

Ghost bat

Macroderma gigas

Endangered[#] (*Nature Conservation Act 1992*) |
Ecological Sciences, Queensland Herbarium

Identification

Macroderma gigas is distinctive and readily identifiable. It is the largest microbat in Australia; weight 74-144 g, forearm length 96-113 mm. Fur and wing membranes are pale in colour, from pale grey or light brown to cream. Large ears are joined above the head and there is a large forked tragus. *Macroderma gigas* also has large eyes, a long prominent nose-leaf, and has no tail but retains a full tail membrane (Churchill 2008).

Echolocation call

When free flying, calls are characterised by steep linear frequency modulated (FM) pulses at 45-56 kHz, of low intensity and short duration (0.8-2.3 ms) (Guppy et al. 1985; McKenzie et al. 1996). When perched to forage calls are of lower frequency 28.5-36.5 kHz (McKenzie et al. 1996). Calls have up to four harmonics but most of the strength is in the 2nd or 3rd harmonic (Guppy et al.1985).

Previously echolocation calls of *M. gigas* recorded by Anabat to tape were faint and poorly defined. However, calls that are digitally recorded may be of better quality (Milne 2002). Reference calls of *M. gigas* have been successfully recorded using other bat detectors in the field such as the Pettersson D140 (McKenzie et al. 1996).

Distribution

Macroderma gigas is endemic to Australia. In Queensland this species is currently distributed in only 4-5 highly disjunct populations along the coast and inland from the McIlwraith Range in Cape York to Rockhampton. The major colony of *M. gigas* occurs at Mount Etna.

Macroderma gigas also occurs in the northern Pilbara and Kimberley in Western Australia, and the top end of the Northern Territory (Churchill and Helman 1990; McKenzie and Hall 2008).

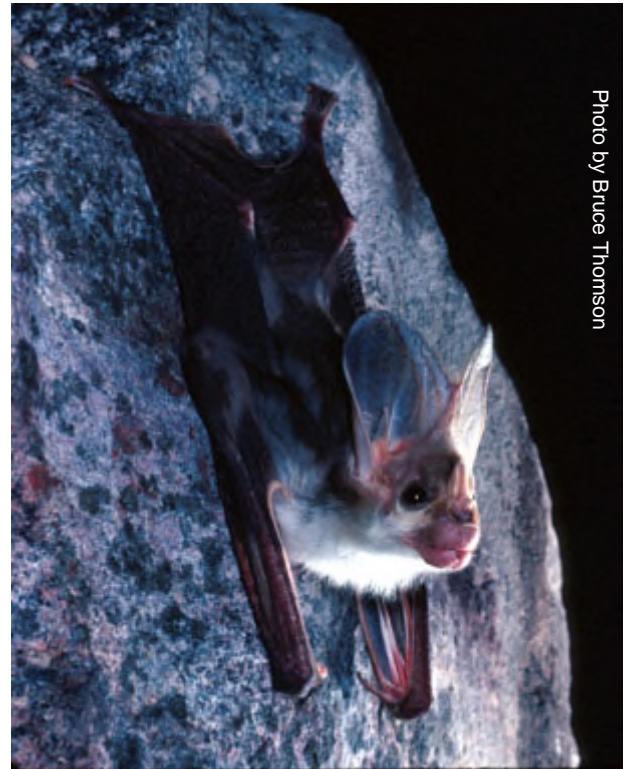
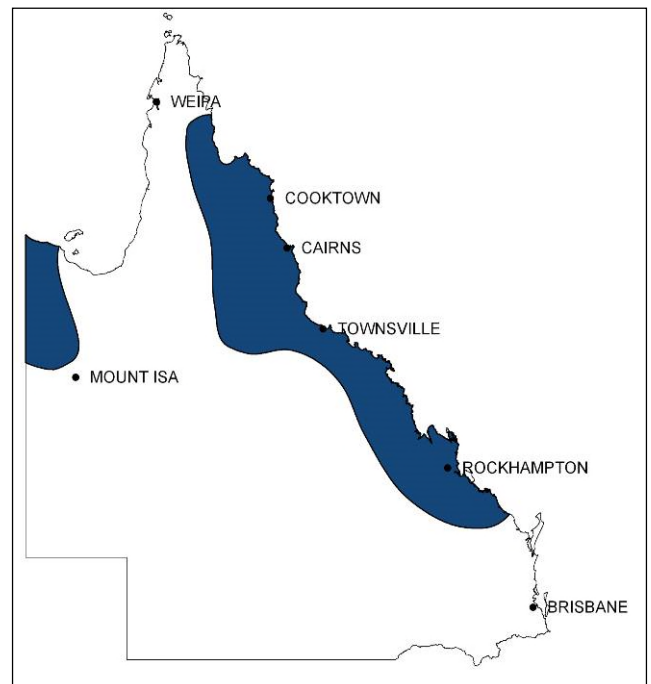


Photo by Bruce Thomson



[#] Conservation status updated from Vulnerable to Endangered in 2017

Habitat: roosting and foraging

Regional populations of *M. gigas* are centred on permanent maternity roosts that are genetically isolated from each other (Worthington-Wilmer et al. 1994). Roost sites are deep natural caves or disused mines with a specific microclimate, which is a relatively stable temperature (23°C to 28°C) with moderate to high (50-90 %) relative humidity, and the ceiling at least 2 m above the floor (Churchill and Helman 1990). Individuals aggregate in these maternity roosts during spring and summer.

Most of the colony disperses (up to 150 km) from permanent roosts during the non-breeding season in the cooler months. During this time *M. gigas* use large numbers of caves, rock shelters, overhangs, vertical cracks, and mines during the year as day roosts (Toop 1985). Dispersed groups are small, usually a single pair (Toop 1985).

This species is recorded from a wide range of habitats from rainforest, monsoon and vine scrub in the tropics to open woodlands and arid areas (Churchill 2008). Radio tracking by Tidemann et al. (1985) revealed *M. gigas* forages an average of 1.9 km from day roosts, over an area of 61 ha, generally returning to the same areas each night. Foraging bats spent most of the time perch hunting from small branches or the main trunk in the mid-to-upper canopy of eucalypts at heights up to 3 m from the ground (Tidemann et al. 1985).

Macroderma gigas is a high order carnivore with a diet of large insects, small mammals, reptiles, birds and bats (Schulz 1986); and does not enter torpor (Leitner and Nelson 1967, Kulzer et al. 1970). Therefore this species requires environmental conditions capable of providing an adequate supply of prey throughout the year, and is likely to be sensitive to changes in foraging habitat that result in reduced prey supply (Churchill and Helman 1990).

Seasonal and timing considerations

Macroderma gigas vary seasonally in the use of roosts, with individuals congregating in maternity roosts from September to April and dispersing in small groups over winter (Toop 1985). Surveys targeting this species should be carried out between September and April, as the species may be easier to detect when individuals are more aggregated. However, as *M. gigas* has the potential to be present in a wider range of areas during the winter months, surveys may need to be repeated between June and August, particularly if maternity roosts are not present within the project area.

Recommended survey approach

A combination of the following survey techniques is recommended:

Acoustic detection: active monitoring

Walking transects in the evening with a hand held bat detector and spotlight should be used to increase coverage of the project area in targeted surveys for *M. gigas*. Ghost bats are very distinctive in flight and can be distinguished from other bats by their pale colour, large size (weight 74-144 g; wingspan 640-720 mm), and often by their distinctively large ears, which can be seen in profile as they fly past (S. Churchill pers. comm. 2011). As the calls of *M. gigas* are of low intensity, the bat must be close to the microphone (< 5-7 m) in order to detect the call and obtain reasonable recordings (Pettigrew et al. 1986). However, ghost bats are attracted to prey distress calls and will fly in close to investigate. Short noisy whistles or squeaks made through pursed lips by observers, and the use of 'fox whistles' have been effective in attracting *M. gigas* within the range of hand held detectors in the past (Pettigrew et al. 1986; Lumsden et al. 2005).

At the very least, the bat detector will be useful in ruling out observations of the yellow-bellied sheath-tail bat *Saccolaimus flaviventris*, which when glimpsed briefly may be mistakenly identified as *M. gigas*. It can be differentiated from *M. gigas* by its small size (max 60 g), long narrow wings, fast direct flight, and readily recorded echolocation calls (18-21.5 kHz; Reinhold et al. 2001). Similarly, glimpses of the barn owl *Tyto alba* may also be misidentified as *M. gigas* as they are similar in size, colour and flight pattern (Churchill and Helman 1990). However, *M. gigas* is distinctive and readily identified in flight from clear observations.

Macroderma gigas make distinctive audible 'chirps' in the roost and whilst foraging in the early evening, which can be heard over 100 m away (Tidemann et al. 1985; Pettigrew et al. 1986). The 'chirp' sounds like two coins being rubbed together and once learned by an observer it can be used to indicate the presence of *M. gigas* in the vicinity (Pettigrew et al. 1986; S. Churchill pers. comm. 2011).

Transects should be distributed so as to give good representation of the major habitat types within the project area, and can incorporate gullies, gorges, watercourses, scarps containing caves, mine entrances, rock shelters, overhangs, and pools of water. Walking transects should begin at dusk and continue for at least two hours duration. GPS tracks of transects should be kept to quantify effort and highlight areas surveyed. When using an Anabat bat detector, the sensitivity must be set as high as possible (> 9). Spurious noise from insects and so on can be removed from calls in AnalookW later using a filter. Only clear observations of *M. gigas* should be relied upon to confirm the presence of this species, and any recorded calls would allow independent verifications to be made.

Capture techniques

Harp traps and mist nets are successful in capturing this species. Harp traps and or mist nets should be placed across flyways along vehicle and walking tracks, watercourses, gullies and so forth in a wide variety of habitat types within the project area. Leave harp traps set for the entire night.

Roost searches

Prior to the survey it is important to establish whether there are any caves and mines in the project area, and any known roosts. Further searches of gorges, gullies, fissures, rocky outcrops, overhangs, and cliff lines should also be conducted at the site for potential roosts for this species. Chirping or twittering may be heard coming from within. However, ghost bats can also be very quiet and evade detection in caves and mines, often flying out into daylight to avoid you. Therefore it is helpful for one person to remain outside watching while the other searches the roost (S. Churchill pers. comm. 2011).

Searching the cave floor for fresh dung and prey remains is also very an effective technique used to indicate the presence of *M. gigas*. Their droppings are large about 15 mm x 4 mm and usually deposited in mounds under favoured roosts, with discarded food remains scattered amongst the dung pile (S. Churchill pers. comm. 2011). Several hours per day may be required to conduct ground-based surveys for caves and mines. The most prospective caves can then be monitored for the emergence of bats at dusk or dawn, as *M. gigas* can often be seen returning to the roost at or just after sunrise, flying fast and straight (S. Churchill pers. comm. 2011).

Survey effort guide

There is currently no information on capture rates for *M. gigas*. However, the recommended level of effort below may provide a reasonable opportunity to detect or capture *M. gigas* if present in the survey area.

Per 100 ha of project area		
Survey technique	Minimum Effort	Minimum number of nights
Active monitoring	8 detector hours	4 nights
Harp traps	8 trap nights	4 nights
Mist nets (optional)	8 mist net hours	4 nights
Roost searches	2 hours per survey day	
e.g. 2 harp traps set for 4 nights each or 1 trap set for 8 nights, and so on.		

Ethical and handling considerations

Care should be taken when surveying bats during the breeding season; survey methods should not include those which would cause distress resulting in the abandonment or dislodgement of young. Female *M. gigas* are likely to be heavily pregnant, have young attached, and/or be nursing crèched young from late October to March (Churchill 2008).

Roost searches

- *Macroderma gigas* are highly sensitive to disturbance at the roost and every effort should be made to minimise disturbance.
- When entering or working at the entrance of roosts be as quiet as possible. The number of people entering & searching a cave or mine for bats should be kept to a minimum.
- Any damage to the bat roost, such as removing rubble blocking corridors is unacceptable, even if these activities would increase the effectiveness of the search.

Capture

- Allow sufficient time to ensure the final check and closure of all traps occurs before early dawn.
- Harp traps must be checked at least twice during the night where lactating females are present, and during adverse conditions (very cold or wet).
- Mist nets must only be used by trained and competent personnel.
- Do not use mist nets across the roost entrances of caves and mines unless there is prior knowledge of the number of bats within, and the number is not large.
- Nets must be monitored constantly and should be closed when not attended.
- To reduce the chance of catching birds, mist nets should be furled until dark, not left open.
- All bats should be removed as quickly and gently as possible from mist nets to reduce injury and stress. If more bats are being caught than can be safely dealt with, the net should be furled as soon as all bats are removed.
- Place bats into a dry calico bag, one bat to a bag, keep bags off the ground.

- Release bats close to their point of capture while it is dark.
- Care should be taken when working around or handling microbats due to zoonotic diseases, such as Australian bat lyssavirus (for further information see the www.health.qld.gov.au). Only fully vaccinated personnel are to handle bats.

Acknowledgements

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Citation

Hourigan, C. 2011. Ghost bat, *Macroderma gigas*. Targeted species survey guidelines. Queensland Herbarium, Department of Environment and Science, Brisbane.

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