

The biology of the malleefowl *Leipoa ocellata* Gould in the Little Desert area, Australia

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Several pairs of malleefowl *Leipoa ocellata* Gould, 1840, have been studied intensively in a block of natural mallee habitat. The unique observational situation, the result of years of patient and low-impact interactions between the observer and the birds, has provided detailed information on a normally secretive species. The regular mound construction behaviour is described, as is temperature testing and manipulation, copulation, egg laying and hatching.

Introduction

This article is a summary of information collected over almost two decades of observations and, more recently, video footage recorded on a tract of land, protected by covenant, where malleefowl *Leipoa ocellata* Gould, 1840, live in their natural habitat. The site is in the Little Desert region of western Victoria, southern Australia. The habitat of the malleefowl in this area is typical mallee environment: the light sandy loam, grey clay, buckshot and sandstone soil is covered by moonah *Melaleuca lanceolata* Otto, broom bush *Melaleuca uncinata* R. Br., dumosa mallee *Eucalyptus dumosa* A. Cunn. ex Oxley, red mallee *Eucalyptus calycogona* Turcz., green mallee *Eucalyptus wimmerensis* K. Rule, and yellow mallee *Eucalyptus costata* F. Muel.

Pair bond

A number malleefowl mounds (2-5) have been operating on this land for many years. One mound, named "Buckshot" because of the laterite found at that spot, was first recorded in 1876 by the original settlers on that block, the Janetzki family. A local identity, Keith Hateley, a keen observer of the malleefowl, also observed birds on this mound in the 1930's. Another mound nearby has been named "Tower Mound". The malleefowl may have used these and other mounds on the block for hundreds of years. "Tower Mound" has been monitored with temperature and humidity meters since 1981 in order to record data throughout the breeding season. At the centre of the observations are two birds known as Charles and Di which until their separation in late 1995, worked "Tower Mound".

Charles and Di were first observed working together on this mound by the author in May 1978. Prior to that, Charles worked the mound on his own and a mutual acceptance was formed between the observer and this bird by continuous contact on and around the mound.

The first observation of the mating of Charles with Di was noted in August 1981. The process of developing a mutual relationship with both birds was continued by the observer until acceptance was finally achieved in late 1981. This mutual relationship continued until November 1995 when the two birds separated after the intrusion of a new male named Romeo into the territory. The observation of the separation

records that Charles left the area and Di continued to work the mound for four days after which she mated with Romeo and moved to the nearby "Buckshot Mound", leaving nine eggs in the egg chamber of "Tower Mound". Di and Romeo continue to work "Buckshot Mound". Charles has mated with a younger female, hatched under supervision in the Little Desert Lodge incubator, and they continue to work "Tower Mound". This observation of the separation of these birds contradicts observations of Frith (1962) who argued that once the birds are mated they remain paired for life.

Breeding

The breeding season in this area usually commences in April/May with the birds cleaning out the mound. This requires removing the old material from the previous year's egg chamber. The birds dig down below ground level in the centre of the mound to form, in some years, a stocking shaped hole in the base of the mound. When this has been completed, the birds begin to collect leaves, sticks and bark in the vicinity of the mound. This material is typically formed into "windrows", elongated piles leading towards the mound. It is finally moved over the top of the mound and into the prepared cavity where it is mixed with sand. Holes are made in this material to catch any rain. The removal of the leaves, sticks and bark from under the nearby trees, results in the ground around the mound being almost entirely clean of debris (Frith, 1962). The mound when completed is of a conical shape.

Throughout the breeding season the birds are continually changing the shape of the mound to regulate the temperature in the egg chamber (Frith, 1957). The heat used to incubate the eggs in the chamber comes from two sources. The decomposing leaves, sticks and bark provide some heat. The production of this type of heat is assisted by the birds' faeces which are dropped and mixed into this material whilst the birds work on the mound. The birds also utilise solar heat (Jones et al., 1995). In regulating the temperature, the birds dig down to the egg chamber and test the temperature using their bill. After digging down to the egg chamber, the male and female bird alternately thrust their open bill up to their eyes into the material. When the birds withdraw their bill, sand falls from their mouth. This whole process results in activity on the mound by the birds lasting at least one hour to maintain a constant temperature within the egg chamber or precedes egg laying.

When the egg chamber reaches a constant temperature of approximately 34 degrees Celsius, egg laying commences. The temperature may vary slightly throughout or between breeding seasons. The female, on most occasions, indicates that egg laying is imminent by calling. Frith (1957; 1962) describes this process in detail. The birds then open the mound down to the egg chamber, test the temperature and prepare a place for the female to lay the egg. She may reject the choice of location for the egg and they then have to locate another spot. This continues until the female is satisfied with the place chosen. The female deposits the egg, which may be pink, off-white or brick red in colour, and then after resting, moves away. The male often scratches the egg, for unknown reasons, with his bill thus removing some of the outside colouring and revealing the white shell. The male then covers the egg and backfills the mound to a round and moat shape. Egg laying usually commences in September and is completed in January, but this is dependent on seasonal conditions (Frith, 1959;

1962). The number of eggs laid varies each season depending on such factors as food supply, physical condition of the male and female, and the prevailing weather conditions and can vary from five to 22 eggs (see Jones et al., 1995). After working the mound the birds are exhausted. They spend time cooling themselves under the nearby mallee trees. This involves crouching or standing with wings held out from the body and touching the ground to enable the breeze to cool the body. When relaxing the birds rest or dustbowl in the soil in the shade under trees. Another activity that occurs on and off the mound is the preening of their feathers. The time of preening varies from five to 20 minutes.

Copulation

Copulation by the paired birds takes place close to the mound (Frith, 1962). The first observation of this occurring by the observer was in July and it continues until February. This is an extended period to that noted by Frith (1959). The birds on "Tower Mound", Charles and Di, have been observed to copulate three times in four hours on one morning and then the female laid. There is no set time or regular pattern to copulation but it usually occurs in the cool of the morning near the mound (Frith, 1962). The process of copulation is commenced by the male making a booming noise. He lowers his head to his chest with its crest raised, wings spread slightly and lifted and uttering a booming sound. The female returns with a high pitched call. The male then mounts the female from behind, holds the crest of the female with his bill and copulation occurs, lasting only a few seconds. Copulation takes place more frequently during the egg laying period but it has also been observed to occur outside the egg laying period (see also Immelmann & Böhner, 1984).

Food

During the egg laying season considerable time is spent by the birds foraging, wandering up to 500 m radius from the mound. In other seasons, the distance travelled by the female can be up to one kilometer. The mallee environment provides a variety of food for them. Depending on the season, the diet includes seeds, native grasses, growing tips and leaves, flowers, orchid tubers and insects such as termites, ants, moths, beetles and dragonflies. Other foods include fungi, lily stalks, tubers and lerps (psyllids, which feed on the sap of the eucalypt trees) (Frith, 1962; Benshemesh, 1993).

Predation and competition

The malleefowl, both adults and chicks, in this area, have to be ever vigilant for predators such as the red fox *Vulpes vulpes* (Linnaeus, 1758), domestic cat *Felis catus* Linnaeus, 1758, brown falcon *Falco berigora* Vigors & Horsfield, 1827, and brown goshawk *Accipiter fasciatus* (Vigors & Horsfield, 1827). The remains of five adult malleefowl have been found on the property. Their colouring provides some protection from these predators. Foxes have also been known to eat the eggs. Introduced European rabbits *Oryctolagus cuniculus* (Linnaeus, 1758) and the brown hare *Lepus capensis* Linnaeus, 1758, have a detrimental effect on the birds by eating some of their food sources (Frith, 1962).

During the winter, echidnas *Tachyglossus aculeatus* (Shaw, 1792) may appear in the mound and occasionally live inside the mound until the end of August. It is the opinion of the author that the echidna aerates the mound and so assists the work of the termites in breaking down of the litter that produces heat in the egg chamber. This more recent research of 1998 contradicts a previous conclusion, hypothesized by the author, that echidnas might damage the eggs and egg chamber as it has been observed that the echidnas vacate the mound prior to the malleefowl egg laying. Three echidnas were observed living inside "Tower Mound" in 1997 and 1998 and three and five were observed in "Buckshot Mound" in 1997 and 1998 respectively.

Hatching

The culmination of the birds' efforts is the hatching of the chicks. The chick makes its way from the egg chamber to the surface of the mound where it rests for a short time, then rolls down the side of the mound, stays at the base of the mound to gain strength and then shakingly moves into the bush. The birds, that have devoted considerable energy throughout the breeding season to ensure the eggs are incubated, take no interest in the chick which has to fend for itself after leaving the mound (Frith, 1962).

The breeding season ends with the temperature in the egg chamber declining to less than 18 degrees and the birds' activity on the mound ends in late February or early March, depending on seasonal conditions. And within two months, in April/May, it starts all over again.

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