Foraging Ecology, Behaviour and Management of the Mahogany Glider *Petaurus gracilis*

Thesis Submitted by

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The Gliding Ability of Petaurids.

"On board a vessel sailing off the coast of New Holland was a Squirrel *Petaurus*, which was permitted to roam about the ship. On one occasion it reached the mast-head, and as the sailor who was despatched to bring it down approached, it made a spring from aloft to avoid him. At this moment the ship gave a heavy lurch, which, if the original direction of the little creatures course had been continued, must have plunged it into the sea. All who witnessed the scene were in pain for its safety; but it suddenly appeared to check itself, and so to modify its career that it alighted safely on the deck".

From: Penny Cyclopedia (1839) Marsupialia, Charles Knight & Co. Vol xiv p. 460-461.

A Mahogany Glider Launching Into a Glide.

Photo by John Young

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Abstract

The mahogany glider *Petaurus gracilis* is a large species of gliding possum that was rediscovered in 1989, after not having been formally seen since 1886, and has a naturally very limited distribution, between the Hull River near Tully and approximately 30km south of Ingham in North Queensland. As a result of habitat loss, its naturally limited distribution, the potential for further habitat loss and the small amount of habitat protected within national parks it is considered endangered. The objective of this study was to examine the ecology and habitat requirements of the mahogany glider so that this information can be used in its long term management. To achieve this, the aims were to:

1) Examine the demography, reproductive biology, population density and longevity of the mahogany glider and sugar glider *Petaurus breviceps* in sympatry in both continuous and fragmented habitat.
2) Identify the habitat characteristics that determine the local distribution of both the mahogany glider and sugar glider, as the use of the different habitat types has important implications in managing the habitat of the mahogany glider. Compare the preferred habitat used by the mahogany glider to that used by the sugar glider when both species occur in sympatry.
3) Determine the diet of the mahogany glider and how it changes seasonally. Examine the timing and success of flowering for species of trees which are utilised by the mahogany glider and the potential availability of insects.
4) Determine the area of habitat required to supply adequate food and shelter. Determine the distance individuals move each night in maintaining their home range and finding food. Determine the number of dens required and interpret the social system.
5) Determine the gliding efficiency of the genus *Petaurus* using the mahogany glider and the sugar glider, and compare this genus of gliding mammals with other gliding mammals.
6) Examine the distribution of the mahogany glider with respect to its close relative the squirrel glider and examine their evolutionary history.
7) Examine the probability of extinction of different sized populations of the mahogany glider and the impact of a one in a one hundred year catastrophe.

The ecology and social behaviour of the mahogany glider was studied in an area of continuous forest and an adjacent area of fragmented forest between Cardwell and Ingham in North Queensland, between December 1994 and December 1996. A mark recapture study was undertaken to examine the life history of the mahogany glider and sugar glider *Petaurus breviceps*. A radiotracking study was also completed to examine the home-range, social behaviour and foraging strategies of the mahogany glider. Food availability was also determined to allow a comparison with the observed diet.

The mahogany glider has a distinct breeding season, with births occurring between April and August/September each year. This appears to synchronise the weaning period with a peak in the availability of insects and acacia arils, which are presumably needed to supply nitrogen and lipids to subadult animals during this growth phase.

The mean litter size for the mahogany glider was 1.55, and females appear to be able to raise only one litter per year, although they can re-mate and replace a litter if it is lost early in the breeding season. The sugar glider had an average litter size of 1.83, and was able to produce more than one litter per year. Both male and female mahogany gliders and sugar gliders appear to be able to live until at least 5 years of age. Female mahogany gliders appear to mature between 12-18 months of age.

Trapping information revealed the density of mahogany gliders was on average $0.24ha^{-1}$, with the density of sugar gliders being $0.26ha^{-1}$ in the continuous forest. However in the discontinuous fragmented forest, the density of the mahogany glider was greatly less than the continuous habitat ($0.16ha^{-1}$), while the density of sugar gliders was greatly more than found in the continuous habitat ($0.46ha^{-1}$). An examination of the habitat utilised by the mahogany glider and sugar glider in the continuous and fragmented areas, revealed the mahogany glider to prefer open habitat dominated by eucalypts and *Albizia procera*, while the sugar glider favoured closed habitat, with an understorey of acacias. As corridors are typically comprised of a greater understorey of acacias this helps to explain the significant decrease in

mahogany glider density within riparian strips in fragmented forest (although the results do show that corridors may be used by mahogany gliders).

The mahogany glider fed on a diverse variety of food items, including nectar and pollen from Myrtaceae species such as eucalypts, bloodwoods and melaleucas. Sap, from *Acacia mangium* and especially *Albizia procera* were important. Lerps and honeydew, insects, acacia arils and fruit from mistletoes were also consumed. In obtaining this variety of food the mahogany glider depended on complex seasonal cycles of food availability, requiring a high species diversity of plants with distinct periods of availability.

The annual home-range averaged 19-20ha for both males and females in continuous forest and 10 hectares for females and 16 for males in the riparian fragmented linear habitat. Individual males and females formed pairs with home-ranges overlapping by approximately 86%, whereas they overlapped only 8-10% on average with other animals of either sex, suggesting that they are socially monogamous. Both males and females have 6-13 dens within their combined home-range, which they either share with their mate (and offspring) or often den apart. The use of a number of dens, and denning apart, appears to be a cost effective means of jointly defending a territory.

In traversing their home-range, the mahogany glider has a glide angle of 28.26° (or 1.91m distance per 1m loss in elevation), which was not significant to the sugar glider that had a glide angle of 29.69° (or 1.82m distance per 1m loss in elevation). Significant differences were found between them for height of launch (19.75 and 11.96m respectively), height of landing (4.48 and 1.95m respectively), diameter at breast height of landing tree (44.12 and 23.22cm respectively), and glide distance (29.71 and 20.42m respectively). Although both gliders do make short glides, direct observations, and the significantly greater height of launch and landing points, show the much larger mahogany glider preferred more open habitat and to glide from the top of tall trees, where longer glides could be made. In contrast the sugar glider clearly preferred the mid storey with a higher density of trees, where shorter glides would be preferred.

Bioclimatic prediction of the potential distribution of the mahogany glider using the BIOCLIM program, suggested their distribution was unlikely to extend much beyond their presently known range or much greater than 500m elevation. The predicted distribution of the closely related squirrel glider overlapped almost entirely with that of the mahogany glider, although there is no known overlap of these two species as the closest records are 25km apart. It is proposed that an isolation event resulted in the separation of a population of squirrel gliders (or a common ancestor) and consequently allowed the evolution of the mahogany glider in the highly productive area where they occur.

The population viability analysis program VORTEX showed that populations up to 300 individuals (1500ha) have a negative population growth rate, high losses of genetic diversity and a greater than 5% chance of extinction within 100 years. A population of 800 individuals (4000ha) was needed for the population size to stabilize. Sensitivity analysis showed adult mortality of greater than 25% to be important in decreasing the viability of populations. Populations of 400 were resistant to a one in 100 year catastrophe which had a 20% mortality and 20% decrease in reproduction. As only approximately 50% of the available habitat appears to be occupied, an area approximately 8000ha (800 individuals) is suggested to be required to maintain viable populations of mahogany gliders.

In order to manage this species over the long term a number of management issues need to be addressed. These include: (1) the establishment of reserves of adequate size to maintain viable populations; (2) establishment and maintenance of corridors between key areas of habitat to allow individuals to move between populations; (3) monitoring and controlling rainforest expansion within corridors and in key habitat; (4) use plain wire instead of barbed wire where possible; (5) minimise the distance of gaps in habitat for tracks and roads so that these can be crossed easily, reducing the opportunity for predation on the ground or being run over; and (6) conduct research to determine the most appropriate fire regime to control rainforest expansion.

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