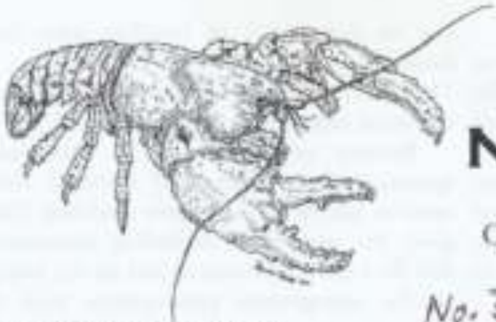

THE NATURAL NEWS

Central North Field Naturalists Inc.

No. 32 **Autumn 2006**

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Walks Program (see insert for more details)

Sunday, May 7th
A fern and fungi walk at **Holwell Gorge.**
Meet at the northern end of the track at 10.00

Sunday, June 4th
Hawley Point Coastal Reserve
Meet at 10.00 at Hawley Esplanade.

Sunday, July 2nd
Jim's studio, 68 Dynans Bridge Rd, Weegena.

Sunday, August 6th
Quamby Bluff cryptogamic adventure
Meet at 10.00 at the car park on the Lake Highway.

Friday May 19th Sir Henry Somerset Memorial Lecture
The Burnie Field Naturalists present:
An Evening with Martin George.

The CNFN is running a raffle to raise money for the threatened species at Wielangta. It will be drawn at 4.00 in the garden at "Heron on Earth", 6 Edward St., Port Sorell following our June outing. **If you would like to sell (or buy) tickets, please contact Sarah**

What's happening at Wielangta?

By Craig Woodfield (with thanks to the Environmental Defenders Office)

Most people would be aware that Senator Bob Brown is involved in a legal action against forestry activities in the Wielangta forest on Tasmania's east coast. But what is the case really about?

The area known as Wielangta forest is found between Orford and Copping on the east coast, roughly adjacent to the southern part of Maria Island. The Wielangta Forest Drive is promoted by both Forestry Tasmania and Tourism Tasmania, and focuses on the small Wielangta Forest reserve, which is surrounded by a much larger area of State Forest.

The first thing to note about this case is that it is not against Forestry Tasmania, nor is it being heard under Tasmanian law. It is in fact targeting exemptions given to forestry activities under Commonwealth law. In general, activities that could have a significant impact on a nationally listed threatened species need to be approved by the Commonwealth Environment Minister. However, s.37 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides that forestry operations undertaken in accordance with a Regional Forest Agreement do not require this approval. For this reason and other reasons, forestry activities are frequently not subject to the same level of assessment and public scrutiny as other land uses that adversely affect threatened species.

Senator Brown has made an application to the Federal Court challenging the application of this exemption on a number of grounds. In particular, he argues that forestry operations in Tasmania are not in accordance with the Tasmanian Regional Forest Agreement because there are not adequate systems in place to assess the impact on, or to protect, endangered species.

The action focuses on the impact of proposed logging in the Wielangta forest on the following threatened species:

- broad-toothed / Wielangta stag beetle (*Lissotes latidens*)

The Wielangta stag beetle is a small, flightless, ground-dwelling beetle. It has been found in around 38 sites in south-eastern Tasmania (between Orford and Copping) and on Maria Island. Habitat loss through forestry practices is recognised as a major threat to the beetle.

- Swift Parrot (*Lathamus discolor*)

The Swift Parrot is a migratory species which breeds in Tasmania before migrating to mainland Australia in autumn. Their main breeding area is coastal south-eastern Tasmania, where grassy blue gum forests are prevalent. Swift Parrots nest in hollows in old-growth trees across a range of eucalypt species, generally near the coast.

- Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*)

The Tasmanian Wedge-tailed Eagle is the largest and heaviest wedge-tailed eagle. It nests in a range of old-growth native forests throughout Tasmania. The species is suffering a decline in breeding success due to disturbance of breeding pairs and habitat loss.

The birds are also highly susceptible to unnatural mortality.

Because of this focus on threatened species, a large number of scientists have been or will be called to give evidence. This gives the somewhat misleading impression that the case will be won or lost on the merits of the management prescriptions used to protect threatened species. This is unfortunately not the case. As dodgy as the scientific justification for logging activities may or may not be, the case will ultimately be decided on the legal arguments that are presented.

Nevertheless, the revelations so far have been breathtaking, even by Tasmanian standards. It was widely reported that biologist Dr Jeff Meggs changed the content of his affidavit after comments by Forestry Tasmania. A paragraph on the Wielangta stag beetle that read 'the longer the status quo of conservation management for this species is maintained, the higher the risk of extinction to the species based on current knowledge' was removed. The change was defended as this statement was seen to be a 'gratuitous' call for research funding.

The case is being heard in the Federal Court in Hobart, before Justice Marshall. The first two weeks of the trial were heard from 5 to 16 December 2005. The hearing will recommence in February 2006. Forestry Tasmania has undertaken not to conduct any forestry operations in Wielangta before April 2006 (unless the court gives permission). If the application is successful, forestry operations in Tasmania, and possibly under RFAs in other states, will not be automatically exempt from assessment under the EPBC Act. It is also worth noting that Senator Brown is personally funding this case – a very courageous move.

[This article first appeared in the March edition of the TCT newsletter.]

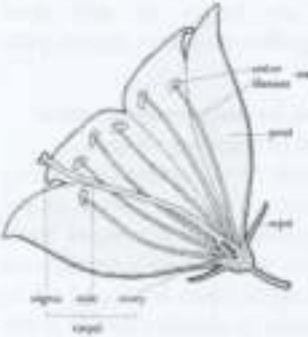
Footprints in the Pollen (Part 1)

By Phil Watson

Visual and aromatic treats are only some of the pleasures provided by a carpet of wild flowers. Waiting to be discovered by the nature lover is the fascinating world of curious structures, processes and complex interrelationships between plants and animals that have evolved to ensure plants reproduce. In fact, flowers are simply the plant's tool in the mating game, with their intricate designs refined over millennia of generational change. This article explores the exciting field of pollination ecology, which studies the interaction between plants and their pollinators.

Nectar and pollen are irresistible rewards

Although flowers appear very different, they all have the same basic structure. Their central female parts (carpels) contain the ovaries which require pollinating to form fruits and seeds. These are surrounded by the male parts (stamens) which are the pollen producers, designed to ensure the fertilization of the ovules in the ovary. Encircling the stamens and pistils are the petals and sepals, colourful accessory structures whose roles are to protect the pollen and nectar and to promote their floral attributes as boldly as they dare.



To achieve a transfer of pollen from the stamens of one flower to the ovules of another, pollination agents are targeted, attracted by a reward of delicious body building pollen which is high in fats and protein, or energy giving nectar which is high in sugary carbohydrates. To maintain a competitive advantage, the flowers' colours and scents must be as irresistible as possible. In human terms this is somewhat akin to streets lined with cake shops, cafes and restaurants displaying windows of decorated cakes and other delicacies. Like the flower-scented breezes, these are made even more tempting by fans wafting mouth watering aromas into the street.

Pollen is too expensive to waste

As there is always ample carbon in nature for plants to make carbohydrates, sugary nectar is a cheap product. In contrast, pollen demands large amounts of nitrogen and is generally at a premium in the low nitrogen environments of dry coastal heaths, grassy woodlands and vegetation communities located on siliceous and skeletal soils. In these areas nitrogen is mostly obtained through healthy symbiotic relationships between fungi and plants.

Because pollen is precious, flowers have developed structures and processes that attract pollinators while excluding other potential nectar and pollen raiders.

No footprints required

There are many self pollinating flowers. Of these, a few practise the bizarre process called cleistogamony, where flowers such as *Viola* sp, *Wahlenbergia* spp, a few species of Leek Orchids *Prasophyllum* spp and small-flowered *Caladenia* spp. pollinate without opening.

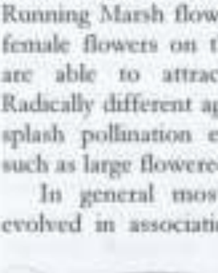
Wasteful wind and wondrous water pollination

Using wind to waft the fine pollen around is a rather wasteful and haphazard process. Typical wind pollinated plants are from the monocotyledonous families of *Cyperaceae* (sedges) *Poaceae* (grasses and cereals), *Juncaceae* (reeds and rushes) and a small number of dicotyledonous families including *Casuarinaceae*, *Urticaceae* and *Plantaginaceae*. Wind pollinated plants produce no nectar and have insignificant flowers that are mostly dioecious (separate male and female plants).

These families are responsible for many of the allergenic pollens known to induce the classic springtime hay fever and asthma attacks. But although the grasses tend to get the blame, Plantains *Plantago* spp., *Amaranthus* sp., Docks *Rumex* sp, Mustards, Stinging Nettles and Paterson's Curse are the worst culprits.

All seagrasses rely on water pollination but it is uncommon in terrestrial plants. Some wetland species such as the brilliant yellow Running Marsh flower *Villarsia reniformis* have female flowers on the water's surface which are able to attract passing pollen rafts. Radically different again is the rarely seen rain splash pollination evolved by a few plants such as large flowered Clematis.

In general most flowering plants have evolved in association with pollinators. The plants are commonly monoecious (male and female flowers on the same plant) and employ the services of diurnally active invertebrates, (such as soldier beetles, left) marsupials and birds or nocturnally active mammals, bats and moths. Most plants are able to recognise their own pollen and have evolved the ability for male and female parts to be receptive at different times, thus ensuring that outcrossing and hence genetic robustness is perpetuated.



Bees are nectar and pollen addicts

Whereas some pollinators only require nectar and/or pollen for part of their lives, bees need these honey ingredients throughout their adult and larval stages. To accumulate one kilogram of honey, bees will have pollinated a million individual flowers and flown over 50,000 kilometres.

Sadly, native bees are declining or have gradually been displaced since the introduction of the commercial honey bee and more recently the bumble bee. This has led to a reduction in native flora pollination and an increase in the pollination of weeds. Hence weeds like Lopins, Agapanthus, Genista, exotic *Solanum* sp. and Foxgloves are flourishing amongst our indigenous plants. Recent studies of the Bush pea *Gompholobium huegelii* report a large reduction in flower visits by the native *megachilid* bees (left) where they competed with the bumble bee. The hairy body parts of this native bee perfectly match the location of the flower's anthers and stigma, whilst the equivalent areas on the bumble bee are smooth and unable to attach pollen.

In general, native bees favour the blue and purple flowered Sun Orchids, *Thelymitra* spp., Blue Iris *Patersonia* sp. Blue Bush Pea, *Hovea* sp. and Happy Wanderers, *Hardenbergia* sp., although they are happy to add their footprints in the pollen of yellow, mauve, pink and white blooms.

Pollination by long tongues, short tongues or buzzing wings

Bees are capable of manipulating a variety of floral constructions to gain access to the nectaries. Some flowers have developed finely tuned relationships so that only a few species can decode the cryptic clues leading them to the flowers' rewards. A classic example is the Bloodroot *Haemodorum* sp. where specialised bees are able to enter and pollinate their closed flowers, thus eliminating other nectar competitors.

The largest and most commonly seen bees are the sparsely hairy **short tongued species** (right) that have evolved in parallel with the Myrtaceae family. Gums *Eucalyptus* spp., tea trees *Leptospermum* spp., paperbarks *Melaleuca* spp., and heath myrtles *Baeckea* spp. have shallow cup-like nectaries ideally suited for lapping by short tongues. Prolific nectar

producers such as Native Box *Bursaria spinosa*, and waxflowers *Eriostemon* spp. (left) are also suited for short tongued bees.

Only a small number of the estimated 700 species of solitary bees are **long tongued.** One, the **leaf cutter bee,** confines its foraging to flowers with deep floral tubes such as Native Fuchsia, *Correa* spp. (right) Native Rosemary, *Westringia* sp and Native Heath *Epacris* spp. As they feed the pollen is dusted onto their bodies or hairy legs and is carried to the stigma of another flower. This process has recently been short circuited by the ubiquitous bumble bee which has learnt to thieve the nectar by drilling into the base of the Epacrid's corolla tube.

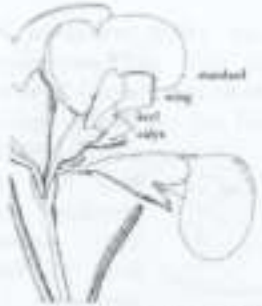
Of horticultural importance to commercial growers for pollinating glass house tomatoes is the bumble bee's **buzz pollination technique**. However it is also feasible that native buzz pollinators such as the large, hairy, metallic green Carpenter Bee and the smaller Blue Banded Bee could fulfil this role. These bees collect the pollen that is flung from vibrating flower anthers. They carry it to their nesting holes bored in the soft wood of Grass-trees' *Xanthorrhoea* flower shafts or old Banksia trunks. Here, an egg in each cell is provided with a feed of pollen and nectar porridge before it is closed off with wax and frass.

Species such as the golden Guinea Flower *Hibbertia riparia*, Kangaroo Apple *Solanum laciniatum*, Fringe lilies *Thysanotus* spp and Flax lilies *Dianella* spp, rely on buzz pollination but are often inundated by ineffective raiders such as honey bees. Interestingly, *Hibbertia* spp, (below) have no nectary, but instead rely on their pollen to attract those bees that are searching for high protein food to feed their larva.

Members of the *Goodeniaceae* family such as Native Primrose *Goodenia lanata*, and Spur Velleia *Velleia paradoxa* also have buzz-pollinated flowers, but they are designed differently to protect them from self pollinating. With the aid of a cup-like structure (indusium) they catch maturing pollen that is ready for dispersal. Once the pollen is dispersed or becomes non viable, the stigma will change to become receptive for pollination. Most *Goodeniaceae* (right) have the nectary **spur** hidden at the base of the petals which restricts nectar access to long tongued pollinators.

Bush peas are a bee's favourite

The Bush Peas (*Fabaceae*) with their functionally designed wing and keel structure (eg. Showy Bossiaea *Bossiaea cinerea*, Bitter Peas *Daviesia* sp. and Golden pea *Aotus ericoides*) along with the pea-like flowers of the Polygalaceae (e.g. Blue Love Creeper *Comesperma volubile*) have evolved an ingenious system suited for bee pollination: With the anther and stigma protected below the flexible lower keel petal, only the



landing of appropriately sized bees can part the petals and trip the spring loaded organs to tickle the bee's hairy belly.

Nectar Guides

Intriguing associations have evolved with native bees and other insects whose eye receptors are strongest in the far blue end of the UV spectrum. This allows flowers that appear white to mammals and birds to display distinctive UV colour patterns which act as nectar guides. Common UV patterns include light blues with darker maroon or violet streaks and patches. Coupled with the flower's ability to emit romantic pheromone attractants, the guides become magnets for bees and other insects. Numerous examples include the vivid set of spots and streaks on Donkey orchids *Diuris spp.* and Bush peas, the rosy red streaks on the petals of Native Pelagonium *Pelargonium australe* and the prominent purple veins on the floral throats of Native Flax *Linum marginale*.

The bee and orchid love story

Due to the lack of a nectary, the pollination of many native terrestrial orchids is contingent on their ability to mimic nectar-bearing flowers found within their vegetation communities. (The Tiger Orchid *Diuris sulphurea* and Leopard Orchid *D. pardalina* mimic numerous bush peas by replicating their structure, colours and timing of opening.) This, coupled with their ability to emit the female bee's pheromones, lures the male bee into attempting to mate with the labellum, which results in pollen transfer.

Similarly, blue-flowered species such as Sun Orchids *Thelymitra* spp. (right), small flowered Caladenias and Wax Lip Orchid *Glossodia* sp., have modified labella that are similar in size and shape to their petals.

This has enabled them, with their strong aromatic scents, to mimic blue flowered irises &/or lilies (e.g. blue stars, *Chamaescilla* (left)) and attract a similar suite of pollinating insects, mostly native bees.

Pollen Clogging

As insects rapidly learn to recognise the flowers that provide key food, the colour, shape and overall appearance of the flower are soon retained in their memory. Specialised native bees, like many other insects, indiscriminately visit flowers that fit within the same group or "guild" (eg blue lilies and sun orchids). Hence they often accumulate pollen on their bodies from several different species. With this mix of pollen types scattered over their bodies, foreign pollen can be inadvertently placed on the stigma of a flower preventing pollen of its own species reaching the stigma.

This **pollen clogging** is cunningly avoided by some highly evolved inter-relationships. The anthers position the pollen consistently on one point of the bee's hairy body, so that only the perfectly poised stigma receives a brushing of this pollen.

The many other Pollinators

During the peak flowering season, wildflowers are enveloped in clouds of pollinating insects such as flies, wasps, gnats, beetles, moths and butterflies, all busily leaving their footprints in the pollen. Part 2 of this article will explore other plant-insect interrelationships, and also cover the important role that birds and mammals contribute to pollination ecology.

Recommended Reading

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Stromatolites

By Helen Jones

One of the highlights of my recent trip to West Australia was a visit to Shark Bay and Hamelin Pool to see stromatolites (left). We watched bubbles rising surface-ward from these large mushroom-shaped structures half submerged in the extra salty sea water of the nearly enclosed Hamelin Pool; bubbles of oxygen which had made the evolution of higher life forms possible. Microbialites (stromatolites and thrombolites) were only known as fossils up to the 1950s. They are rock-like structures and their microbial mats are built by cyanobacteria and other microscopic organisms.

Cyanobacteria or blue greens are primitive single-celled organisms that have no cell nucleus and are related to bacteria. The microscopic cells form colonies or threadlike chains. Like plants they use light energy for photosynthesis.

Cyanobacteria were among the first forms of life and they dominated the earth for millions of years, producing carbohydrates from solar energy and releasing oxygen, thus helping to make our atmosphere.

Microbial communities build stromatolites in two ways:

1. Cyanobacteria trap fine sediment with a sticky film of mucous which they secrete. This binds the grains together with calcium carbonate extracted from the water in which they live. (Hamelin Bay stromatolites)

2. Cyanobacteria form their own framework from the calcium carbonate. Many of the stromatolites growing in lakes form this way.

Stromatolite means "layered rock" and thrombolite is derived from the root for thrombosis (clot). Thrombolites have a clotted interior while stromatolites are layered in cross section.

Stromatolites are not restricted to hyper saline waters. In fact they are recorded in an incredibly wide range of environments, some of which, like glacial lakes and volcanic springs, are extremely hostile. They are also found in normal marine situations such as the Bahamas. In W.A they are found in freshwater, brackish and saline lakes.

Lake Clifton is on the west coast about 100kms south of Perth. (see map below) It is less salty than the sea and has a thrombolite reef at its northern end which is 6 km long and 120m wide. These thrombolites are said to be modern day examples of the 600 million year old fossils found on ancient shorelines in the Amadeus Basin in the Northern Territory.

The structures we saw at Lake Clifton were quite different from those at Hamelin Pool, looking like nothing else but large submarine cowpats.

At the Hamelin Pool we spent a long time silently watching oxygen bubbles rise, very conscious of own breathing and mesmerized by the simplicity of this part of our life support system – the waste product of a bug.

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Dawn at Black Sugarloaf

by Sarah Lloyd

"Until we better understand diel patterns in signalling, such as the dawn chorus, we will not fully understand why birds sing".
(Staicer et al 1996).

"Night owls" may shudder at the thought of a project that involves getting up with the birds, but there's a particular beauty in the pre-dawn day. As I listen to the last nocturnal hootings of the resident owls and watch as the Southern Cross and the waning moon fade with the increasing glow on the eastern horizon, and the rising sun colours wispy clouds pink then brilliant red, I think about how fortunate I am to live in a place where I can step outside my front door and listen to the dawn chorus; surely one of nature's wonders and one that has been very little studied, not just in Australia, but anywhere.

I have based my project on a study undertaken by Allen Keast in 1985 called "Springtime song, Periodicity and Sequencing, a comparison of a southern forest and Northern Woodland Bird Community". Keast documented a week of dawn singing at the beginning of the breeding season at a eucalypt forest on the Hawkesbury River, NSW and a eucalypt woodland on the south Alligator River, NT, but restricted his research to sunny, windless days in spring. In the northern hemisphere, however, studies have shown that weather conditions, especially wind, rain and light intensity, influence the starting times and intensity of singing so I was determined to ascertain the impact of these conditions and started monitoring the dawn singing regardless of the weather.

I soon found that prevailing weather conditions did affect the starting times of each species' songs as well as the audible range. On still misty mornings I hear roosters crowing, magpies carolling and kookaburras laughing from the cleared farmland about a kilometre away while the audible range on windy days is reduced to approximately 80 meters. This encompasses the dense habitats where most of the resident passerines, the main focus of my study, roost for the night and remain to greet the day with song.

The project involves listening to and documenting the simultaneous singing of the resident birds (often referred to as the dawn chorus) once, twice and sometimes three times a week. The singing starts from between 30 to 60 minutes before sunrise, depending on the time of year, and continues until there is a noticeable lull, usually when the sun comes up. I make a minute by minute note of what bird species are singing, their location, and the time of their first and subsequent songs. I later transfer this information onto a daily excel data sheet. For the many forest birds with extensive vocal repertoires I also note the song type used at dawn. For example, prior to and during the breeding season the Yellow-throated Honeyeater would start the day with its distinctive three note song, occasionally followed by its slow trill and/or "tonk" calls. By the time breeding had ceased in mid-January, I heard only its warble at dawn.

Yellow-throated Honeyeater

Here, as in the rest of the world, birds usually sing in a set daily sequence. When I started the project in late August the beautiful fluty song of the Bassian Thrush heralded the dawn at 6:05, 30 minutes before sunrise, and five minutes passed before I heard the ravens' baritone "kaarr". By 6:15 Tasmanian Scrubwrens had joined the refrain followed by the Yellow-throated Honeyeater, the strident song of the Strong-billed Honeyeater (a sound it only makes at

Bassian Thrush

Strong-billed Honeyeater

dawn) then the Eastern Spinebill and Pink Robin. Not only did this sequence remain almost constant for the first few weeks, but if I documented the dawn chorus on consecutive days, species would start singing at exactly the same minute each morning.

More surprises were in store: although I have lived at Black Sugarloaf for 16 years and was confident that I could identify every species by their calls, by the third morning I'd heard not one but two mystery sounds. One, a haunting owlish howl, I ascribed to the Southern Boobook which would be hooting softly as I started each day's listening. That the eerie howl was interspersed with soft boobook-like phrases seemed good reason for this attribution but until I'd actually seen the bird emit the song I wouldn't be convinced.

Fortunately (or unfortunately depending on how tired I'm feeling), even on those mornings when I decide to stay in bed I can hear the birds from the bedroom. Early one morning I woke to the sound of the mystery call so I leapt out of bed, put on my boots and ventured to the gully, the early morning gloom just enough to light my way. High in a tree the aforementioned sound emanated from the distinctive silhouette of a Grey Currawong and immediately confirmed the misidentification. The singer of the second mystery sound, best described as a mournful warble, remained unidentified for several months. I have now confirmed that it is another crepuscular call of the diurnally "clinking" currawong adding yet another song type to the remarkably diverse repertoire of this bird.

Grey Currawong

During the third week of September I witnessed the passage over several mornings of numerous small flocks of migrating Silvereyes. While most continued on their southerly path, close to forty returned to their breeding territories in the dense vegetation in nearby gullies and I must admit to feeling a little ambivalent about their return. Silvereyes are accomplished mimics and for several mornings after first arriving one would sing loudly from a nearby wattle tree. Perfect renditions of the songs of Golden Whistlers, Grey Shrike-thrushes and Green Rosellas emanated from this little bird. When heard during the day, the imitative songs of a solitary singing silvereye alternate with its distinctive warbling and are obviously coming from one source. But at dawn, when many different species are singing continuously and simultaneously, the imitations are more difficult to differentiate. The loud song of the resident Blackbird, another skilled mimic, only added to the cacophony of confusion.

Silvereye

The propensity of birds to sing more intensively at dawn than during the rest of the day has been the subject of much theorizing. There are probably many factors contributing to this phenomenon including environmental conditions such as reduced air turbulence that may facilitate the transmission of sound and social functions including mate attraction and territorial advertising. In addition, intensive dawn singing may serve a function intrinsic to the singer's internal state.

Light levels affect the beginning and

ending of a bird's day and thus influence the time they start singing. As the summer solstice approached birds began singing correspondingly earlier. In late August when I began the project Grey Fantails, though present in the area, were silent at dawn, by September they were making a minor contribution and by October 17th they had taken over the lead, starting at 4:29, (Eastern Standard Time) 52 minutes before sunrise and well before most other birds. By December 9th one bird in the eastern gully introduced the singing at 3:30 and four other birds immediately responded. Despite the presence of fledglings, which indicated that breeding had ceased, this pattern persisted until January 19th, but by the 22nd they were all but silent again.


Grey Fantail

Why the Grey Fantails' contribution to the dawn singing has changed both in intensity and timing, and other species have at times dominated and later dropped out of the dawn chorus may be related to their internal states. Not only do increasing levels of the sex hormone testosterone (triggered by increasing day length and light intensity) stimulate singing, but in many species the production of testosterone and the growth of their reproductive organs is stimulated by the songs of both conspecific birds and a bird's own vocalisation. In many species singing peaks at the time when females are fertile and laying eggs.

With the approach of autumn and the cessation of the mating season, birds are spending more time foraging than singing, intent on building up fat reserves to prepare for their migration flights or in readiness for winter. And although birds are occasionally vocalising during the day, many are silent at dawn and those that are still singing are doing so softly and less frequently.

Like any such study many questions have arisen and I can envisage the project continuing for some years, if for no other reason than to experience the tranquillity of the still early mornings and to hear and occasionally glimpse the elusive Owlet Nightjar.


Owlet Nightjar

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Sunrise times at Black Sugarloaf (Lat 41° 23' Long 146° 48') were obtained from the website www.ga.gov.au/geodesy/astro/**sunrise**

Above: One of the first attempts to record birdsong in musical notation. (After Kircher 1650) From Armstrong (1963)

<u>Illustrations in the bulletin are from:</u>

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