ANTBED

Issue 6 October 1995

An occasional newsletter about the Golden-shouldered Parrot produced by Gabriel Crowley and Stephen Garnett.

This newsletter is for those following the research on the Golden-shouldered Parrot since it began in August 1992. Having finished the intensive work, this issue summarizes most of our findings and describes how conservation management will proceed. Our conclusions may be modified as analysis continues but expect most to remain unchanged.

Golden-shouldered Parrots live in open grassy woodlands on central Cape York Peninsula. Over the last 150 years they have progressively disappeared from most of their former habitat, and their decline is continuing.

Work on the Golden-shouldered Parrot over the last three years has been undertaken with several aims.

Initially we needed to confirm that the parrots were indeed scarce and not just hard to find. Before we could establish any threats to the parrot, we needed to know enough about its biology to establish its breeding patterns, its food requirements, its movements and its main predators. We needed to look for signs of disease, changes in habitat and whether trapping was a problem.

From reading old diaries we found that the parrot's decline coincided with that of many other species. We therefore aimed to find management practices that would not only support the Golden-shouldered Parrot, but restore the wide range of species dependent on the grassy woodlands of the Peninsula.

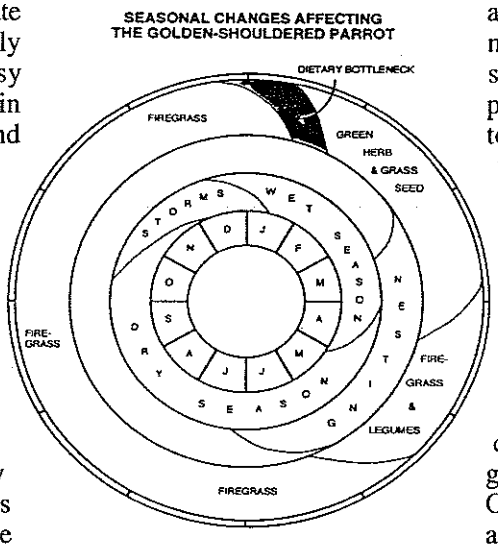
The parrot's core populations are in areas grazed for cattle. So we needed to understand cattle behaviour and management and how these affected the parrot. On the whole we have tried to make recommendations that will benefit both cattle and parrots so that they can be implemented as part of existing management regimes.

At the end of three years, we believe we have collected enough information to make such recommendations, and as we write, the first management plans are being put in place. From here the emphasis will be on management and monitoring. If this is successful, the decline should be reversed and the birds should return to areas adjacent to existing populations. Eventually we hope they can reoccupy much of their former range.

Life cycle of the Golden-shouldered Parrot

Nest searching, to begin the story, starts late in the wet season, the parrots, scratching away at termite mounds and chasing other birds from their territories. When food supplies become reliable, they rapidly excavate a chamber inside a mound, usually situated on the edge of a grassy drainage flat. The first eggs are laid in March, a female usually laying and incubating 5 or 6 eggs. Most eggs hatch; most hatchlings, raised by both parents on a diet that includes green legume seed, fledge. Peak egg laying occurs in late March and the last young fly between June and early August depending on the length of the wet season. For a few months the young remain near their nests. Then they start to range more extensively. Only a small proportion of the fledglings are seen again after they leave the nest.

During the dry season juveniles birds gather into flocks with unmated males at traditional sites near water, feeding on the abundant fallen grass seed. Adult pairs stay near their old nest sites. With the first storms the flocks move to equally traditional areas around the nests of Black-faced Woodswallows. The parrots feed near the woodswallows until these disperse as the real wet season sets in. The parrots themselves then disperse, seeking food which is now in short supply. Many young birds probably die after dispersing, particularly in years when heavy rains at the start of the wet season cause most seed to germinate simultaneously. Dispersal of both parrots and woodswallows appears to be delayed in areas burnt early in the wet season.



As the new season's food becomes available, pairs choose a termite mound in which to nest, birds with established territories returning to within a few kilometres of their previous nest site.

Such is the parrot's annual cycle but this simple description gives few clues to the species' rarity. Only by more detailed study of each aspect of the cycle has it been possible to develop a theory for why the Golden-shouldered Parrot has become so scarce and what can be done about it.

Distribution

Analysis of the climatic data using the BIOCLIM program suggests that most of Cape York Peninsula is likely to be suitable for Golden-shouldered Parrots. And last century, when the birds were first collected for science between Normanton and Croydon, they may indeed have had such a broad distribution.

Recent records of the species, however, are far fewer. When Mark Weaver searched for the birds in the late 1970s he found nests only in the current nesting area near Musgrave. More recently Lana Little and Danny Chew found another population further south. Apart from these we have been able to confirm their presence at no other site. They have almost certainly gone from Silver Plains, from north of Coen and from Violetvale - all sites where there was a high density of breeding birds in the 1920s. They are also very scarce, if not extinct, on several properties between Laura and the Morehead River from which there were reliable records in the 1980s.

The core populations have always been associated with hilly areas such as Coen, the Silver Plains escarpment and the Great Dividing Range near Musgrave - places where the parrots are sure to find food in the wet season regardless of burning patterns. Each wet season many of the young birds disperse away from these areas in search of food. We think many of the sightings reported from outside the core distribution are likely to be these itinerant birds. Sometimes the itinerants may survive long enough to be able to breed. However unless the country is well drained and properly burnt, we think that few survive for more than a couple of years.

Other substantial breeding populations may indeed exist. However we have always felt it more important to discover what is happening to the populations we know than to search for populations we may never find. Processes threatening the parrots we have studied are also likely to be affecting those we have missed. So we hope that the management actions we are proposing will be implemented widely enough to benefit all surviving populations, regardless of our knowledge of their existence.

Population trends

Often one of the hardest pieces of evidence to obtain on a threatened species is whether it is in fact declining. It has taken us four nesting seasons. Sadly each year we have become more confident that the extent of nesting habitat used by the parrots each year is still declining. Every year along the north-east edge of the species' range we find fewer nests over a smaller area. One section of this area, slightly separate from our main study area, had its last nests and signs of birds in 1993. In other areas chambers were built, but no eggs laid, or else there were simply fewer nests. Each nesting season we were in the field we hoped the trend would be reversed, but each year we were disappointed. Each year we would blame the decline on the vagaries of the wet season but each year the wet season was different and none turned the trend around. Fortunately, away from the fringes of the distribution, there is still as high a nesting density as in the first year we searched.

Population size

Knowledge of population size is essential if the status of a species is to be worked out, but desperately difficult for a cryptic green bird in a huge green landscape. Nevertheless we have made some estimates.

The number of parrots is lowest at the start of the breeding season when, apart from the breeding pairs, only a few unattached young males remain. At that time of year we believe that a reasonable working maximum is about 2,300 individuals (including 100 bachelors) or 1100 pairs. As a minimum, based on what we have seen with our own two binoculars, and no extrapolation, we can confirm only about 100 pairs.

During the non-breeding season there are large numbers of young of the year in flocks. In the 215 km^2 of our main study area we know of at least 150 young birds at the end of 1994. In total, this translates into a non-breeding population of 3,500-5,000 individuals.

We must stress that these figures are provisional subject to the results of more survey work planned over the next few years.

Trapping

In Peter Carey's book *Illywhacker*, the last Golden-shouldered Parrot dies crushed in the groin of a smuggler as he tries to seduce the woman in the adjacent airline seat. Fortunately this scenario is unlikely. Undoubtedly trappers took many birds from the Musgrave area in the 1960s and early 1970s, and may have been partly responsible for the bird's disappearance from Violetvale Station. It is also possible that trapping continues on a small scale. However there are many areas from which the parrot has disappeared where few birds were ever trapped. Also, though the parrots have had the opportunity in the last 20 years, they have not reoccupied Violetvale. We must therefore conclude that trapping is not currently a major threat to the species.

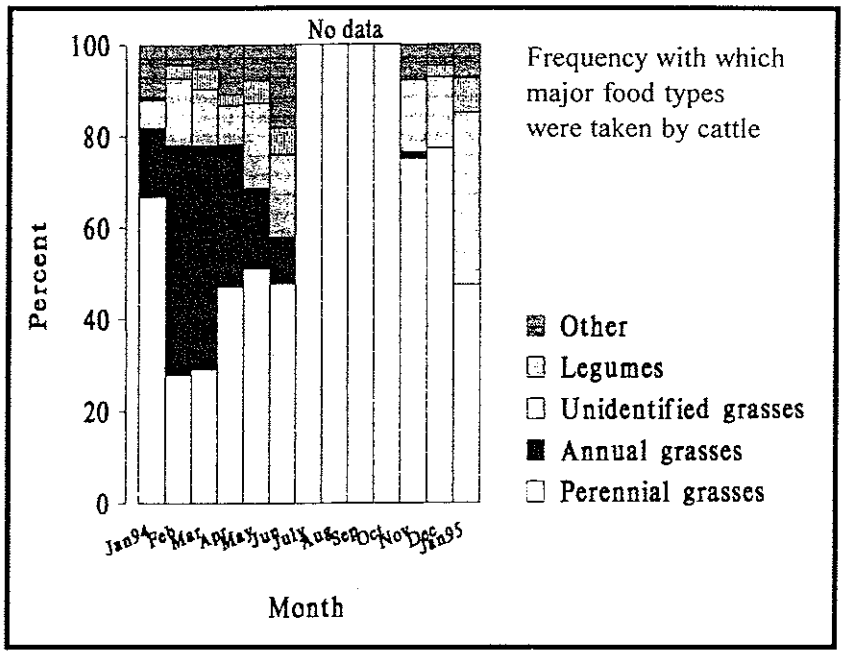
Golden-shouldered Parrots are now reasonably well established in captivity both in zoos and in private collections, both in Australia and overseas. And, so far, fears that this captive population has been contaminated by genes from the Hooded Parrot have not been borne out by genetic studies. There is thus neither need nor great incentive to take birds from the wild. Trapping is certainly undesirable but the main emphasis for recovery of the parrot must be habitat management.

Cattle Grazing

As both Golden-shouldered Parrots and cattle depend on grasses for food, it was important to establish whether the feeding patterns of cattle threatened the bird's food requirements. As there was nothing published on the grazing patterns of cattle on the Peninsula we spent a year stalking them to see what they were eating (no easy task when they associate people on foot with a branding iron on the rump!). We also revisited sites through the area that had been surveyed by CSIRO in the 1960s to assess grass composition.

The mainstay of cattle grazing is the perennial grasses, especially cockatoo grass *Alloteropsis semialata*, plume sorghum *Sorghum plumosum* and giant spear grass *Heteropogon contortus*. But there were differences in the times of year these were selected. Plume sorghum was taken most heavily after flowering and into the early wet season until the biomass of other grasses had a chance to build up. Cockatoo grass was mostly eaten through the wet season, while actively growing.

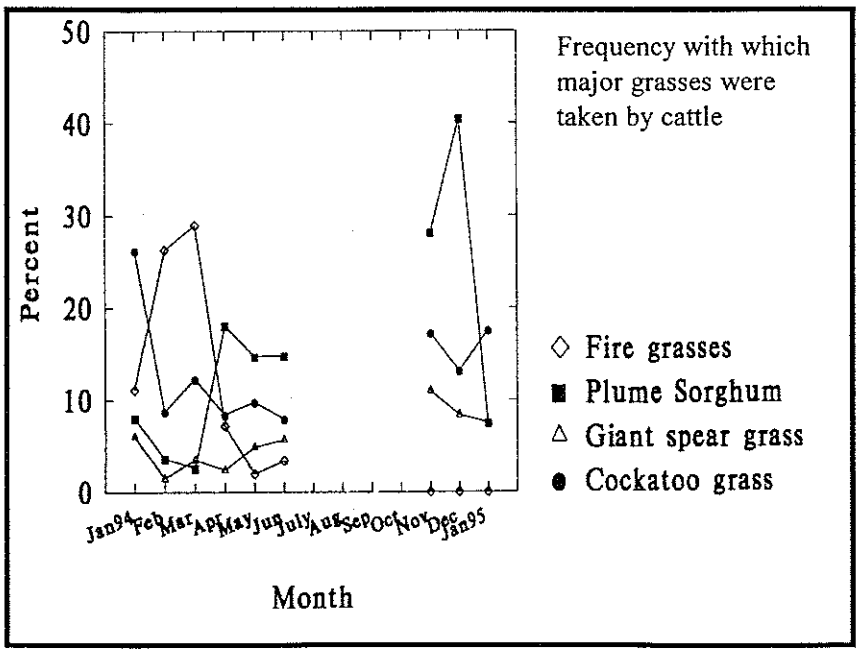
The pressure on perennial grasses was reduced through February to April when annual grasses were green. Legumes, herbs and browse were only a small component of the diet throughout the year.



Perennial grasses are the most vulnerable to cattle grazing, as overgrazing can kill tussocks, and young plants rarely establish from seeds. Species grazed heavily during the growing season are most at risk. Thus cockatoo grass is the grass most likely to be adversely affected. We therefore monitored the growth and seeding of cockatoo grass in areas where it was grazed and adjacent areas from which we had fenced cattle out. There were signs that plants of cockatoo grass were being lost under grazing, and grazed plants produced both fewer flowering spikes and fewer seeds per spike - the spikes often being eaten by cattle before they could produce seed. However there was no evidence of a decline at sites first surveyed by CSIRO in the 1960s, and healthy stands of cockatoo grass are found through most of the study area. Nevertheless, this species is likely to suffer where heavier grazing pressures are imposed.

Though giant spear grass was taken less frequently than plume sorghum or cockatoo grass, it appears to be selected by the cattle. The resurveys showed it to have declined markedly in abundance since the 1960s. Our observations suggest that the fragility of the shallow-rooted tussocks make it vulnerable to even moderate cattle grazing pressure. By contrast, Plume Sorghum had become more common since the 1960s, in many cases replacing Giant Spear Grass.

Parrots eat the cockatoo grass and plume sorghum but have difficulty with the larger-seeded giant spear grass. Therefore, under moderate grazing pressure, cattle pose no threat to the food sources of the Golden-shouldered Parrot.



Termite Mounds

Three sorts of termite mound occur in the parrots' habitat - bulbous, magnetic and conical. Bulbous mounds, which are regularly used by the wet-season-nesting Hooded Parrots, are exuberantly extended by their owners *Nasutitermes triodiae* both before and after the wet season, including the time Golden-shouldered Parrots are excavating. This pattern of building probably assures their mounds are safe from parrots, although we did find one exceptionally late Golden-shouldered Parrot nest in a bulbous mound.

Magnetic mounds are rather like extravagantly wide headstones, with their broader sides facing east and west. Young nesting parrots occasionally dig in the sides of magnetic mounds, soon emerging at the other side. A small proportion of pairs (2.8%) nest in them successfully, entering from one of the narrow ends and digging long tunnels to where the mounds are thicker, but the walls of such nests are perilously thin.

Most nests (96.7%) are built in conical mounds, also called witch's hats. Conical mounds are usually found in clusters in areas that get saturated in the wet season and dry out in the dry season. They grow extraordinarily slowly - on average between one and two centimetres a year (one group we measured went slowly backwards over a two year period!) and even the most vigorous take 30 years or more before they are big enough for a parrot nest. Nevertheless they are abundant over much of Cape York Peninsula and, over the period we monitored them, almost all survived. Pigs and cattle may knock down a few, but pose no real threat to mound abundance.

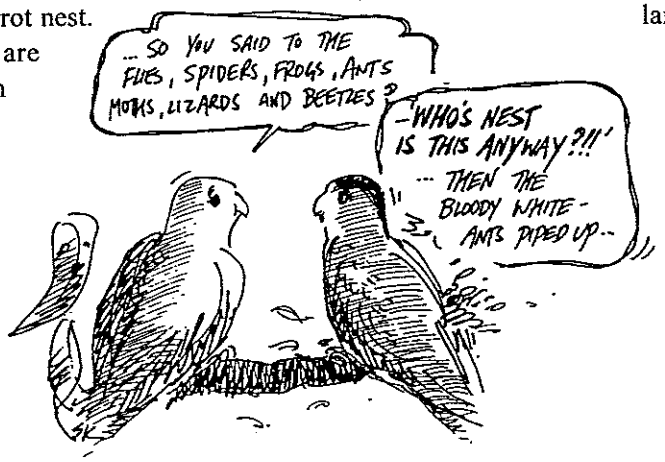
Nests

All the nests we found had been excavated in termite mounds. Contrary to popular belief, the nest entrances can face any direction, though only 16% faced the eastern quadrant. We think this is because most digging is done in the morning when the sunshine bakes the eastern side of the mound. The nest chamber is usually scraped out to within a few centimetres of the mound wall, with light sometimes peeping in through the thinnest sections. Most chambers (92%) are freshly dug but 8% of nests are used again the following year. Of the new chambers 3% are dug in mounds that had been used for nesting previously, though usually at a different height and from a different direction. Active nests can be as close as 100 m apart but such close nests are always separated by a dense barrier of trees. In more open country they are usually separated by a much greater distance.

Other Nest Fauna

The parrots' nest holes are inviting to a whole host of other animals. The most famous of these is a moth, *Trisyntopa scatophaga*, which lays its eggs at the same time as the parrot so that its larvae can eat the parrot's faeces and the remains of any parrots that die in the nest. The moths do not appear to use the nests of any other bird in the region and so are probably as endangered as the parrot. It used to be thought that the parrots benefited from the moth by having a clean nest but the few nests we found that lacked moth larvae have produced young without difficulty, and where the moths pupate early enough, their pupae, built at the nest entrance can prevent the parrots fledging. The relationship is probably better described as parasitic rather than symbiotic.

Other animals that use active parrot nests include a blowfly, whose maggots flourish when a chick dies but, like the moth, seem able to survive on faeces alone. There were also two nests in which the young parrots shared their chambers with large green frogs. The nests made magnificent sounding chambers, though the young parrots may have been somewhat deaf by the time they fledged. After the parrots have gone, the chambers are occupied by crickets, spiders (including redbacks) and casemoth larvae, though most nests are soon filled in by the termites.

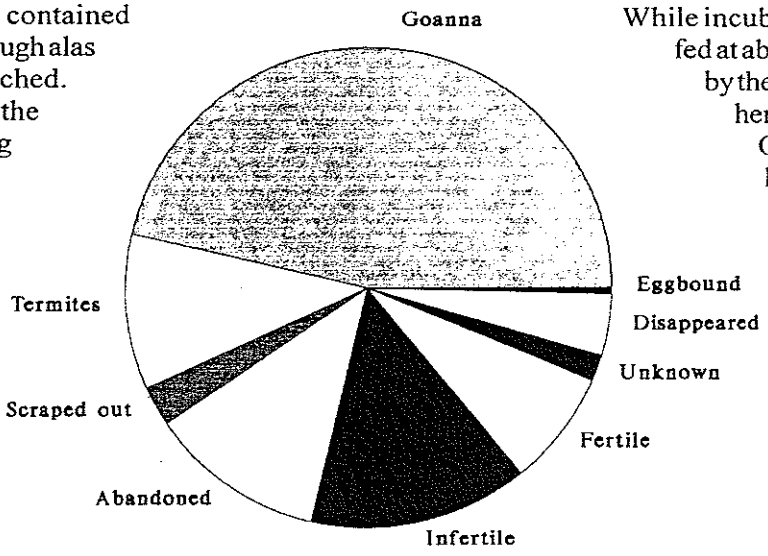


Eggs

Like those of other parrots, Golden-shouldered Parrot eggs are white and almost spherical. The average clutch size is 5.7, clutches tending to be smaller at either end of the breeding season and highest in the middle when a few nests contained 7 eggs. There was also one nest that contained an extraordinary 13 though alas only one of them hatched. We rather suspect that the male, a strange looking bird with gold feathers in the crown as well as over the beak, had both fertility and fidelity problems.

Of the 695 eggs we found in 148 nests, 68% hatched. All the eggs hatched in 65 clutches. In 41 clutches all failed, mostly as a result of predation (see *Predation*). The remaining eggs failed for a variety of reasons. Apart from infertility some eggs were scraped out of the nest by their own mother or another female wanting to raise her own brood in the same nest and some were orphaned by the loss of a parent. The first eggs of a clutch were sometimes glued to the floor of the nest chamber by the resident termites which became more active during rainy weather.

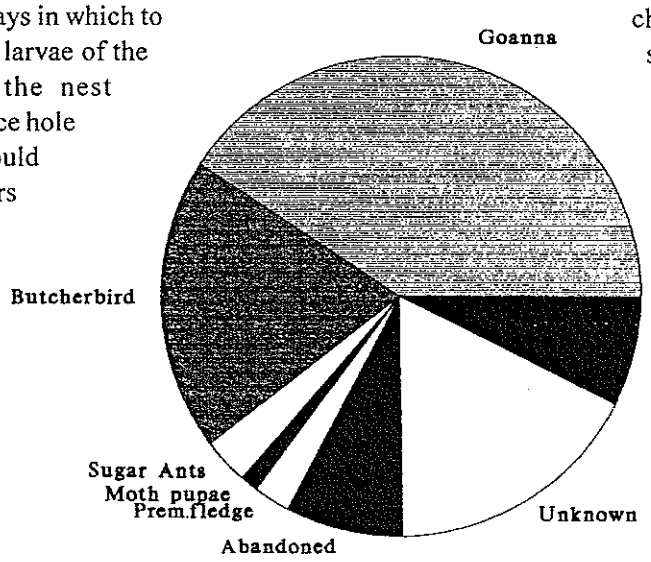
Eggs are laid two days apart and hatch after about three weeks. While incubating, the female is fed at about hourly intervals by the male who first calls her away from the nest. Once he has fed her, he flies to the nest mound to call her back in. It is not surprising she is sometimes reluctant to return. Incubation is a dangerous activity - at four nests we found a predator had eaten both the female and her eggs.



The fate of failed eggs

Nestlings

With oversized bald heads and pimply pot bellies, few chicks are uglier than those of the Golden-shouldered Parrot. Unfortunately an unappetising appearance does not discourage predators which account for 60% of nestling losses (see *Predation*). However nestlings find several interesting ways in which to die. At two nests the larvae of the moth that shares the nest pupated in the entrance hole before the young could fledge. At two others automatic video cameras saw chicks leave the nest before they could fly and are unlikely to have survived. In each case there were good reasons for the early departure. At one nest the tunnel had been invaded by a crowd of sugar ants. In another, nest mites swarmed over everything that touched the mound (including any human beard that came too close!) and the parrots were always fidgeting. The unlucky corpse we did recover was covered in mites when we found it.



The reasons for nestling death

Nestlings are fed five to seven times a day by their parents and take about five weeks to reach fledging size . Their diet consists primarily of grass seed but characteristically also contains the seed of legumes. The bright green legume seed is clearly visible through the bulging wall of the chicks' crops. Absence of legume seed from the crops of free-flying birds later in the year suggests availability of legumes may determine the length of the breeding season.

If one parent dies the remaining adult takes over all the feeding and can still rear five chicks. If the female dies, the male works alone. A bereaved female, however, is remated within days, though the new male does not feed the chicks.

Predation

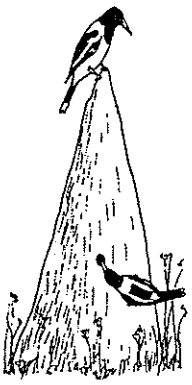
Nest failure rate is no greater for Golden-shouldered Parrots than it is for more secure tropical birds. Determining the cause of failure, however, has helped us work out the major threats to the species.

Butcherbirds

The other major predators at nests appear to be Pied and, to a lesser extent, Black-backed Butcherbirds. As young birds approach fledging they come to the nest entrance to be fed or simply to look out at the world. Four nests at which we had video cameras were visited by butcherbirds at fledging time. In one nest into which a butcherbird had thrust its beak we found a dead chick with a cracked skull. At another nest a chick triggered the camera as it fledged, and immediately there were butcherbirds on and around the nest, appearing to pounce on something on the ground just out of the camera's vision. At eleven nests we found dead chicks with cracked skulls.

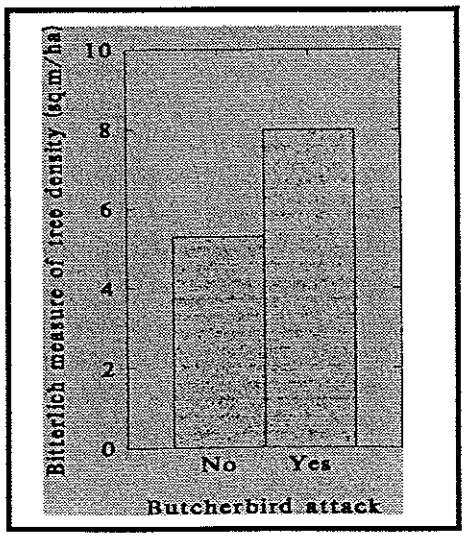
The evidence is circumstantial but we think sufficiently strong to say that butcherbirds are a problem for the young parrots immediately before they fledge and, probably, in the period just after fledging.

But, as with goannas, we think predation of young at the nest is of little consequence for survival of the species. Of greater concern is the loss of adult parrots during the breeding season. At 12% of 135 nests there were the remains of adults - bundles of tail or wing feathers - below the nest mound. Each of these nests subsequently failed or one of the parents disappeared. At 9% of 51 nests one of the adults failed to return to the nest, though there was no evidence of mortality at the nest itself. Although such deaths could be attributed to a number of predators, butcherbirds again seem most likely. At one nest a Pied Butcherbird pounced on a nest entrance moments after the male parrot, which had been perching there feeding young, suddenly took flight. Away from the nest Pied Butcherbirds were the only predators seen attacking parrots during the breeding season. On thirteen occasions between January and May Pied Butcherbirds were seen to pounce at parrots as they fed on the ground, appearing to prefer parrots even when there were other species, such as doves or finches, in the feeding flock. None of the attacks were successful, possibly because we were there watching, but all were close enough to be sure of the butcherbirds' intentions.



Butcherbird attacks were most likely in areas of dense vegetation. We also know from general bird surveys that there are high densities of butcherbirds in the major habitats used by the parrots for feeding. Vulnerability is likely to be lowest during the dry season, as the parrots are only feeding for a short time each day. In the early wet season, too, parrots are protected by Black-faced Woodswallows (see Woodswallows). After the woodswallows disperse, however, and food becomes harder to find, feeding times increase, as does exposure to predators. Vulnerability is likely to be greatest before and during the breeding season when the parrots are feeding for most of the day, and in the densest vegetation.

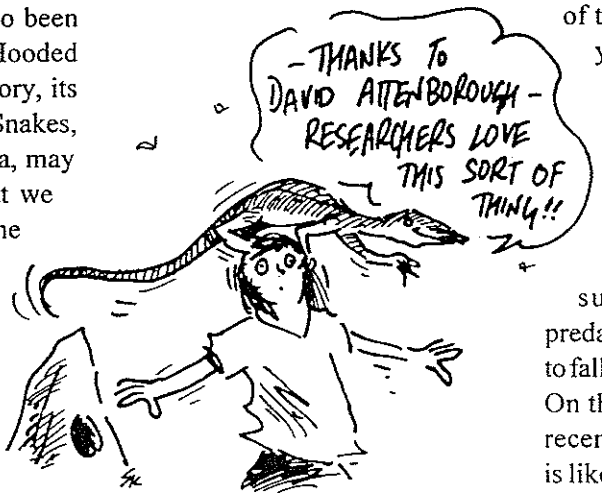
We beleive the loss of adults to be the major cause of the species' decline, with Pied Butcherbirds the major predators.



Goannas

Goannas appear to be the main predators of nest contents. One automatic video camera we set up at the nests recorded a tree goanna consuming a chick, and Sue all but caught another among the bloody remains of chicks in a nest - she had it trapped but it escaped to the top of her head before leaping away out of reach. A tree goanna has also been caught inside the nest of a Hooded Parrot in the Northern Territory, its stomach full of parrot eggs. Snakes, though rarely seen in the area, may also take eggs or young, but we have no evidence of this. The contents of nests vanished in a manner consistent with goanna or snake predation from 28% of nests accounting for 44% of all losses of eggs or young. Goanna or snake attacks were not restricted to any vegetation types, but nests in tall mounds were most vulnerable, particularly if the nests themselves were near the ground. The safest nests, it would appear, are high up in low mounds, which makes nest site selection difficult because the mounds taper towards the top.

Severe though it is, goanna predation is unlikely to have caused the decline of the parrots.

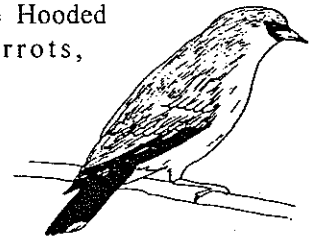


At about the time parrots disappeared from Violetvale station, cane toads arrived. As Chris Roberts has noticed over the last two years at the tip of the Peninsula, the arrival of big toads saw the disappearance of the larger sand goannas. When carpets of toadlets appeared the following year, the small tree goannas disappeared. It takes about 20 years for goannas to adapt to the toads and for their numbers to recover. Alas the parrots do not seem to have been able to take advantage of such a respite from goanna predation, as their numbers continued to fall throughout the 1970s and 1980s. On the other hand it means that the recent recovery of goanna numbers is likely to be of little consequence to the parrots.

The Parrots and the Woodswallows

Black-faced Woodswallows are innocuous birds. Mostly grey with a black mask and white belly and tail tip, woodswallows are usually seen in dead trees from which they sally out on triangular wings to catch passing insects. That they should have an important role in the conservation of an endangered parrot seems most improbable.

We first became aware of their importance when we were studying Hooded Parrots in the Northern Territory. There just about every Hooded Parrot we found was feeding beneath a flock of woodswallows. We then studied the association of Black-faced Woodswallows with Golden-shouldered Parrots and found it was closest during the late dry season and early wet season. Each year the woodswallows nest in the same patches of open woodland scattered at regular intervals about 3 km apart. After a while we could predict where we would find the next flock from the positions of the ones we knew about. And near most of them we found flocks of young Golden-shouldered Parrots, as well as finches and doves, trillers and sittellas, Willie Wagtails and Leaden Flycatchers. In the Northern Territory, we had also found treecreepers with the Hooded Parrots,



but these have already disappeared from much of the Peninsula, just as woodswallows and Golden-shouldered parrots have disappeared from round Coen and Silver Plains.

The benefit to the parrots becomes apparent when predators approach. Any butcherbird or kookaburra that comes near the woodswallows' nest is chivvied and chased until it changes its mind. The woodswallows may in return pick up insects disturbed by the feeding parrots, as they are often on the ground amongst them, but of this we could not be certain.

When the woodswallows finish breeding and their young are feeding themselves with reasonable proficiency they become more mobile. Mobility doesn't suit most seed-eaters, who tend to stay on a good patch of seed once they find it, but throughout the breeding season a few parrots can usually be found near woodswallows, particularly young males with no responsibilities to female or nest.

In 1994, the first year we studied the woodswallows, the country had been storm burnt and the breeding season was longer than in the second year, in which the country had remained unburnt. In both years the parrots remained with the woodswallows only as long as the latter were near nests.

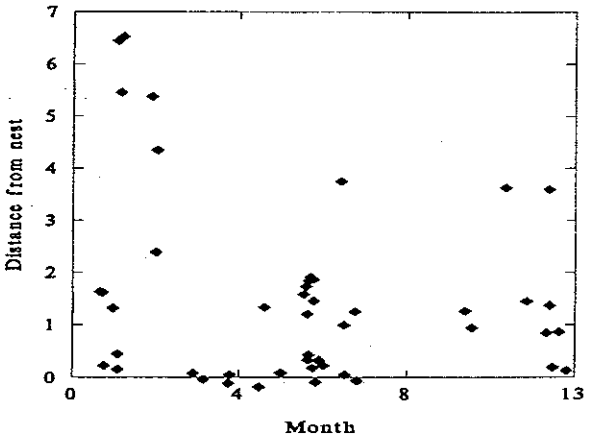
Movements

In Antbed 5 we described how very difficult it is to see the colour bands on the parrots' tiny legs. Nevertheless we managed to work out some patterns of movement from band resightings.

In the first two months after fledging the chicks gather in small nursery flocks within a few kilometres of their nest and are fed by their parents. Mostly they sit silently in the foliage, but for half an hour or so each day they go crazy, careering wildly in and out of the trees as they learn to avoid predators. Unless one is nearby in that brief period young Golden-shouldered Parrots are just about unfindable.

When the young parrots reached independence they dispersed further afield. Some stayed near their natal nest, others went to the limits of our study area and still others must have gone beyond it. One young female we saw 11 km from her nursery flock, and at the limits of the study area. The same afternoon she appeared 6 km away in another flock in which we were able to find her almost daily for another 5 months. If some of our banded young went beyond our ken others arrived. We suspect that many of the unbanded young birds we saw late in the year must have come from areas where we hadn't searched for nests.

By September the young birds had settled in one of several dry season flocks. These flocks form in the same place each year and consist of the young of the year plus any unmated young males from the previous year. Most of the older males are almost fully coloured and attain full adult plumage by the end of the dry season. Usually they have also picked up a young female. Only 3 out of 10 banded first year females were still unmated at the end of the dry season whereas 16 out of the 17 young males we knew personally had still found no partner. At the end of the dry most young birds move to the breeding site of a flock of Black-faced Woodswallows. These sites occur at regular intervals through the landscape in areas where there is plenty of early wet season food. The parrots stay with the woodswallows for several months until the woodswallows disperse and the food starts to run out.



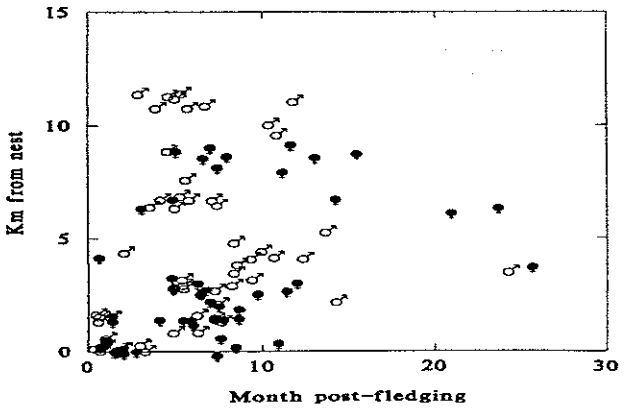
Adult Golden-shouldered Parrots are furthest from the nest in the wet season

There is then a second period of dispersal which we suspect takes many young birds well beyond our study area, into the low flat country to the east and west. Here we think most die, unable to find food, particularly if there have been heavy falls at the start of the wet season. Certainly after January young birds from most flocks were never seen again. The exceptions came from two flocks out of five we were following closely. Of these all the young banded males seen the next breeding season were also seen during the intervening wet season on gravelly hills in the middle of our study area, some having moved there from 7 km away. By contrast none of the young females were seen in this habitat but, by this stage, most females were mated to older males and would have been restricted in their movements.

Movements of adults are even more difficult to follow than those of immatures. After the nursery flocks disperse, adults appear to stay in the vicinity of their nest sites, only occasionally feeding on the fringes of dry season flocks of immatures. When the first storms arrive the adults, stimulated by the rain, display on potential nesting mounds less than a kilometre from either past or future nest sites. As food gets short, however, adults also spend most of the day finding food, also travelling long distances when necessary. Several pairs we saw on the gravel slopes up to 7 km from where they later nested. However we suspect they leave their nesting area for as short a period as possible.

Site fidelity and the lack of reports of nesting in areas further away suggest that dispersal is rarely successful for the Golden-shouldered Parrot, though gives hope that the birds will recolonise by themselves when conditions are right for them.

After the first few months young Golden-shouldered Parrots spread out rapidly.

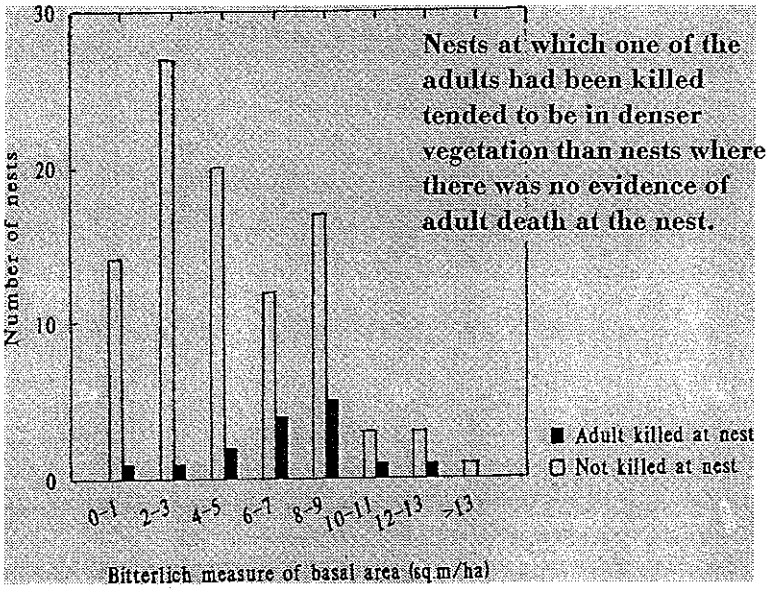


Habitat use

Although Artemis has been known as the stronghold of the Golden-shouldered Parrot for many years, little was known about which bits of the landscape they used. Similarly, conical termite mounds are abundant on the Peninsula, but most sites lack parrots. We needed to find out just which parts of the country are suitable, and whether apparently suitable country in fact differs from the areas actually used, or whether there are just too few parrots to take advantage of all suitable sites.

Nesting Habitat

To find out whether nesting habitat was scarce we set up 80 sites randomly across the area and measured their vegetation and physical characteristics in 40 x 40 m plots. Then we compared these to all 53 sites where we had found nesting in 1993 and 1994. We found that about one third of the random sites were similar to actual nest sites, indicating no lack of nesting sites. Sites that were unsuitable included rocky hills with long grass, sand-ridges with few termites mounds and the dense woodland that occurs at the edges of drainage flats, even though this sometimes contains suitable mounds. These results nevertheless suggest that there are many potential nesting sites which remain unoccupied, possibly because there are too few birds to occupy them. However, invasion by broad-leaved ti-tree appears to render many flats unsuitable for nesting long before the flat is entirely occluded.

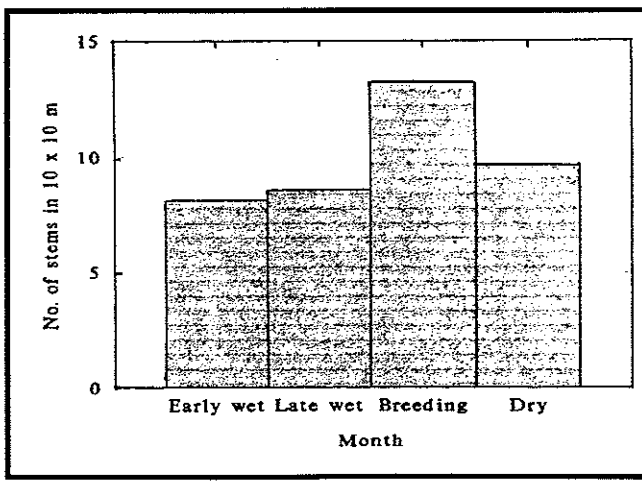


Nests at which one of the adults had been killed tended to be in denser vegetation than nests where there was no evidence of adult death at the nest.

Feeding Habitat

Feeding sites were found in almost all the different habitat types in the region but their popularity varied through the year. Sandy ridges under eucalypts was favoured through most of the dry season. At the onset of the wet the birds then moved to flats where seeds needed more rain to cause them to germinate. Eventually these too ran out and the birds tried finding food in almost every habitat, even among the long grass and boulders of the ridges and beside the heavily wooded streams. Eventually the birds were found only on storm-burnt sand ridges or on a habitat used at no other time of year, quartzite gravel slopes that occur between the old granite of the ridge and the sedimentary rocks of the sandplain. In such sites, where there are few trees and almost no soil, much of the seed falls on rocky ground where it needs a great deal of rain before it becomes sufficiently saturated to germinate.

Feeding site selection was most restricted in the breeding season when the birds moved off the hills to beside flats and creeks where green seed was abundant. The feeding sites during the breeding season were also surrounded by the densest vegetation, which we think explains why so many breeding adults are killed away from the nest (see predation).



Parrots find food in denser habitat during the breeding season than at other times of year.

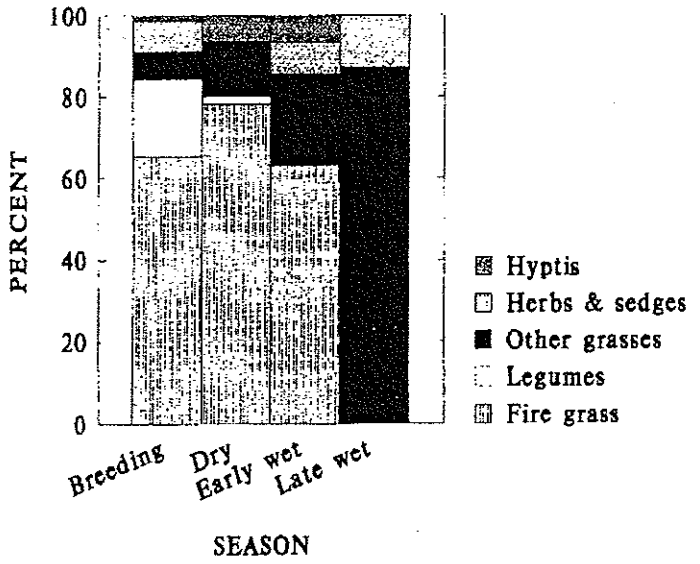
Diet of wild parrots

There are four ways to find out what parrots eat. The first is to watch them feeding and collect or identify the plants they use, the second is to collect and identify the fallen discarded husks, the third to take samples from the crops of live birds and the last is to dissect dead birds and remove their entire gut contents. Each is useful for different reasons.

During the wet season we had to rely entirely on direct observations, the herbs and standing grasses they eat at this time being readily identifiable. Even if we could have caught the birds, we were reluctant to take samples of the little food they were managing to garner.

When food became more plentiful we were more prepared to sample crop contents. Using a thin tube eased down the throat, we extracted a small subsample of seed from the crops of chicks in the nest or birds caught during the dry season. Nestlings especially had bulging crops, one dead chick we found containing over 900.

The most exacting task was to locate feeding sites used by the parrots and sweep up the discards for identification. This was done throughout the year, and usually confirmed more direct observations, but was often the only way to identify seeds that were being picked up from the ground. Pooling all our results we now have a fairly complete picture of the foods the parrots take.



The contents of the crops of Golden-shouldered Parrots

Fire grasses *Schyzachyrium* spp. are the food taken most frequently as well as being the most abundant in the environment. In the breeding season they are supplemented by legumes, both the native desmodiums and the introduced Verano- a variety of stylo *Stylosanthes hamata.* The introduced weed *Hyptis suaveolens,* locally known as Sinking Roger, is also taken in small amounts through much of the year. Herbs, sedges and other grasses are important through the wet season, when fire grasses are unavailable. These include glimmer grass *Planichloa nervilemma* and milk-drop sedges *Scleria* spp., which are taken at either end of the wet season. When young the husks are soft enough to split. Through the dry season the husks harden and the seeds are avoided by the parrots until again softened by rain. But these too disappear from the diet as they germinate or are inundated by rising swamps. The remainder of the wet season is spent seeking out flushes of ephemeral herbs and grasses or chewing on flowers and new growth of trees.

As the wet season progresses large perennial grass seeds become available. The most important of these is cockatoo grass followed by plume sorghum. By May fire grasses are once again available and the parrots turn happily to their staple for the next eight months.

Food requirements

Since 1993 Kevin Langham of Tipperary Sanctuary for Endangered Wildlife has been weighing the food eaten by his captive Golden-shouldered and Hooded Parrots as part of a collaborative effort to see how much the parrots need. During the breeding season he also compared their performance on green seed compared to dry seed. Overall intake by the birds was similar except when feeding young. Birds fed dry seed during the wet season still laid eggs, though later than those given green grass seed. It will be interesting to see whether they can rear young successfully because every young bird we have examined has had at least some green legume seed visible through the wall of the crop.

So far the results fit in very nicely with our observations of birds in the wild. Through the dry season, the parrots are actually capable of laying eggs. However their young would die because no legume seed is available to provide the growing young with protein. From measurements of feeding rate and knowledge of the size of the grass seed we can also tell that it is only by feeding all day in the wet season that the parrots can get enough to meet their basic requirements.

Food Availability

For most of the year food for the parrots is superabundant. Fire grasses are not only the most common item in the parrots' diet but are also the most common grass in the landscape. Most of the other food plants, though less common than fire grasses, are also widespread not only in the parrots' habitat but throughout most of Cape York Peninsula. Therefore the parrots are not relying on a food plant that is itself endangered.

Food availability, however, is not just about abundance. Fallen seed is selected by parrots because they can pick it up and eat it quickly. During the wet season, however, each food type is eaten in a different way - some plucked by reaching up from the ground, some taller grasses clasped and eaten from the stem. Food species may be common enough but take considerable skill and experience to consume. We have watched young birds, for instance, clumsily reaching for stems of cockatoo grass which even we can see have no ripe seed. Adults, on the other hand, are businesslike and efficient, marching over to laden stems, cocking their heads to check the seed set, then crimping them until they come within reach. It also takes experience to find food that occurs in widely scattered patches or is ripe for eating for only a short time. Such patchiness is typical of many of the wide variety of foods taken in the wet season.

There was also a time in the 1993/4 wet season when we could find birds only in areas that had been storm burnt or were in rocky hills. In these areas fallen seed remained available whereas in flat, unburnt sites nearly all seed had either germinated or was hidden in the growing sward of new seedlings. In the 1994/5 wet season such a gap in availability was not apparent. The difference, we think, was in the pattern of rainfall at the start of the wet season. In the first wet there was enough rain to start the grass growing but not enough to bring the first herbs into seed before the fallen grass seed ran out. In the second the early rain was much more patchy with heavy storms in some areas bringing herbs rapidly into seed but little rain as close as a kilometre away ensuring there was ample seed available. We suspect that the parrots had an even more difficult year in 1992/3 when the wet season began with a cyclone that dropped 250 mm over a wide area. Such a fall would have caused seed germination in all but a few rocky sites and there would have been a long gap before the first herbs and grasses set seed. Heavy rain at the start of the season we think is likely to be fatal for parrot populations that do not have access to stony ground or storm-burnt habitat, which is why, we think, all recent breeding records have been from near hills.

Cockatoo Grass

Cockatoo grass *Alloteropsis semialata* is a perennial species that seeds about six weeks after the onset of heavy storms. Its seeds are available for only a few weeks, though this is extended in patches after the first storms. Those patches burnt produce seed later and more heavily, bridging the gap until the ripening of later-seeding grasses such as Plume Sorghum *Sorghum plumosum*. Parrots with access to storm burnt cockatoo grass began breeding early in the season and were thus able to replace failed nests before the breeding season ended. Thus storm-burning of cockatoo grass can help maintain parrot numbers.

Cockatoo grass seeds are only taken from the stem; fallen seed are obscured by lush grass growth, and are soon harvested by ants. Although one of the major grasses in the area, not a single viable seed was found in 400 random soil samples taken over three years, and most regeneration is by division.

Cockatoo grass is also an important cattle food, particularly in the early wet season. Overgrazing can eliminate it, but the moderate grazing pressures in the areas where the parrots persist pose no threat.

Fire Grass

Fire grasses *Schizachyrium* spp. are the main foods taken by the parrots through the dry season and into the early wet season. These are short annual grasses that tolerate high levels of disturbance. They are grazed by cattle only when green, and produce large numbers of seeds as they die towards the middle of the year. Their seeds will not germinate until they have experienced a dry season, after which one heavy fall will produce a green sward of new seedlings almost overnight. In 1995 all the seed that eventually produced seed itself germinated in two episodes of rain.

Golden-shouldered Parrots start taking fire grass seed from the plants as they are first produced in April. They continue to eat it once it falls to the ground through to the time the last seeds germinate in January or February. Birds feeding on dry fire grass seed can gain their fill in only a couple of hours, then retreat to safe roosting sites in the tree tops. After it has rained, the soggy husks are difficult to split, and the parrots leave them alone. However as soon as the ungerminated seeds dry out again, the parrots return to them. The parrots stop eating fire grass only when the seed supply is totally depleted by germination, or obscured by grass growth. They even take seeds that are germinating or are partially rotten. Eventual depletion can be delayed by burning just after the first flush of germination, providing roasted seed that can last until the new season's seeds are available. Locating patches of edible fire grass seed can be the key to surviving the wet season.

Vegetation change

In August 1966 a group of CSIRO scientists travelled about Cape York Peninsula surveying soil and vegetation. In March 1995, with support from the Grasslands Ecology Program of the Australian Nature Conservation Agency, we were able to repeat the survey.

This was done with the aid of Robert Story, the botanist on the original survey, who guided us through the CSIRO archives.

Some of our findings are reported in the section titled *Cattle grazing*, which explains the replacement of Giant Spear Grass by Plume Sorghum. Another important finding was the decline of Kangaroo Grass *Themeda triandra* which is now only a minor component of the grass layer at the sites we visited, and its replacement by Black Spear Grass *Heteropogon contortus*. Such a replacement has occurred throughout eastern Queensland, and has been attributed to heavy grazing pressures, particularly following fires. Heavy grazing pressure at some sites we visited was also associated with the loss of most perennial grasses and invasion by exotic weeds.

However, the main reason for the resurvey was to gather firm evidence for the invasion of the grasslands by broad-leaved ti-tree. This invasion has been noticed by local residents and other visitors who have had a long association with the Peninsula, though there has been no measurement made of its advance. Places evocatively named around the turn of the century - Silver Plains, Pussycat Plains - now support thickets of ti-tree, some too dense to ride a horse through.

Of the 68 sites we visited, broad-leaved ti-tree was present in 42 sites in 1995, compared with 35 sites twenty-nine years earlier. Ti-tree cover had increased at four of the original 13 grassland sites to the extent that they could no longer be classed as grassland, but were now ti-tree woodland. Two of three other sites associated with the boundary between grassland and woodland had also converted to ti-tree woodland. By contrast, at only one of 19 ti-tree woodland sites, had ti-tree dominance been compromised. There, signs were found that a hot fire two years earlier had knocked back the ti-trees and stimulated a flush of wattle regeneration. In the absence of further fires recovery of ti-tree suckers may soon return the site to ti-tree woodland, but a fire in the immediate future may see it revert to grassland.

As an adjunct to this work we also compared two sets of aerial photographs of some of the Morehead River catchment kindly provided by the Department of Defence. In the 19 years between 1969 and 1988 nearly 10% of the grassland was lost from sample areas totalling 255 km^2. Some grassy flats had disappeared entirely but mostly they had become narrower or less continuous. From this we can concluded that the grasslands of the Peninsula are slowly being replaced.

We believe that it is this process which is the fundamental threat to the Golden-shouldered Parot.

Fire

Fire is needed to keep Golden-shouldered Parrot habitat open. The invasion of the grassland by ti-trees, therefore suggests that fires are less frequent, or less effective than they were in the past. This is born out by a comparison of records of fire from old diaries and journals. Accounts of early European explorers, beginning with the Dutch crew in 1623, were studded with references to fire and smoke.

From the journals fires appear to have been lit by Aboriginal people whenever the country was dry enough to burn, with records of smoke only being absent when it was not actually raining. This contrasts with work that indicates an avoidance of fires in the late dry season in the Northern Territory, where fires at that time of the year tend to be far hotter and more destructive than on the Peninsula.

Aboriginal burning on the Peninsula also contrasts with the records of burning around Musgrave in the diaries of Fred Shephard and his descendants that span from 1913 to the present day. Most fires were lit at the start of the dry season and after the first wet season storms. A comparison of burning patterns shows that, since cattle grazing became important on the Peninsula, fires have been lit over a much more restricted part of the year. Nevertheless, where the parrots still survive, burning has been practised with regularity. On several other properties, the emphasis on burning has been lost, at least temporarily, when ownership changed. In some cases fires were avoided altogether to 'protect' pastures. From such properties Golden-shouldered Parrots disappeared. Overall a reduction in burning frequency underlies all other threats to the survival of the Parrot.

The Rise and Rise of Broad-leaved Ti-tree

Broad-leaved ti-tree *Melaleuca viridiflora* is the main invader of the open grassy flats needed by the parrots, and their invasion appears to be the result of an altered fire regime. We therefore looked for ways of burning that would reduce their abundance. We have blow-torched them, cut them to the ground and dug them up and always the vast majority have stubbornly resprouted. We have also followed the history of over 1000 individual plants to see how fast they grow and how they respond to fire.

The toughest time for a ti-tree is getting through the grass layer. In unburnt areas only 3% managed to break the 50 cm barrier in the two years we were measuring them. None got through in areas that were burnt by even a cool fire because each time they were burnt they had to sprout again from the bottom. Beyond 50 cm, growth can be rapid. As it only takes a handful of ti-trees to transform a grassland into a woodland, average growth rates are less important than the growth rates of the fastest growing individuals. Each year between 3 and 7% grew into the next 50 cm size category. And the higher the ti-tree the less likely it was to have to sprout from the bottom when it was burnt. Instead, even though all its leaves had been burnt off, it could sprout from the top as soon as the wet season started and just keep on going.

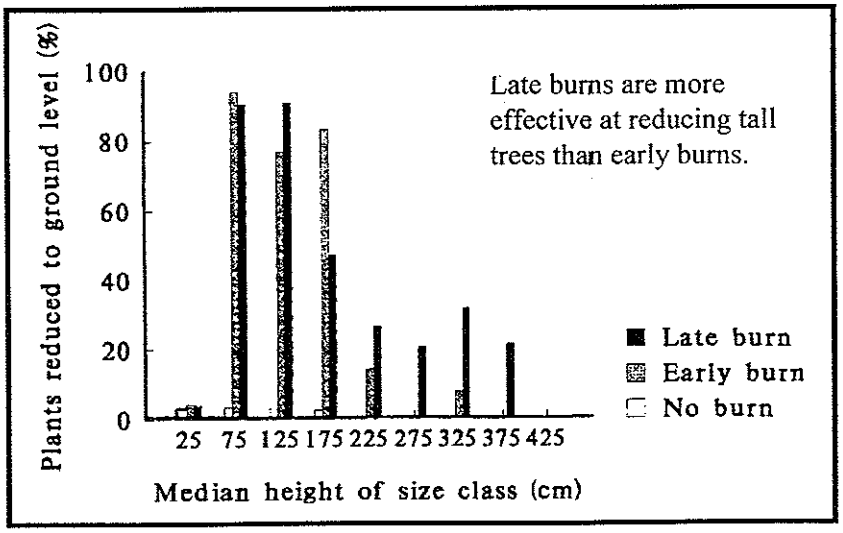
The hotter the fire the taller the ti-tree that will be knocked back to ground level. The hottest fires occur during sweltering afternoons in the late dry season or early wet season. Trees over 6 metres high were reduced to ground level by a fire one November afternoon when the temperature at the surface even before the burn was over 50°C. By contrast shrubs just over a metre high barely paused in their growth during a fire lit in May. Such cool fires are adequate for maintaining grassland in areas where the suckers are all below grass height but are worse than useless where you are trying to restore grasslands because they only consume fuel that might have been burnt at a higher temperature later in the year.

In many grasslands early burns are impossible because the ground is still too wet, even if the surrounding ridges have dried off. To keep the ti-trees down in these areas they can be burnt either deliberately or by a wildfire. The ti-trees are taking over the flats primarily because few people are brave enough to light fires late in the year, in case they burn out the neighbours. The wildfires that do occur only come through once every few years and are only effective in scorching the bigger ti-trees during hot afternoons. From a rough calculation flats are burnt by hot fires only once a decade - by which time many of the trees will have grown beyond scorchable height.

Two other factors are involved in ti-tree invasion. One is germination. We never found a seedling ti-tree - all the small ti-trees we excavated were suckers with well-established root systems. Germination of seed probably occurs infrequently, and as a result of particular rainfall patterns, such as during the exceptionally wet years of the 1970s.

The second factor is fuel load. The more grass, the hotter the fire. Unfortunately the flats the ti-trees are invading are favoured through the dry season by both cattle and wild pigs which eat, trample or uproot much of the grass. We have some information on fuel loads in grazed and ungrazed sites but a study of pig impacts remains to be done.

In summary hot fires are needed to fell large ti-trees while frequent fires are needed to keep suckers at bay.



Conclusions

We have been able to confirm that Golden-shouldered Parrot numbers have declined substantially since they were first collected in 1855, that the decline began at least 70 years ago and is continuing. The decline is steady rather than precipitous but, given the small area over which the parrot is currently found, it is deservedly classified as Endangered.

As causes for the decline we have been able to rule out damage to mounds, disease, predation by cats or toads and moderate cattle grazing. Trapping for the bird trade may have contributed to some localised declines from the 1950s to the 1970s but is no longer a major threat. Similarly predation by goannas, though heavy, is likely to have been lower over the last twenty years because of toads, yet the decline has continued.

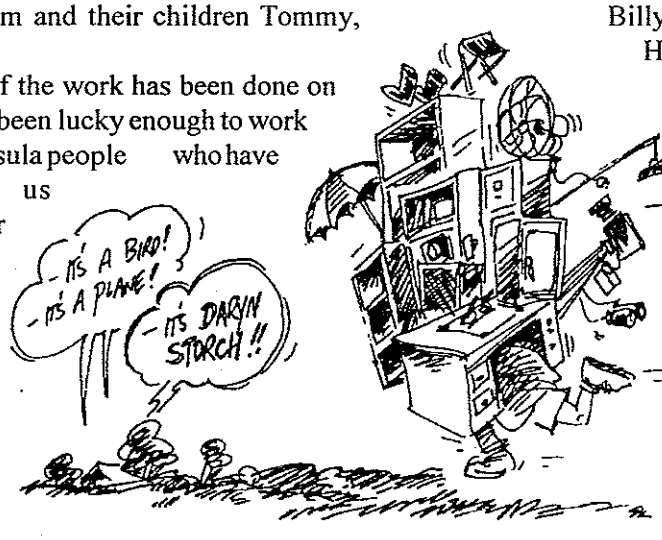
We are much more concerned about predation by butcherbirds since they appear to be taking adults and preventing recruitment by young birds after they have fledged. Butcherbirds are more likely to kill adult parrots if they nest in dense vegetation. Opportunities for butcherbirds to ambush parrots appear to be less common in open gassy vegetation, especially if they are protected by Black-faced Woodswallow sentinels. However grasslands on the Peninsula are being lost to ti-trees at a rate of about 5% every decade under current fire regimes.

Clearly more fires are needed: hot fires to reduce trees >2m tall and more frequent fires, though not necessarily hot ones, to prevent the suckers from reaching the canopy. Implementation of such fire regimes should not only recover the grassland but also save the Golden-shouldered Parrot.

Thanks.....

This project owes a great deal of its success to the extraordinary kindness and interest of the Shephard family of Artemis Station, particularly to Sue Shephard whose long-standing concern for the parrot led to the initiation of the work and who will continue to study them now the intensive research has finished. If parrot numbers recover it will in large part be due to the efforts of Sue and Tom and their children Tommy, Trevor and Kerry.

Though much of the work has been done on Artemis, we have also been lucky enough to work with many other Peninsula people who have invariably made us welcome on their properties and plied us with tea and advice: James and Tricia Gordon of Astrea, Doug and Marietta Price of Balurga, the late Mary Ferguson of Blackdown, Dave, Jenny, Rob and Fay Willis of Bulimba, Anne Creek of Coen, Don and Christine McDonald of Devoncourt, Herb and Noela Hughes, and later Glen and Karen O'Donoghue of Dixie, Cecil Sellars of Glen Garland, Daryl and Janice Hall of Hereford, Keith, Sue and Wendy Shepherdson formerly of Holroyd, Dan and Ivy O'Sullivan of Hurricane, Ken and Betty Duffy of Imooya, Alan Holmes of Kalinga, Simon Reid of Kalpowar, Peter O'Shae of Killarney, Colin and Margie Innes of Kimba, Glen Shephard and Susan Raymond of Lilyvale, John and Carol Blacklock of Lyttleton, Paddy and Barbara Shephard of Lochinvar, Dennis Lowe of Marina Plains, Maurice and Carole Shephard of Mary Valley, Don Henwood of Melsonby, the late Noble Keppel of Merapah, Warren Entsch of Olivevale, Billy Raymond of Pinnacle, Eddie Holroyd of Pompuraaw, Jimmy Gordon formerly of Rokeby, Sunlight Bassini of Stewart River, John and Wendy Price of Strathgordon, Alex Chapple of Violetvale, and Barrie and Mary Shephard formerly of Yarraden. National Parks staff have also been helpful well beyond the call of duty. Mick and Clare Blackman, Ron and Betty Teece, Merv and Jean Shaw, Lana Little, John Fred, Danny Chew, Jack and Elle Borgert and Mike and Di Delaney have all welcomed us as friends and gone out of their way to help with our research.



We have also been fortunate to work with such a supportive department. Daryn Storch first developed the proposal and has been pivotal to the subsequent success of the project through his ability to 'maximize the productivity of government equipment'. He and

Nance Storch welcomed us to Cairns, and provided a launching pad for our journey to the Peninsula. Lindsay and Jean Delzoppo and Nicky Goudberg also opened their homes to us to use as a base whenever we needed to visit Cairns. Buzz Symonds, Leasie Felderhof, Ian Garven, Peter Harris, Geoff Kelly, Nicky Goudberg, Lindsay Delzoppo and Tim Clancy protected us from everyday administration and found funds and equipment for the project from sources we never knew existed. Which is not to say that the project has not been well funded. After the Queensland Government matched the initial generous donation from Sir James Fairfax to the World Wide Fund for Nature (Australia), the Endangered Species, Save the Bush and Grassland Ecology Programs of the Australian Nature Conservation Agency all made substantial contributions to the work. We are grateful to Bruce Male, John Henry and John Lumb at ANCA and Ray Nias at WWF for their parts in the administration of the project. Thanks to Bob Reid and Cath Shurcliff we also received assistance from the Cape York Peninsula Land Use Strategy for ti-tree research. Other departmental staff whose guidance through the administrative maze we have greatly appreciated are Anne Mensel, Debbie Murray, Janette Stevens and Rhonda Thompson while Jo-anne Hunt and Mary Anne Irvin have been exceptionally diligent in the library. *Antbed* would not have been produced without the help of Stella Martin and Simon Kneebone.

Many volunteers have helped in the often demanding fieldwork. Andrew Ley served three long productive terms. Others who helped in the field were Camelia Armstrong, David Baker-Gabb, Bryan Bailey, Edna Barker, Chris Barnes, John and Judy Blyth, Allan Burbidge, Patrick Carmody, Simone Chick, Mark Clayton, Pat Daley, Peter Ewin, Paul Fisk, John and Sue Fraser, Tommy Garnett, Andrée Griffin, Marilyn Hewish, Richard and Betty Hill, Oskar Kirsche, Wally Klau, Robin, Sarah and Hannah Lendon, Bettye Lester, Phil Lethbridge, Richard Loyn, Bruce Male, Helen Myles, David Mitchell, Rachel Nelson, Ray Nias, James Nicholls, Duncan Palmer, Barrie Pennefather, Ivan and Win Poetsch, Brian Russell, Eleanor Scambler, David and Alistair Stewart, Richard Thomas, Margaret Thorsborne, Debbie Tully, Klaus Uhlenhut, Fred van Gessell, Brian Venables, Mark Weaver, John Winter, John Woinarski, John Woodburn, Pip Yencken, John Young and Eric Zillman. Others shared with us their experiences with the parrot including John and Jeny Barnett, Noel Beare, Roger Bilney, Fred Bohner, Bill Boyd, Mark Cabouret, Ann Colman, Bill and Wendy Cooper, Peter Courtis, Cliff and Dawn Frith, Bowie Gostelow, Guy Hales, Neill and Alison Hayes, Sandy Hunt, Dick McArthur, Simon Nevill, Peter Readers, Len Robinson, Syd Smith, Graham Taylor, Irene Taylor, Dorita Thomson, Ria and Ber van der Kamer, Eileen Wassell and Graham Wood.

Many people have shared with us the results of their work and their wealth of experience concerning the environments of the tropical Australia. For the Peninsula these include John Clarkson and John Neldner of Queensland Herbarium (Mareeba), who provided assistance with plant identification and habitat information, Peter Stanton (QDEH, Cairns) who gave insights into vegetation change and fire, Joe Miller, Peter McKeague, John Boorman and Jim Turnour of the Department of Primary Industries (Mareeba) who advised us on cattle industry research, and Bruce Rigsby (University of Queensland) who provided ethnographic information. Others whose experience is elsewhere in the tropics have also given us all sorts of helpful advice, particularly Alan Andersen, David Baker-Gabb, Gordon Beruldsen, Dick Braithwaite, Gordon Duff, Jim Gasteen, Beth Gott, Graham Harrington, Lesley Head, Diane Lucas, Jeremy Russell-Smith, Sonia Tidemann, Peter Whitehead and John Woinarski. Finally there are a whole bundle of people who have helped in ways too diverse to categorize: Peter Brown for Orange-bellied colour bands, Les Christidis for genetic advice and research, Maria Cofinas, Matt Bolton and David Stockwell for operation of BIOCLIM and GARP, Maria and Phil Crowley for their donation of video equipment, Belinda Dettman for penguin bands and jolly Sebers, Teresa Crowley and Captain R.G.Sharp for aerial photographs, Alaric Fisher for statistics, David Hodges for ever-cheerful computer support, Leo Joseph and Denis Saunders for their comments on our initial proposal, Kevin Langham for detailed work on captive birds, Ross Meggs for video camera development and long-distance maintenance, Freddie Morris for keeping us mobile, John Norton for finding no disturbing diseases in parrot corpses, Richard Pearson and Jim Monaghan for co-supervision of students, Hugh Possingham for introducing us to ALEX, Don Sands for arthropod identification, Robert Story for botanical advice and interpretation, Dorita Thomson for access to Donald Thomson's records, Mark Tozer and Ross Bradstock for soil temperatures, Norman and Joan Wettenhall for access to their library, and the staff of Brisbane Herbarium for plant identification.

We shall miss greatly the people and parrots of the Peninsula and all the other wonderful people who have made this project so very enjoyable. We are leaving the project in the very capable hands of Sue Shephard of Artemis and Leasie Felderhof of the Queensland Department of Environment and Heritage, PO Box 834, Atherton 4883. We ourselves are now moving on to Kangaroo Island to study Glossy Black-Cockatoos where we can be contacted at the Department of Environment and Natural Resources, PO Box 39, Kingscote SA 5223.

Plans for the Future

So far most of the research on the parrots has been passive, trying to find out what is happening to them in the wild before attempting to do anything about it. Intervention in the decline before it was confirmed would have obscured any trends in the population size. But now begins the hard work of putting theory to practice. Proposed actions fall into three categories - survey, habitat management and parrot protection.

Surveys.

The success of any management actions can only be measured by comparing follow up surveys of parrot numbers against firm baseline data. Therefore, over the next few years, it is intended to survey the remainder of the known populations. Each breeding season, people will go out on motorbikes or packhorses to map the density and extent of nests in other parts of the species' range. This will provide a baseline which can then be compared with a repeat survey in five years' time.

Habitat Management

Having identified fire as the primary factor in the decline of the parrot we have to see whether putting in a few good burns does in fact result in the increased survival of the parrots. As part of this project the Shephards on Artemis Station will go half shares in the construction of a new paddock under a conservation agreement with the Department. The Shephards will then be able to destock their existing bullock paddock, leave it ungrazed for a year to let the fuel build up, then burn early the following wet season to clean up the suckers. All going well the subsequent breeding season should see an increase in the number of nests in surrounding areas. The key will be the timing of the burn - not too early that the whole Peninsula is set ablaze, not too late that the sprouting grasses are scalded and fail to recover. Fortunately Tom Shephard is one of the most experienced fire managers in the region and if anybody can put in a good burn he can.

After the old paddock has been burnt it is intended to repeat the process with the new paddock. The Queensland Department of Primary Industries has also promised to hold a field day on Artemis once the burning has been through a full cycle. If the fires are indeed effective the paddocks should not only be better parrot habitat but should also be better for grazing and easier to muster.

The other habitat management we hope to undertake is simply to assist some of the other properties with their burning program, particularly in remoter areas that are rarely burnt deliberately, and particularly during the storm time.

Parrot Management

Intensive management of the parrots is not an option for their conservation throughout their range - it would be too expensive and the area is too remote. However, in case parrots ever reach a stage where only a few remain, we are hoping to test some techniques of increasing the survival of birds during the wet season and while nesting.

During the wet season it is intended to put out extra food for one of the flocks that gather under the woodswallows late in the dry season. The area we have chosen is one in which the parrots bred until the last two seasons, when they have departed in January and not been seen again there until the return of the woodswallows for breeding in October. If the supplementary feeding works the flock should stay longer and parrots should again breed in the vicinity.

The other plan is to choose ten nests on flats that have been closed over by tea-trees and thin the trees within 20 metres. We already know that such nests have a low probability of success and our results suggest it is the tree density around them that increases their vulnerability to butcherbird attack. Though the trees will grow back in a few seasons we should at least know whether clearing can be used to increase the success rates of nests in the future.

Recovery Co-ordination

The success of these actions will be assessed by the Golden-shouldered Recovery Team which consists of representatives from the properties where the parrots occur, the Australian Nature Conservation Agency, the World Wide Fund for Nature (Australia), the Royal Australasian Ornithologists Union and the Queensland Department of Primary Industries. It is chaired by the Queensland Department of Environment and Heritage. Observers invited to the meetings include the Cairns and Far North Environment Centre, the Cape York Land Council and the Cape York Peninsula Pastoral Advisory Group. Enquiries about the project should be directed to Leasie Felderhof, Queensland Department of Environment and Heritage, P.O.Box 834, Atherton, Qld 4883.