at both state and private schools, at pre-schools and to community groups such as scouts and guides, service groups, senior citizens etc.

We also attend a number of Open Venues such as community fairs, Agview, Kukundi Wildlife Shelter at Lane Cove National Park in the school holidays and the Australian Museum activities.

Open Venues are important - usually whole day events where we are able to reach a much wider cross section of the community. There again it is the hand-reared flying-fox which really does the educating.

A summary of Bat Talks given over the last 4 years:

| | Formal Talks | Informal Talks | TOTAL |
|---|---|---|---|
| 1990 | 72 | 6 | 68 |
| 1991 | 86 | 12 | 98 |
| 1992 | 139 | 11 | 150 |
| 1993 | 75 | 12 | 87 |

$8,000 was raised in 1993.

The Talks program is supported by the production of a quarterly Friends of Bats Newsletter (subscription $10 per annum) and two evenings a year at Gordon, with a guest speaker, when the average attendance is approximately one hundred.

We have developed a Photographic Display from the slide set for use in libraries, fairs etc. It is available for loan.

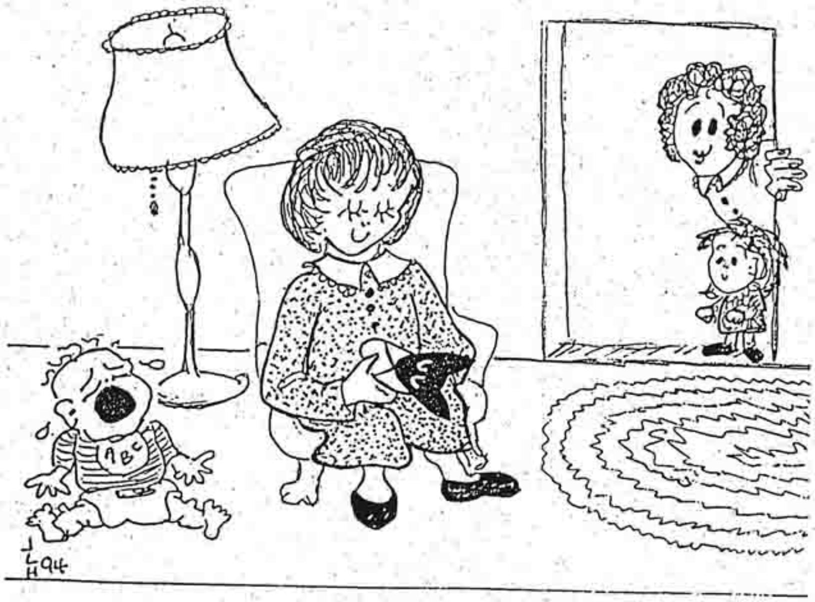
Over the years we have received literally thousands of phone calls from all over the state - concerning both flying-foxes and microbats; from students wanting information for projects, people reporting interesting information about bats and some (to put it mildly) seeking solutions to perceived problems.

All are treated courteously; students are referred to the library, and hopefully all callers have a better understanding of bat ecology before they hang up. Names and addresses are taken and appropriate brochures posted as follow up.

**FIGURE 4**

FLYING-FOX RESCUE /CARE /RELEASE PROGRAM

- CO-ORDINATION & RELEASE in Sydney region
- CO-OPERATION with WILDLIFE CARE GROUPS
  - Sydney
  - Newcastle
  - NSW North Coast
  - Dubbo
- TRAINING COURSES for CARERS
  - FAMILY, FRIENDS and NEIGHBOURS



'MAY WE COME IN AND SEE THE NEW BABY?'

## RESCUE/CARE/RELEASE PROGRAM

This program has put the committee in close contact with branches and the Wildlife Information and Rescue Service (WIRES) and other wildlife care groups in many parts of the state.

In Sydney KBCC coordinates the flying-fox rescues and fostering and is responsible for the release of the banded juveniles back into the Gordon colony.

A Care/Release Program has now been established on the North Coast of NSW, with good liaison between these wildlife care groups and with KBCC in Sydney.

The Committee conducts flying-fox foster carer training courses for carers who are authorised by their NPWS licensed care group. They attend not only from the Sydney region, but also from Blue Mountains, Gosford, Newcastle, North Coast and Dubbo. In 1993 we released some little red flying-foxes into the colony at Dubbo.

The course starts with a Bat Talk so that carers understand the behaviour of the animals in the wild, their ecological role and the variety of habitats they use.

The foster caring of baby bats takes the conservation message into the circle of family, friends and neighbours - which may never be reached by the committee in other ways.

## SUBMISSIONS

We have made formal submissions to both Federal and State Governments. We have written many letters to ministers and members of parliament sending copies to the opposition. We have been contacted by both Bellingen Council and officers of Ipswich City Council seeking information on dealing with people/bat relationships.

The committee has always had good communication with NPWS both in NSW and Queensland, especially North Metropolitan District which negotiated the Conservation Agreement 1991 for the Ku-ring-gai Flying-Fox Reserve with Ku-ring-gai Council in 1991. We were particularly pleased to be asked to assist in organising the seminar in 1992 on Fruit Crop Protection, held at Hornsby. This reached a very different audience.

The Committee at present has 10 members who plan and coordinate these programs. Our achievements are due to the support of a wide network of volunteers who are not committee members, mostly FOBS Newsletter subscribers - each offering their help in the area of their choice.

To sum up....

Over the years of conducting this environmental education program we have been very conscious of a change in people's attitude to bats. It is very rare now to address an audience of any age in Sydney which hasn't some prior knowledge of flying-foxes. People everywhere are more environmentally aware and concerned about a wide range of issues.

This doesn't mean that the fight for habitat conservation is anywhere near winning. It means a lot of hard work is ahead; but our experience encourages us to believe that it is possible.

The KBCC is now part of a loose network of environmentally concerned people who see Habitat Conservation as a necessity.

*Drawings by Janet Hutchinson*

## NOTE ON THE DEATH OF BATS TRAPPED IN A HARP TRAP IN TROPICAL AUSTRALIA

**Geoff Underwood**
PO Box 248
Healesville VIC 3777

Bats caught in a harp trap have been recorded as being predated by a Bush Rat *Rattus fuscipes* in the past by Lumsden (1989) and Wallis and Lumsden (1993), but there has been few reports of bats trapped in harp traps being killed by other species, particularly invertebrates.

A preliminary trapping survey was undertaken of the microchiropterans of the Territory Wildlife Park area, approximately 45 kilometres south-east of Darwin. Between the 18th August 1993 and the 21st August 1993, six species of bats totalling 33 individuals were trapped and released at the point of capture. A further two bats were found dead.

All bats were trapped utilising collapsible "Harp Traps", under a permit issued by the Conservation Commission of the Northern Territory (permit number DASC930045). Traps were set across vehicular access tracks or walking trails, for a period of one to two evenings at each site. All bats trapped showed little deleterious effect from either the bat trapping process or the collection of morphometric information, with the exception of two individuals.

A single harp trap was set across a vehicular access track on the afternoon of the 19th August 21993, and remained set up until the morning of the 21st August 1993. Over this period, a total of four bats were trapped at this site. The trap was cleared at approximately 11.30 pm on the evenings of the 19th and 20th August, when on each occasion a single *N. walkeri* was released.

On the morning of the 21st August at 7.30 am, two dead *C. nigrogriseus* were found within the bag section of the trap. A large number of Green Tree Ants (*Oecophylla smaragdina*) were also in the bag, having climbed onto the trap utilising the anchor cords securing it. The bodies of the two *C. nigrogriseus* were covered by a large number of Green Tree Ants, and whilst there were no visible marks on the bats, it appeared that they had been killed by the repeated stings inflicted by the ants. There had been no reason for concern about the welfare of bats previously caught within this trap, and little prior indication that Green Tree Ants would attack bats within the trap.

I have been unable to find any records of bats having been attacked by Green Tree Ants in the past, and other workers that have undertaken bat trapping in tropical Australia, have not encountered this concern in the past. (Temby, Webber, Richards, pers. comm.), although there have been cases where animals trapped in small mammal traps have succumbed to the repeated stings from Green Tree Ants (Churchill, pers. comm.)

It should be brought to the attention of workers intending to trap fauna within tropical areas of Australia in the future, that Green Tree Ants are of potential concern. With adequate preparation and by avoiding sites frequented by them, it should be possible to avoid this species having an adverse effect upon any animals trapped as part of future projects. The development of methods effectively prohibiting the entry of these invertebrates into traps should also be considered.

### REFERENCES

Lumsden, L.F., (1989) Predation by a *Bush Rat Rattus fuscipes) of bats captive in a harp trap*. Macroderma 5: 41-42.

Wallis, R. & Lumsden, L.F., *Another*

*Predation of Bats Captive in a Harp Trap.* Australian Bat Society Newsletter, 1:February 1993.

**PERSONAL COMMUNICATION**

Churchill, S., (1993) Conservation Commission of The Northern Territory.

Richards, G., (1993) Division of Wildlife & Ecology, CSIRO.

Temby, I., (1993) Victorian Department of Conversation and Natural Resources.

Webber, J., (1993) Entomology Department, Darwin Museum.

## USE OF DENTAL PROBES TO REMOVE DAMAGED BAT BANDS

**Geoff Underwood**
PO box 248
Healesville VIC 3777

Most bat banders will occasionally come across cases of bats which have injuries to the forearm, caused by the band having become damaged or having been crushed onto the wing membrane.

At times the removal of these bands can be a difficult task, particularly when there is little room between the band and the forearm. In these instances the normal technique is to use a pair of circlip pliers, modified by sharpening the ends of the pliers down to fine points, and placing these points under each side of the band. The circlip pliers are then used to expand the band to enable its removal. In cases where there is not enough room between the band and forearm to use circlip pliers under the band, the use of loops of wire around the band which is then pulled by the circlip pliers can sometimes be a successful technique. In a few cases there is no room between the band and forearm for either circlip pliers or wire loops to be used, without causing further damage to the membrane or forearm of the patient.

An alternative technique which I have tried and found particularly useful in cases where there is little room to place circlip pliers or wire under the band, has been to utilise a pair of stainless steel dental probes. The points of these dental probes are placed under each side of the band, which with the application of steady pressure, is then used to pull the band apart. I have now successfully carried out this process on a number of bats where it has not been possible to use traditional methods.

Because of the need to hold a dental probe in each hand, the bat should be held firmly by a second person to enable the band to be carefully removed without placing undue pressure or strain to the animals wing.

The use of these tools can enable bat bands to be removed with a fair degree of ease compared to the use of circlip pliers, and may enable some individuals to be re-released which may have otherwise required further medical attention or even euthanasia.

There is undoubtedly a variety of sources for these implements, although I purchased my set through a mail order catalogue a couple of years ago. Contact Mannmade Marketing on (02) 899 9498 for the purchase of Stainless Steel Dental Probes ($22.95 + $3.50 P&H).

# NEWS & VIEWS

## AERIAL BUNDLED CABLE OR ABC CABLE

The Electricity Commission is replacing 'Bare Wire' power lines with ABC cable which consists of a number of insulated power lines twisted together, earthed and completely inert, and thus flying-foxes, birds of prey, possums etc. are safe from electrocution.

The following is a quote from Sydney Electricity's Environment Brochure on protection of flora and fauna: 'Our policy is for the use of low voltage Aerial Bundled Cable (ABC) for all new overhead construction and the upgrading of existing construction. This type of cable is fully insulated, providing protection for fauna and reducing the amount of tree trimming required'.

It will be a slow process over the next decade, however we hope that in areas where flying-foxes are frequently electrocuted (usually powerlines intertwined or nearby feeding trees) that we can approach either Prospect or Sydney Electricity to replace those 'Bare Wire' power lines with ABC cable. If anyone is having similar problems, perhaps you could do the same, now that this ABC cable technology is available.

## FLYING-FOX SHOOTING IN ORCHARDS

It is irritating that in an age of sophisticated 'netting technology' that methods of protecting many orchards have not advanced from the 19th Century, ie shooting wildlife.

To bring about changes to NSW Agriculture's Crop Protection Act ie. 'to exclude wildlife from orchards rather than eliminate wildlife', and to have these changes implemented is the difficult part, and can only be achieved by lobbying. Personally written letters about this issue to your State Minister for Agriculture and State Minister for Environment from all people and groups concerned about the welfare of flying-foxes is important. Please read the abstract by Greg Richards about the estimated numbers of flying-foxes shot annually in orchards, in the 'Mammal Society Abstracts' from the Zoological Society London(1993,page 3), reproduced in this newsletter.

The Kur-ring-gai Bat Colony Committee, Wildlife ARC, Hugh Nicholson, Secretary of Lismore District Advisory Committee, National Parks & Wildlife Service, have written expressing their concerns to the Government regarding the annual shooting in orchards, however, flying-foxes need more support in this issue, including the support of CSIRO scientists, Environment & Conservation Departments.

An Orchard Netting Day is to be held in Nambour, 18 May 1994, for orchardists, and as usual the Gough family will be there to add their wonderful expertise and to encourage the correct netting methods for orchards. I understand Peggy Eby and Les Hall will also be attending and will be gently imparting their wealth of experience with flying-foxes to the orchardists present.

This planet urgently needs more people of their calibre.

**Jillian Snell**

***"Your attention please".***
The following letter is concerned about the proposed farming of wildlife:

**NASCARING WILDLIFE SHELTER**

**Geoff & Lorraine Conley**
**M/S 464 via HELIDON QLD 4344**
**Telephone: 076 97 5273**

19 April 1994

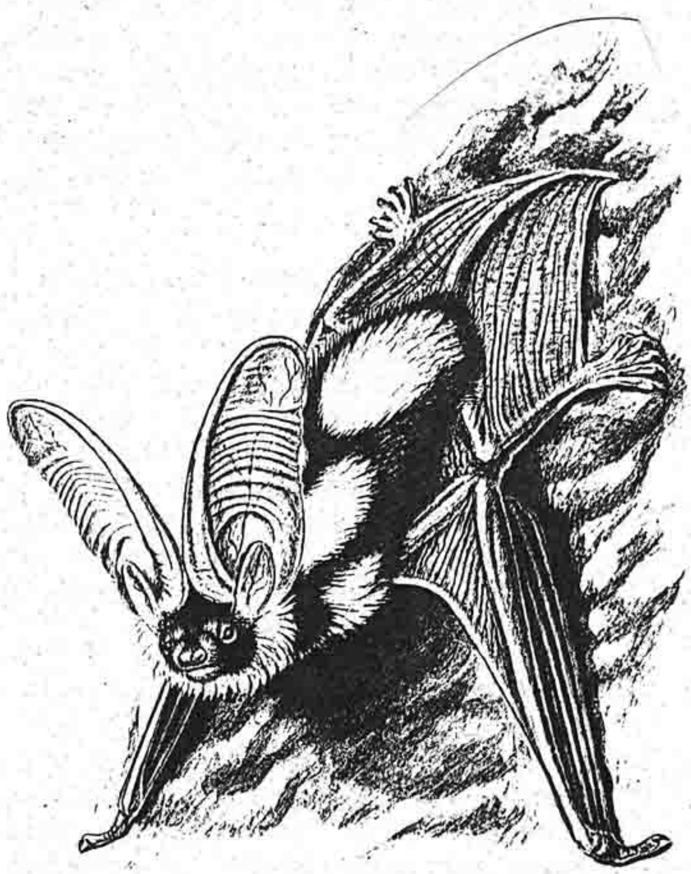
In the Queensland Times, Saturday, 9 April 1994, an ad appeared in the Public Notices section asking for submissions from interest groups and members of the public as well as landholders and local authorities to help prepare draft conservation plans relating to the taking of protected animals such as wallabies, fruit bats, birds etc. A copy of the ad is enclosed.

Then on Saturday, 16 April 1994, an article appeared in Brisbane's Courier Mail stating that the Queensland Government and Department of Primary Industries are considering allowing the intensive commercial farming of possums, bandicoots and fruit bats, with other species to follow, for export and human consumption. A copy of this article is also enclosed.

We, along with other animal and wildlife groups are fighting this issue before it goes through legislation.

The help we ask for is that you reply to the ad and article (both are related) voicing your objections. Even though this has nothing to do with other states at this time, other state governments will see dollar signs and follow suit if Queensland goes ahead with this. We need as many objections and opposition to the farming of wildlife in Queensland as we can get. We must receive sufficient objections Australia-wide in order to reinforce the opinion that Australians will not tolerate the farming of our wildlife in spite of the income that may be perceived. Every state government can only comprehend the threat to their power base equated to the volume of lost votes.

Replies to the ad can be sent to Department of Environment and Heritage as per the ad. Objections to the intensive farming of the wildlife can be addressed to us at the above address where all letters and petitions including the ones which are being circulated in Queensland will be presented by us personally to the Premier of Queensland, Mr Wayne Goss, or in his absence, the relevant Minister, at Parliament House in Brisbane.



# Possums, bats may be farmed for food

COMMERCIAL farming of bandicoots, possums and fruit bats and other protected species could be allowed in Queensland.

The State Government has released a Department of Primary Industries policy options paper discussing the farming of protected wildlife.

The proposal has "alarmed" animal liberation groups.

They say that if the proposal went ahead, native fauna could be destined for Asian and European dinner tables.

The Farming of Protected Wildlife paper refers directly to bandicoots, possums and fruit bats.

It says: "There is interest in establishment of commercial farming in a number of protected species (eg, bandicoots, possums, fruit bats) and a demand from industry for assistance with respect to commercial development and animal husbandry.

"Providing appropriate safeguards are followed (such farming) is now recognised as an acceptable practice."

But liberationists say a worst-case scenario could be "battery bandicoots" - keeping small marsupials in cages similar to intensive chicken farming.

Queensland Animal Liberation president SueSheppard said the Government was moving to create legislation about wildlife farming without sufficient public scrutiny.

She said the farming of native wildlife raised a whole range of serious issues such as welfare and negative effect on native populations.

A DPI spokesman said the paper was released to promote discussion on the farming of protected wildlife and did not imply any commitment.

"It's a matter of submissions coming in and being considered towards a positive legislative framework for any farming of wildlife under managed conditions" he said.

"It might never eventuate."

RSPCA operations manager Dr Cam Day said the society was ill at ease with the commercialisation of protected wildlife.

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**PLEASE WRITE YOUR OBJECTIONS RE: WILDLIFE FARMING (Aust. wide); WILDLIFE EXPORTING (N.T.); PROTECTED FLORA & FAUNA HARVESTING (QLD)**

Senator John Faulkner, Federal Environment Minister has the power to prevent wildlife farming becoming a reality. I propose we write to Senator Faulkner and Mr Walthall, Department of Primary Industries, opposing the above and sending copies to the relevant ministers in Queensland and the Northern Territory.

Senator John Faulkner
Minister for the Environment
Parliament House
Canberra ACT 2600

Hon. Molly Robson, MLA
Q'ld Dept of Environment and Heritage
PO Box 155
Albert Street
BRISBANE QLD 4002

Minister for Conservation
Legislative Assembly
Darwin NT 0800

Mr Walthall
DPI
GPO Box 46
BRISBANE QLD 4000

**Sample letter:**

The Hon. Wayne Goss MLA
Premier and Minister for Economic
and Trade Development
100 George Street
BRISBANE QLD 4000

Dear Premier,

It has come to my attention that your Government intends to allow more farming of protected wildlife and give the Department of Primary Industries (DPI) responsibility for farmed wildlife.

I wish to register my strong opposition to further farming of our wildlife. It involves unjustifiable exploitation. The many issues associated with farming wildlife, particularly those related to the welfare of the animals, have not been addressed.

I also consider it more appropriate that control over protected wildlife remain with the Department of Enviornment and Heritage as the DPI could not be expected to have adequate expertise in wildlife management, even in the context of farming.

All proposals regarding the farming of protected wildlife should be rejected.

Yours sincerely

# Bird & Bat Control
## for horticulture & aquaculture

**S E M I N A R**

## • Wednesday 18th May 1994 •

*A seminar for growers to discuss the protection of horticultural and aquacultural crops while conserving native wildlife.*

### Topics include:

- *recommendations for control*
- *different types of nets & supporting structures*
- *the economics of netting*
- *experiences of local growers*
- *recent research into flying-foxes*

**When:** 9.30am - 5.00pm Wed 18th May 1994
**Where:** 'Big Pineapple', Bruce Highway, Nambour, Qld 4560 (follow the signs)
**Cost:** $10 includes 'Seminar Proceedings' booklet and morning and afternoon tea.
(Lunch available at 'Big Pineapple' at own expense.)

### For further information contact:

**Ron Turner** **Tel (07) 202 0200**
*District Ranger, Qld Department of Environment & Heritage, Brisbane*

**Jodie Campbell** (Mondays only) **Tel (074) 412 211**
*Extension Officer, Qld Department of Primary Industries, Nambour*

**_BIRD AND BAT CONTROL_**
**_(for HORTICULTURE AND AGRICULTURE)_**
**_SEMINAR_**

*The Big Pineapple ... Nambour*
*18 May 1994*

***CHAIRMAN: Mr Noel Vock***

| | |
|---|---|
| *9:30* | *<u>Opening address.</u> Mr Tim Smith, Regional Director, Department of Primary industries.* |
| *9:40* | *Mr Hayden Hodges, Queensland fruit and Vegetable Growers.* |
| *9:55* | *<u>'Management of birds and flying foxes; an overview of present and future options'.</u> Mr Ron Turner, Department of Environment and Heritage.* |
| *10:10* | *<u>'Problems caused by native fauna to aquaculture and some solutions'.</u> Mr Jeff Guinea, Department of Primary Industries.* |
| *10:30* | *<u>Questions to above speakers.</u>* |

***CHAIRMAN: Ms Rebecca Williams***

| | |
|---|---|
| *11:15* | *<u>'The ecology of Grey-headed Flying Foxes and implications for their management'.</u> Ms Peggy Eby, Researcher.* |
| *11:35* | *<u>'Predicting flying fox movements: when , why and where'.</u> Dr Les Hall.* |
| *11:55* | *<u>Questions to above speakers</u>* |
| *12:05* | *<u>Grower approach to bird and bat problems.</u> Ric Bronson: Orchardist.* |
| *12:20* | *<u>Grower approach to bird and bat problems.</u> Andy Flower: Orchardist.* |
| *12:35* | ***LUNCH*** |

***CHAIRMAN: Mr Lindsay Fullerton***

| | |
|---|---|
| *1:35* | *<u>Grower approach to bird and bat problems.</u> John Gough: Orchardist.* |
| *1:50* | *Ms Jodie Campbell and Mr Neil Greer, Department of Primary Industries.* |
| *2:10* | *<u>Questions to above speakers</u>* |
| *2;25* | *<u>'The economics of orchard netting'.</u> Mr John Slack / Mr John Gough.* |
| *2:45* | ***AFTERNOON TEA*** |

***CHAIRMAN: Mr Noel Vock***

| | |
|---|---|
| *3:15* | *<u>Canopy netting : do's and don'ts.</u> Mr John Hall, Top Australia/Duranet* |
| *4:00* | *<u>'Government schemes finance'.</u> Mr Neil Price.* |
| *4:20* | *<u>Open forum questions, discussion, summing up and seminar closure.</u>* |

## PROCEEDINGS OF THE SIXTH AUSTRALASIAN BAT SOCIETY CONFERENCE

## SOUTHERN CROSS UNIVERSITY, LISMORE NSW

## JANUARY 1994

## CONTENTS

## Raising an Orphaned Broad Nosed Bat (*Scotorepens* sp.) in Captivity

**M. Abrahams[1] and P.A. Towers[2]**

1. Baylis St. Mangoplah, NSW; and 2. Rural Biomedical Research Group, Charles Sturt University, Wagga Wagga, NSW.

On the 5 December 1992 an infant bat (approximately one week old) was obtained from Narrandera NSW. The bat was found under a chair in a house apparently having been dropped by its mother. A local veterinarian was consulted, he advised contacting WIRES. When collected, the bat, was approximately 25 mm long, weighed 3g, had a forearm length of 13 mm and was almost hairless. He was given a solution of glucose in water from a 1 ml plastic disposable syringe to which a length of fine bore infant feeding tube had been attached. These were obtained from the local hospital.

On return to Mangoplah, the bat was wrapped in a cloth and housed in a small glass tank (600 mm x 300 mm) which contained pieces of bark for the bat to cling to; a small shallow water bowl containing a sponge to increase humidity, and a heat pad placed under one end of the tank. To achieve a temperature of approximately 30°C at one end of the tank, a heat pad was wrapped in a towel and placed under the tank appropriately.

The bat was fed on the viscera of 4 to 5 meal worms and 0.25 ml of Wambaroo bat milk replacer (obtained from WIRES) 4-5 times a day. Meal worms were obtained from a local pet supplier and fed unprocessed bran, high-protein baby cereal and raw carrot. The bat improved in condition and after two weeks had increased in weight to 4.1g. An alternative diet of blended scrambled eggs (as suggested by Helen Luckhoff) was used when meal worms were unavailable.

After approximately 3 months, the bat was growing and starting to fly (1-2 metre flights), but winter was approaching and it was decided to keep the bat in captivity over the winter as it would have been unable to catch prey. On the advice of Dr Les Hall (University of Queensland), it was decided to keep the animal warm rather than let it go into torpor over the winter. The bat is now approximately one year old, weighs 9.8g with a forearm length of 25 mm and a body length of 48 mm. The bat is now housed in a free flight aviary, a structure covered with shade cloth, with "windows" made of approximately 10 mm mesh inserted in the walls. These allow entry of insects which are attracted to an "insect light", which is turned on at dusk, any insects caught by the bat supplement the diet of mealworms.

As the bat was obtained at a very young age, and has no contact with other bats of the same species, has no experience in locating and hunting prey or other bat social skills, it was considered that he could not survive in the wild. Until these problems are resolved it will not be possible to release him into the wild.

## Roost Habits of some Indian Megabats

**N. Badwaik**

Department of Zoology, Institute of Science, Nagpur-440 001, India.

Rousettus leschenaulti is essentially a cave dweller occurring in large colonies. However, it has adopted new roosting sites in man-made structures such as dark dungeons in old forts, dark recesses in discarded temples and tunnels. Darkness and the presence of water in or close to the roost seem to be essential factors in the choice of new roosts for this species. Pteropus giganteus giganteus hangs freely in the open from the terminal and sub-terminal branches of tall trees, such as various kinds of wild figs, tamarind and casuarina. This species also roosts near a perennial source of water, such as a river or a lake or a large tank. Two sub-species of Cynopterus sphinx - C.s. sphinx (Vahl) and C.s. gangeticus (Anderson) occur in India. The former is not only considerably smaller but occurs in peninsular India while the latter occurs in central and northern parts of India. Both species are basically arboreal and choose semi-open conditions and roost by making 'tents' among the dried fronds or drooping strings of flowers or fruits of different kinds of palm trees and among the foliage of creepers. Normally, they live in small colonies of 15 to 20 specimens. Both sub-species have also adopted new roosts. C.s.sphinx sometimes roosts in groups of 3 to 5 isolated specimens under the eaves of windows of large buildings, and C.s.gangeticus occurs in small groups of 5 to 8 specimens clustered together on the trunks of trees having thick foliage such as Ashoka tree (Saraca asoka). The adoption of atypical roosts by Rousettus and the two sub-species of Cynopterus is probably due to the fact that there is a progressive increase in their population since they breed twice a year delivering a young one each time, and live for over 16 years. The new roosts are, evidently, formed by the spill-over population from their natural roosts.

## Recent Developments in Bat Survey Methods and Techniques

**R.B. Coles[1], P.H. Glass [1], and C.J. Coles[2]**

1. Department of Biological Sciences, University of Wollongong, Wollongong NSW Australia 2522
2. Kriscomp Pty Ltd., 25 Derinya Dr., Frankston, Victoria. Australia 3199

The use of electronic detection and identification of free-flying bat species by their echolocation (sonar) calls offers a non-invasive method of surveying forested and non forested areas. In many cases, the only method of surveying bats in their foraging areas is by sonar detection. The success of the method depends on the type of bat detector, recording and analysis techniques, and importantly, the development of a call library for reference. A survey technique has been developed based on sampling standardised transects in forests, using an Ultra Sound Advice S-25 bat detector and recording echolocation calls onto a Sony Walkman Professional to obtain satisfactory recordings for analysis. A digital sound analysis system has been developed (Ultrabyte, by Kriscomp Pty Ltd., Victoria) which permits long or short sequences of sonar signals to be digitized directly into a computer (desk or laptop) via a "super dongle" attached to the parallel port, as the original high frequency signal, countdown output or from replayed recordings. This system provides a simultaneous display of the complete digitized sonar waveforms and a zero crossings (ZCA or period) analysis. Since the ZCA has well-known limitations in terms of accuracy and reliability, especially when dealing with bioacoustical signals, spectral (FFT) analysis methods are provided for further signal processing. In the study of the insectivorous bat community in the Kioloa State Forest NSW, the above methods have been used to examine the effects of habitat structure and logging. A comparison has been made between the use of electronic bat detection and conventional trapping, and the biases of both survey methods are discussed.

## *Pteropus poliocephalus*: Responses to Variable Food Resources at Two Scales

### P. Eby

Dept. of Ecosystems Management, University of New England, Armidale NSW 2350
*Pteropus poliocephalus* are highly mobile, colonial megachiroptera which are capable of moving long distances in response to variable food sources. Responses to shifting resources may be viewed both at a gross scale (monitoring the locations of large aggregations of animals over a large areas) and at a fine scale (monitoring shifts to the population of a single camp in response to changes in local resources). This paper presents complementary data gathered at both scales. The results provide some information on the variability of blossom and fruit production within the range of *P. poliocephalus* and suggest the animals use adaptive characteristics, particularly social organisations, to effectively exploit available resources. Radio-telemetry data from animals captured at the Currie Park camp (Lismore) indicate a division in the population which may be defined by the extent of seasonal movements and the location of roost trees within the camp. This information assists in defining essential habitat for the animals.

## Changing the Focus of Research

### L. Collins

P.O. Box 436, Nimbin NSW 2480
Flying-fox research in Australia has been predominantly motivated by the need to manage these animals to minimise damage to the fruit crop industry.
In 1988, a central database to record information on all orphaned and injured flying-foxes received in NSW, was established by the Ku-ring-gai Bat Colony Committee in Sydney. This program has been well supported by wildlife care groups from Sydney, Newcastle, Port Macquarie, Coffs Harbour, Grafton, Lismore and Tweed Valley. Data has been collected on over 1,000 animals (722 orphans and juveniles, 290 adults).
While a need to record this data was recognised at this time, it is only now that the value of this information to assist in monitoring the effects of habitat loss, culling and natural disasters, on flying-fox numbers, has been realised.
The flying-fox carers of NSW would like to present this information and recommend that a broader evaluation of flying-fox management is required, to ensure their continued survival, as effective pollinators and seed dispersers of our remaining forest remnants.

## Preferential Male Mortality and its Bearing on the Population Dynamics in Some Indian Bats

### A. Gopalakrishna & N Badwaik

Dept of Zoology, Institute of Science, Nagpur-440 001, India
Variations in the sex ratio during different phases of life with their possible bearing on the population dynamics of nine species of Indian bats are reported here. The data are based on the study of specimens randomly collected from their natural roosts for several years. Every calendar month is represented by one collection or more of specimens of all the species. Three distinct phases of life are recognised for the present study, namely, infancy or suckling phase, pre-pubertal or growth phase and adult phase. The duration of these phases varies among different species. These animals grow rapidly during infancy and pre-pubertal phases, and reach the size and body weight of adult animals early in life. Hence, sexual maturity or otherwise was determined in both sexes by microscopic examination of the gonads and accessory structures. In all the species the sex ratio is nearly even at birth and during infancy, but it becomes female-biased during the pre-pubertal phase in those species in which the age of sexual maturity is the same in both sexes, and male-biased in those species in which females reach sexual maturity earlier than males. There is pronounced female-dominance in the sex ratio during the adult phase in all the species. Evidently, there is a preferential mortality of males during the growth and adult phases of all species. This is, perhaps, an adaptation to ensure the survival of the potential reproductive population, namely, females in large numbers as a measure for biological economy.

## Harem Structure and Reproductive Behaviour of *Pteropus tonganus* in American Samoa

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The White-necked or Tongan Flying Fox (Pteropus tonganus) is a colonially-roosting bat that occurs on many islands in Melanesia and Polynesia. In American Samoa mating occurs from early February to at least late October (roost moved to an inaccessible location at this time) and as many as 95% of the females in harems may be either pregnant or nursing young during this prolonged breeding season. The basic reproductive structure is a harem, typically a portion of a tree defended by a dominant male with as many as 11 females per harem (average harem size is 4.5 females per male, n + 43). Changes over time in harem structure occur, eventually resulting in the collapse of a harem. Mating behaviour and observations of parturition, including a breached birth, will be discussed. Mating is frequently preceded by licking of the female's genitals by the male and followed by frequent licking of both the female's and male's genitals by the male. Post-partum copulations are frequent, often occurring with females that are nursing young one-half to three-quarters of adult size.

## A Review of the Action Plan for Bat Conservation in Australia

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The development of an Action Plan for Bat Conservation in Australia, a two year project funded by the Endangered Species Unit of the Australian National Conservation Agency, is now nearing completion. The national species inventory was revised and now contains over 80 taxa or "conservation units", as it includes some forms still awaiting description. A database of nearly 52,000 records was compiled to estimate rarity and to conduct geographic analyses. Two species were deemed to be extinct, and 25% of the inventory species were classified as rare. IUCN threat criteria were applied to 37 species that required the development of recovery plans. Three species were listed as Endangered, 8 as Vulnerable, 13 as Rare, and 11 as Insufficiently Known. Research to either recover or reassess the status of these species has been proposed, exceeding several million dollars in estimated cost. As well as identifying single species with conservation problems, many national problems were also reported, particularly a major project to sort out taxonomic problems.
To preserve bat biodiversity, both nationally and globally a Geographic Information System (GIS) was used to pinpoint areas requiring further survey, areas with high species richness, and to identify key conservation areas. This was done for Cape York Peninsula a test case, and then on a national scale. The level of surveying across the nation was very poor, with over 90% of Australia having none or just a few records. Only 3% of the country (or 240,000 $km^2$ out of 7,560,000 $km^2$) has been surveyed well enough to have reliable distribution data. We were able to identify fourteen areas that had high bat diversity, the top few being Coen, Atherton, Bayfield (Shoalwater Bay area) and Mossman, all in Queensland. However, only 0.1% (or 58,000 $km^2$) of Australia supports 20 species or more. We conducted a Critical Areas analysis to target areas vital for the conservation of species endemic to Australia, and also assessed which other species would be conserved if reserves were established just for endemics. The analysis showed that only fifteen areas in Australia were required to conserve all our endemic species, and all other species as well. Of the 15 Critical Conservation Areas identified, 7 already contained conservation reserves.

## Community Involvement in Bat Conservation

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Bat conservation means conserving sufficient variety of habitats with wide geographical distribution, so that no bat species becomes extinct through lack of food or suitable places to breed; and that whole ecosystems do not collapse through decline of keystone species.
Only by the human community at large appreciating this fundamental need to conserve habitats and then applying political pressure will environmentally effective planning, legislation and management result.
The Ku-ring-gai Bat Colony Committee Inc. is a community group which has been involved in the following areas connected with bat conservation: a Habitat Restoration Project at the Ku-ring-gai Flying-fox Reserve, Gordon since 1987; a foster care and release program for Grey-headed Flying-foxes in the Sydney region; and an environmental education program using hand-reared flying-foxes.
Since 1985 in carrying out these programs, the Committee has formed liaisons with many individuals and other organisations in the community who appreciate the ecology of flying-foxes and to a lesser extent other bat species. Many have been reached through the education program.
This paper outlines the way in which the KBCC has reached out into the community to date and now communicates with:
Professional bodies and individuals - bat scientists, botanists eg. Royal Botanic Gardens, TAFE in the fields of bushland management/environment, Australian Association of Bush Regenerators, veterinarians, Taronga Zoo, Australian Museum, NSW Environment Protection Authority, NSW and Queensland National parks and Wildlife Service, NSW Agriculture, Ku-ring-gai, Bellingen, Ipswich Councils, Ministers and other members of parliament, Royal Australian Institute of Parks & Recreation.
Community groups - Nature Conservation Council of NSW, environmental Societies, wildlife care organisations.
People reached through "bat talks" - students from pre-schools, primary and secondary schools, TAFE, Scouts and Guide Associations, Service Clubs eg. Rotary, hospitals/nursing homes, NPWS Chase Alive Program, Ku-ring-gai Council People in parks Program, training programs for foster carers and bat speakers.
Other venues (non captive audience) - Agview at Camden, community fairs, Australian Museum, Lane Cove National Park Kukundi Wildlife Shelter.
Contact is maintained through a quarterly Friends of Bats newsletter. Media coverage through TV, newspaper articles has further brought bat conservation to the general public.

## Background and Elevated Bone Fluoride Concentrations in the Little Forest Bat *Vespadelus vulturnus*

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This study investigates the accumulation of fluoride by the Little Forest Bat (*Vespadelus vulturnus*) at both background areas free of added fluoride and around Tomago Aluminium Smelter, at Tomago, New South Wales. Bone fluoride levels were analysed to examine the effects of age, sex and location on the background levels of this species and to compare these levels with those previously recorded for other mammals.
In background areas this small, insectivorous bat was found to attain bone fluoride levels in excess of those recorded for other mammals. While young bats accumulated bone fluoride at rates comparable to terrestrial insectivorous mammals, older bats attained levels not normally reached by other mammals even in raised-fluoride environments. As with other mammals previously studied, this bat was found to accumulate fluoride linearly with age and independent of sex. There was found to be no significant variation of bone fluoride levels with geographical location.
Around Tomago Smelter, bone fluoride concentrations were found to reach levels previously unrecorded in mammals (or other fauna). These levels occurred in close proximity to the smelter, falling rapidly with distance from the smelter, until by 4 km away they were close to background readings. When this pattern of decrease in bone fluoride with distance from the smelter was compared with that for a terrestrial

small mammal, the Black Rat, it was found that bone fluoride levels decreased more rapidly for the rat, indicating the larger range over which the bat forages when compared with that of the rodent. The accumulation of fluoride in the bone with age for bats close to the smelter was over double that for background sites. Differences in the age structure of bats between sites close to the smelter and at background areas suggest that older bats are being removed from the population through the deleterious effects of fluoride accumulation.

## Bats Evolution of Chiroptera in the Light of Adaptational Transformations of Skeletal and Muscular Systems

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Our investigation is based on the generally used theory regarding the descent of Chiroptera from ancestors, which are similar to Insectivora by their organisation. Hence we obtain a possibility to estimate by means of our special method the degree of the Bats evolution advancement by intensity of the skeletal and muscular changes in the trunk of recent representatives of Bats in comparison with the initial plan of the structure of these systems in the most generalised form in Insectivora. We have investigated representatives from 0 families of Bats and 3 families of Insectivora. More than 30 indices of the skeleton and muscle of the trunk have been picked out and measured. The whole set of these indices in conditionally divided into two groups: the plesiomorphous and apomorphous indices. The plesiomorphous (ancestor) indices generalised representative of Insectivora (tenrec). The apomorphous (derivative) indices are appeared in the course of the Bats evolution by transformations of the "ancestor" homological indices as well as by new formations, which have no analogue in Insectivora. The estimate of the general evolution advancement in Bats has been carried out by quantitative correlations of these indices in the skeletal and muscular systems of representatives of the individual Bats families. The comparative analysis shows, that the representatives of the following recent families: Pteropidae, Emballonuridae, Vespertilionidae, Molossidae, - have such a structure of their skeletal and muscular systems which corresponds to the plesiomorphous state; in this case the quantity of plesiomorphous indices is more than two times as much than the quantity of apomorphous indices. The exact opposite picture is observed in the case of representatives of Rhinolophidae and Hipposideridae. At last, the Rhinopomatidae, Megadermatidae and Nycteridae representatives have the mosaic complex of the apomorphous and plesiomorphous structures, and these structures are approximately equal in quantitative connection. Thus the results of our investigation lead to a conclusion about "the primitiveness" of the first specialisation and consequently the evolution advancement of the next two Bats families; about eh intermediate position on "the evolution stairs of Bats" of the last three examined families as well. Adhering to the hypothesis on the descent of Bats by transition from the ground mode of life to the arboreal one and only then to the active flight. We associate the origin of the apomorphous indices with the ability to flight as well as with new conditions of inhabiting medium of flighting animals.

## Energy is a Limiting Resource for the Common Blossom Bat (Syconcyteris australis)

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The foraging ecology of Megachiropterans is generally considered to be limited by the low levels of nitrogen in fruit. Pollen is rich in nitrogen, however, nectar and pollen have not been adequately studies in an integrated physiological and ecological context to determine its impact on the ecology of megachiropterans. The blossom bat is unusual amongst mammals in that it specialises on a diet of nectar (energy) and pollen (nitrogen), and so it is ideal for distinguishing the effects of energy and nitrogen availability on patterns of local abundance. Physiological experiments indicate that 50% of ingested pollen grains are digested by S. australis and that this is enough to satisfy their daily nitrogen requirements. S. australis is predicted to visit fewer banksia inflorescences to satisfy their laboratory measured nitrogen requirements than required for their allometrically calculated energy requirements. This prediction is supported by correlative evidence from measurements of bat abundance, and densities of Banksia inflorescences and nectar/pollen in nine study sites. The numbers of S. australis caught per mist net hour were more highly correlated with density of energy (nectar) than the density of nitrogen (pollen). Nitrogen availability generally exceeded bat requirements, while energy availability was less than the amount required by S. australis in all sites except those where flying foxes were abundant. Experimental confirmation of such patterns by food supplementation has been carried out for a variety of terrestrial vertebrates, however a recent review indicates that bats had not been tested (Boutin 1990 - Cand. J. Zool.). I carried out a short-term energy supplementation experiment by adding pure energy (sugar solution) to three sites and comparing the change in bat numbers to three unmanipulated sites. Addition of energy led to a direct increase in local bat abundance due to increased immigration. Together, these results suggest that energy rather than nitrogen availability limits the local abundance of these small nectar-feeding megachiropterans. The high energetic cost of flight and an ability to extract the nitrogen-rich contents of pollen suggests that energy may be the primary limiting factor for populations of nectar and pollen feeding bats.

## Roost Sites and Foraging Behaviour of the Lesser Long-eared Bat *Nyctophilus geoffroyi* in a Rural Area of Northern Victoria: Preliminary Results

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The roosting and foraging behaviour of the Lesser Long-eared Bat *Nyctophilus geoffroyi*, is currently being investigated in northern Victoria, as part of a study of the distribution and ecology of bats in fragmented rural landscapes. This area has been extensively cleared of native vegetation
and is used predominantly for wheat and sheep farming. Remnant vegetation remains along roadsides, in small isolated blocks and as scattered trees within paddocks. Individual bats were initially caught in a small remnant of White Cypress pine *Callitris columellaris* surrounded by paddocks and an adjacent vineyard. Extensive areas of River Red Gum *Eucalyptus camaldulensis* forest are within the Barmah State Forest, approximately 7 km to the north and west of the capture site.

A total of 26 individuals (11 females and 15 males) were radiotracked during March, May, November, and December 1993. These bats were tracked for 185 "bat-days", and resulted in the location of 81 roost sites. Approximately 75% of roosts were within trees, with artificial structures such as buildings, vineyard strainer posts, tank stands and an old cart also used. A large proportion of the trees containing roosts