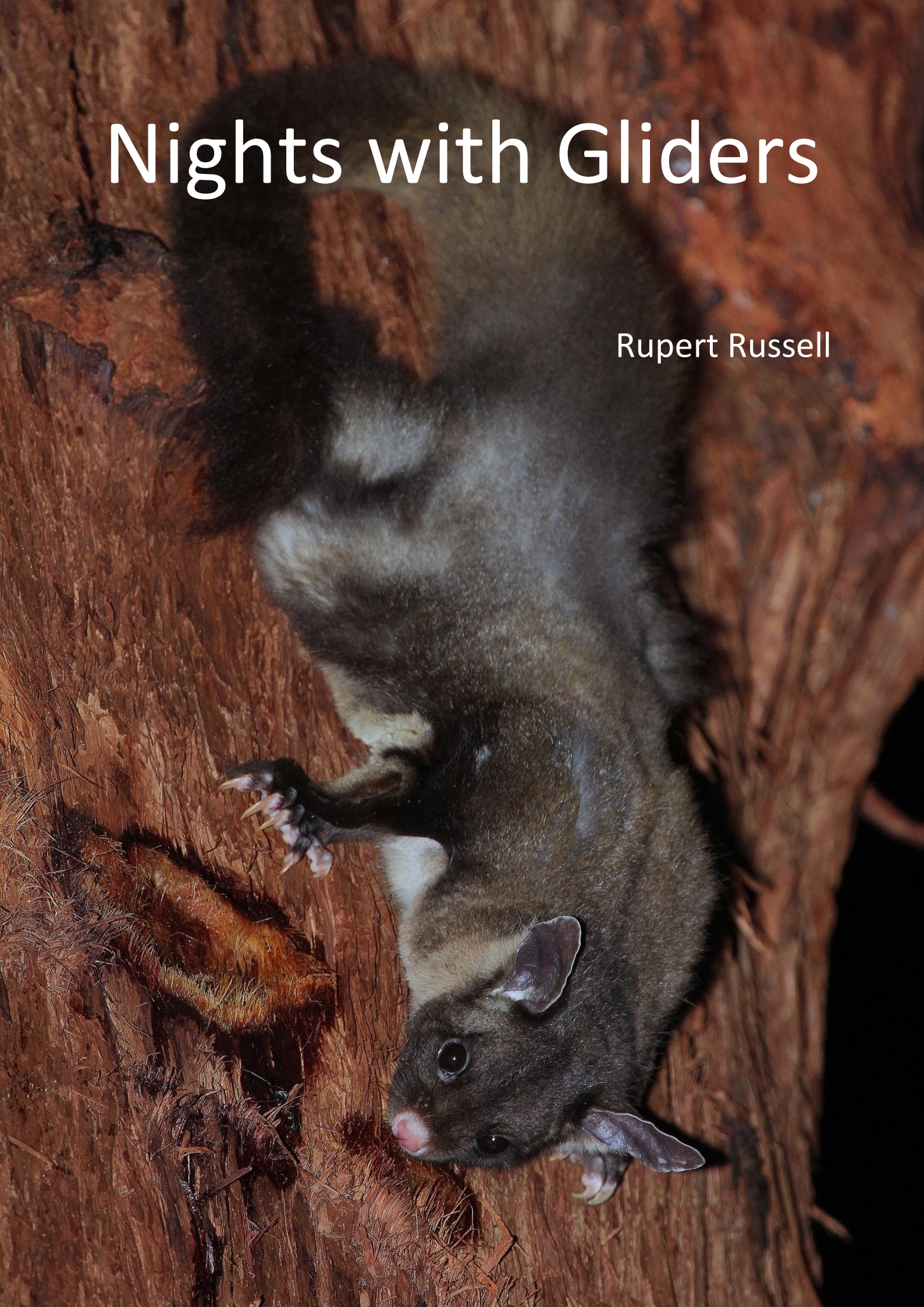
Nights with Gliders

Rupert Russell



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Front cover

Yellow-bellied Glider at sap from excision on Red Stringybark. Photo: Jonathan Munro.

Title page

Members of a family group often meet on a tapped Red Stringybark in their territory. Photo: Rupert Russell.

Dedication

This book is dedicated to zoologist John Winter, PhD, to whom I owe my first sighting of a Yellow-bellied Glider and who has generously provided advice and companionship over many years since.

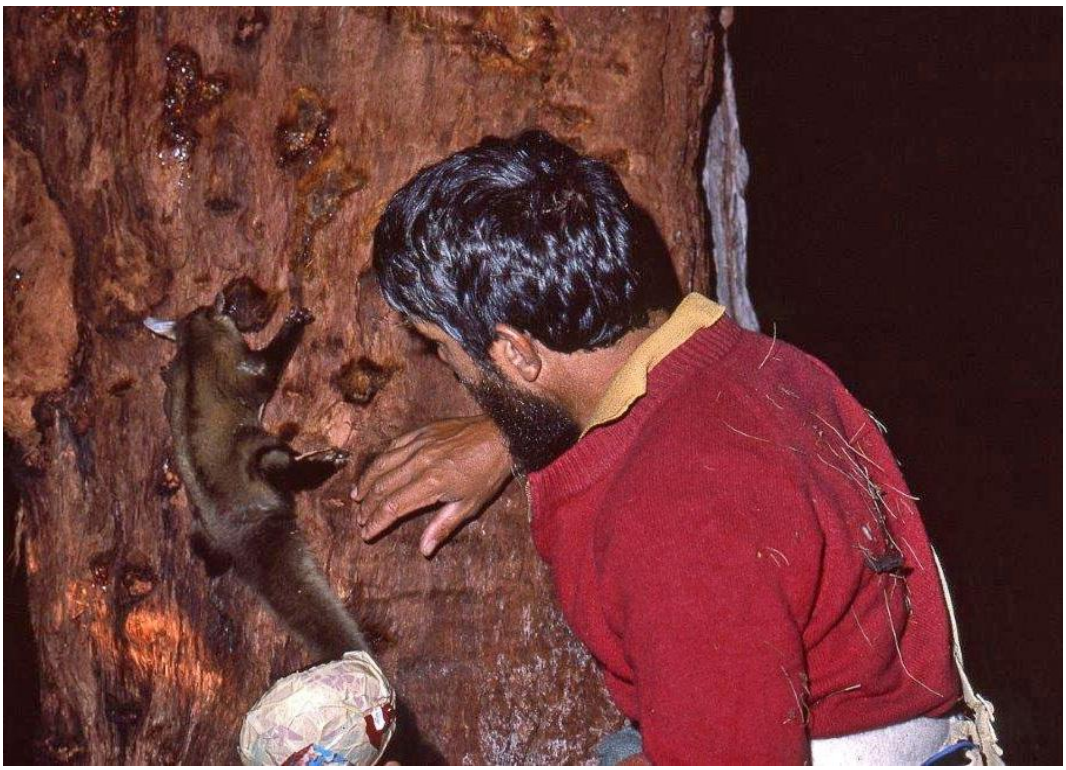
If I can transmit some of the pleasure the gliders have given me, this book may benefit them and the forests they inhabit.

Photo: Jeurgen Freund.

About the author

Fascination with the abilities and behaviour of animals – whether lizards or elephants, has ever been an absorbing aspect of nature for this writer. Born in India in 1939, first interest in animal behaviour was probably sparked through watching poultry and a large number of pigeons kept as a boy; relations in a peck order amongst hens, the sharing of squab-rearing duties amongst pigeons and flirtation attempts by off-duty male birds was far more interesting than school work.

Moving to Australia, a land rich in pigeons, parrots, macropods and snakes, interests in animal behaviour swung about wildly for a disoriented immigrant. The haphazard dictates of people, time, place and employment landed me in Herberton for several years. Friendship with a zoologist and free time after dark brought about encounters initially with rainforest mammals, then with Yellow-bellied Gliders, the most active, the most vocal and – for this observer, the most interesting of Australian possums.



The gliders of Gilbey Forest became very accustomed to the author.
Photo: 1984, Grant Dixon.

Contents

Sap-tappers

Using sunlight, air, and water in a wonderful alchemy, green leaves create sugar which energises each plant and energises our world. Sugar needed by the roots of a tree travels as sap from the crown down microscopically fine tubes termed phloem. These tubes, not far beneath the bark of a tree, will leak sap if broken. This allows a short-cut to sugar that has been discovered by a variety of animals. Delicate invaders of the phloem are insects like the cicada using a fine syringe; more robust are birds known as sap suckers which use their beaks like a hammer-drill; least circumspect are mam-mals, including some Australian possums, which use their teeth to chisel chunks out of the bark. The largest Australian possum breaking into phloem tubes to gain sap is the Yellow-bellied Glider.

The earliest known description of a Yellow-bellied Glider appears in 1790, written by John White, Surgeon General to the First Fleet, gentleman and naturalist. Included as "*Hepoona Roo*" in an appendix of natural history items, John White remarks on the patagium or gliding flap: "… be-tween the fore and hind legs … is placed a doubling of the skin of the side … forming a broad lateral wing or fin ... (which) … when the legs are made use of in walking, this skin, by its elasticity is drawn close to the side of the animal and forms a kind of ridge." This good description of the patagium when not extended suggests the writer may have had the opportunity to watch a living glider moving about in captivity. The illustration is by Charles Catton, a notable painter of animals, who would have worked from a skin sent to England.

Hepoona Roo was allocated the genus *Petaurus* and species *australis* in 1791 in a publication by George Shaw and Frederick Nodder who worked from the account in John White's Journal. *Petaurus australis* (rope-dancer of the south) continues as the name in use for this glider, having seniority over attempts by a few later zoologists to supply a different binomial. In 1941 Ellis Troughton suggested *Petaurus australis* be known in the vernacular as Yellow-bellied Glider. This became the accepted common name for the major population although David Fleay nominated Fluffy Glider in 1947 and John Calaby put forward Dusky Glider in 1966. Neither of these names have persisted, except that Fluffy Glider was resurrected by me in *Spotlight on Possums* (1980) to distinguish the small north Queensland population from the main population. I abandoned Fluffy Glider in 2022 in favour of Northern Yellow-bellied Glider as common name for the north Queensland animals when they were awarded subspecies status – *Petaurus australis brevirostrum* – by experts using DNA and skull studies to separate them from the main southern population, *P. a. australis*.

Yellow-bellied Gliders had been known from parts of north Queensland through occasional reports by zoologists and collectors between 1934 and 1954. Following a hiatus of 25 years a 1979 paper in the *North Queensland Naturalist* announced a sighting in forest on Herberton Range, southwest of Atherton. Dr John Winter, a zoologist with National Parks who had seen Yellow-bellied Gliders in southern Queensland knew that part of their diet came from sap gained by tapping eucalypts. Now living in north Queensland, John had seen what could have been bite marks on eucalypts in wet sclerophyll forest on Herberton Range. One evening between Christmas and New Year of 1977 an impromptu excursion by John, his wife Margaret, and myself took us to the area where John may have seen glider sign. A little after dark we heard quite a loud multi-syllabic call from quite close by. Next my spotlight picked out an animal which John recognised as a Yellow-bellied Glider while Margaret and I stared. This 're-discovery' of the species prompted me to learn more.

I returned to Herberton Range in daylight to get a good look at the eucalypt on which John had seen glider-tapping. Classed by botanists as Small-fruited Red Mahogany (*Eucalyptus resinifera*) this tree was commonly known as Red Stringybark in the Atherton Tablelands region where it was heavily logged for railway sleepers. It is also the only eucalypt tapped for sap by the Northern Yellow-bellied Glider. This glider is equipped with a pair of quite large, sturdy incisors in the lower jaw with which it gouges out a small section of bark from a chosen tree, breaking into the phloem tubes which then ooze sugary sap. Some weeks after an excision is made the oozing sap will be staunched, sometimes followed by bright red blobs of resin known as kino which plug the wound. When a tapped site starts to dry off a glider will make a new excision. As Yellow-bellied Gliders are group-living animals with each territory occupied by up to six animals, a tree chosen for sap will usually have not less than two excisions oozing sap at the same time; a pair of gliders may lick sap side by side from a single excision but a second tapped site allows more hungry gliders to feed early in the night. A group of Yellow-bellied Gliders may use a particular Red Mahogany for decades, resulting in a chosen tree becoming heavily

scarred by small excisions, most of them dry and callused, often too many to count. A fresh excision made to intercept the sap will show moist edges, and at times a trickle of sap darkens the bark below the gouged patch. Because the outer bark is scratched away by sharp claws as the gliders move up and down the tree, the trunk of a Red Mahogany in use for sap often looks quite red. By day a sure sign that one or two of the gouged sites on a tree are oozing sap is the presence of ants or flies, and most definitely signified by the presence of birds, usually honeyeaters and parrots.

By describing the appearance of a tapped Red Stringybark to Herberton people with forest-based interests I heard of what sounded like a glider-scarred tree in forest about a 30 minute drive southeast from the town. At the suggested location I did indeed find a glider-scarred Red Mahogany, and in a short exploration of the area I found more tapped trees including some with fresh, sap-yielding excisions.

This patch of wet sclerophyll forest in which – thanks to advice – I had found tapped trees, was much more accessible from Herberton, where I lived at the time, than the forest where the Winters and I had first seen a Northern Yellow-bellied Glider. Soon after I went out with a spotlight for what – in January 1978 – was to become the first of uncounted thousands of trips across eight successive years. *Nights with Gliders* is chiefly an account of my observations of Northern

Yellow-bellied Gliders during those years, extending into later work which has kept me connected to these animals ever since.

A Northern Yellow-bellied Glider is a small, long tailed arboreal marsupial. It has a soft furred grey face tipped by a pink nose. It has lustrous black eyes and prominent hairless ears which turn and twitch to the sounds of the forest. The fur of its body is longish, very soft to the touch and fluffy rather than sleek in appearance. The upper-parts are chiefly flannel grey in colour, a little intermixed with light brown. A darker stripe runs down the spine, from the shoulders to the lumbar region, and a prominent dark stripe runs obliquely across the upper half of the hind legs. Towards each foot the fur of the legs is very dark. The feet are large and sparsely haired, so the skin of the knuckles shows when the toes are bent. The claws are quite long, strongly curved, glossy and very sharp, looking large on the tips of the bony digits.

The gliding flaps, dark furred above and pale below, stretch from the fifth digit of each front paw to the ankle of the hind foot. As noted by Surgeon General John White these flaps – the patagia, singular patagium – are tucked closely against the sides, scarcely noticeable except when extended during a glide or partially visible when the animal is jumping, grooming or stretching.

The tail is a furry, flouncing appendage which suits the lively nature of its bearer. Body length from nose to vent is about 300mm with the tail noticeably longer, about 450mm. The north Queensland animal is a bit smaller than those of the main population and weighs a bit less – 420–520g, and in most northern populations the underside fur of an adult is more often white than pale cream or pale yellow.

The eyes of a Yellow-bellied Glider do not reflect light brightly so it is hard to find a glider by searching with a spotlight, but as they are quite vocal and have a very distinctive call, this helps to locate a glider or at least to confirm its presence in a particular forest. A call by one of a group is quite often answered by another one or two members and may sometimes trigger a call from the dominant male of a group in an adjoining territory. A group can at times number six animals, comprised of a dominant male, three adult females and two sub adults, but groups are usually not so large.

The patagium extends from the 5th digit of the hand to the ankle.

In north Queensland wet sclerophyll habitat the tallest trees are Rose Gum (*Eucalyptus grandis*), Red Mahogany, Pink Bloodwood (*Corymbia intermedia*) and Turpentine (*Syncarpia glomulifera*). A group territory for Northern Yellow-bellied Gliders is generally not more than ten hectares but in richly forested habitat may be as small as four or five hectares. Of all the Red Mahogany trees in each territory perhaps six may show heavy tapping scars with usually not more than two of them in use at any one time. Each group will have access to hollow limbs in big Rose Gums, into which the gliders retreat near dawn. All members of a group might sleep together, except that a female with a big joey usually dens apart from the group.

Red Mahogany sap is an important staple, but Yellow-bellied Gliders also take nectar and pollen from eucalypt and turpentine blossoms, and from Northern Forest Banksia (*B. aquilonia*) where these occur within their habitat. Pollen, insects such as cicadas and tree crickets, and insect exudates such as lerps are important sources of protein.

Rose Gums are prominent in wet sclerophyll forest.

Beginner's luck

The small area of glider-inhabited wet sclerophyll forest with which I became closely involved is intersected by a permanent stream shown on a topographic map as Gilbey Creek. This prompted me to adopt the name Gilbey Forest for the area – both the State Forest and adjoining forested freeholdings – to which I made my first evening visit on the 28th of January, 1978.

To wait for dark I settled on a spot – chosen almost at random, from where I could watch a big living Rose Gum against the sky. This impressive tree, about 40 metres tall, had a thick trunk supporting a top which offered many dens where big limbs had broken off, exposing hollow spouts. The dusk was serene until cicadas began a noisy performance. Fearing I was resigned to hear nothing other than the noisy insects until the evening grew fully dark, it was cheering to hear the call of a Yellow-bellied Glider. The full call is a loud "Skree-uk-skree-uk-chuga-chuga-chuga-chuga" beginning at a fairly high pitch, then tailing off into a throaty rattle. Next I glimpsed a Yellow-bellied Glider in silhouette, running along a branch of the Rose Gum. Hardly had it swooped away into the darkening forest than a second Yellow-bellied Glider emerged from a hollow limb, scampered along the same branch and leapt off without hesitation.

Once it was too dark to see I walked around in the forest, searching the trees with a spotlight. I heard Yellow-bellied Glider calls at intervals but saw none until on my way out. Then, alerted by the sound of claws on bark, I spotted two gliders moving to the far side of a tree trunk. Both animals circled back into view, the leading glider frequently obstructing its companion by turning to groom or paw it gently. The pair went out of sight again, but as I could still hear the sound of their claws I moved round to the far side of the tree where I saw the animals mating. The female was clinging to the underside of an almost vertical branch, her body nearly hidden by that of the male whose forepaws gripped her shoulders while his hind legs straddled her rump to grip the tree. The animals were motionless now, except that their tails twirled continually, sometimes loosely entwined. Of a sudden the gliders lost their hold on the tree so both of them fell but rolled easily in the air to alight side by side on a lower branch. From there they climbed up out of sight, going along so amicably that there was little doubt they would soon resume their mating.

This sighting, on my very first evening visit to Gilbey Forest, was an extraordinary piece of luck, topping off the view I had earlier gained of gliders emerging from a den. Although I saw gliders behaving amorously on a few subsequent occasions I was not to see another mating for several years.

For my first visit I had used a standard 30 watt spotlight, but on most subsequent occasions I masked the light with a sheet of red cellophane, as 'red light' seems to be less disconcerting to most nocturnal animals.

By the third week of February I had visited Gilbey Forest several times. The Yellow-bellied Gliders so far located were using only a small part of the forest, which coincided with the most heavily wooded terrain. I was alarmed to find that Gilbey

was part of a State Forest in which the Red Mahogany had been put up for sale to sleeper cutters so I went to see David Cassells, a Forester based in the Atherton office of the Forestry Department. I explained that the gliders had only recently been rediscovered in north Queensland and that any logging would have a drastic effect on the animals. Dave gave me a sympathetic hearing, agreeing to come out to inspect the site.

After a daytime visit of inspection to view the scarred Red Stringybarks and the Rose Gum in which a glider den was located, Dave said it should be possible to protect the forest from logging by classifying it as a Scientific Purposes Reserve. Before we parted we set a date for an evening visit to see the gliders.

The Yellow-bellied Gliders gave us a grand performance on the appointed evening. Three of them popped out of the big den limb I knew of, and at almost the same time another three slid through the air, almost overhead. All three of the second group landed on a nearby bloodwood, two of them investigating the tip of a dead stub as though it was a signpost in their world.

Within five minutes Dave and I had established that there were at least six Yellow-bellied Gliders living in Gilbey Forest, the best numbers I had so far recorded. We also saw a Common Brushtail, a Common Ringtail and a Greater Glider during a short spotlighting walk. Thanks to a sympathetic forester and the grand performance of the gliders during his visit, safety from logging came into force for Gilbey Forest, about 140 hectares given protection as Scientific Area 44, which remains in force to this day (2023). Some of the wet sclerophyll forest surrounding Gilbey was at that time leased to graziers, while another portion was part of a large, uncleared freehold block.

Watching and learning

One of the Yellow-bellied Gliders of Gilbey Forest had a piece missing from the tip of its right ear. I named this animal Notchear in my notes, and through repeated observations learned that it was dominant in the group of four gliders I could most readily find. Although Notchear's behaviour prompted the assumption that it was a male it was important to establish this beyond a doubt.

My chance came one evening when Notchear landed on a tapped Red Stringybark just a short distance from where I stood. The glider came down the tree to an excision only one and a half metres above ground, where it began to lick sap. It stopped feeding each time I took a small step forward, pausing not to stare at the red-masked light I held, but down towards my feet, from where the noise of my advance originated. It was raining, and I wore gumboots to help divert leeches. As I crept nearer the glider gave its full attention to my feet, with big ears twitching and head bobbing this way and that, trying to interpret the sounds. I was within arm's length before Notchear turned about, ready for a quick dash but I reached for the long tail and lifted the glider off the tree. With the captive suspended its underside revealed a scrotum just where a scrotum should be. Notchear began to wriggle so I allowed his claws to grip the tree and then freed his tail. He went up briskly for a few paces but soon turned about to stare down at me.

Notchear, known by a piece missing from the tip of his right ear.

I moved off a short way and when I looked back Notchear had returned to his sap-licking. Although glad that the capture had alarmed him so little, I was puzzled that he had not been more elusive, for had I been a leaping Dingo or a lunging Carpet Python the glider would have been an easy meal. The night rewarded me by establishing that Notchear was indeed a male, the dominant animal of his group.

Notchear and another three gliders in his group frequented a small patch of forest on the north side of Gilbey Creek, upstream of the junction with another stream shown as Chunum Creek on the topographic map. To the area used by

A glider licking the twin grooming claws between combing its fur.

Notchear's group I gave the name Lower Gilbey Range, within which I gave thoroughly unimaginative names to several of the prominent trees. For instance the Red Stringybark on which I most often saw the group feeding during 1978 was called Main Tree, not only because it was heavily used but also because it was the biggest stringybark in the patch.

Notchear's group continued to use Main Tree at the beginning of 1979 but they also opened excisions low on the trunk of a ravaged looking Red Stringybark, Leaning Tree, which yielded copiously for many weeks. It was at Leaning Tree that Notchear had been caught, and here too, through being able to approach so closely, that I was able to see tiny differences in

the appearance of other members of his group. The large, almost hairless ears of Yellow-bellied Gliders vary in the chance location of tiny nicks along the margins. It was these differences that provided the chief guides to the identity of the various animals.

Lower Gilbey Range, occupied by Notchear's group, was penetrated by a further three Yellow-bellied Gliders in early 1979. Of the three strangers one, possibly a male, was rarely seen, but the other two were often seen feeding together. They tapped a Red Stringybark in the middle of Lower Gilbey Range prompting the name Mid Tree where these newcomers were most often seen.

The Mid Tree regulars were not ignored by Notchear, who paid them a visit at least once each evening. He would alight well up the tree, usually calling immediately after he arrived. This would trigger anxiety in one of the gliders feeding on sap lower down the trunk. The anxious stranger would start quietly up the tree as soon as Notchear could be heard hurrying down, but the former was seldom able to slip past undetected. When Notchear gave chase the other would run up as fast as it could go, race out along a branch and then leap from the tree in a hurried glide. Notchear usually perched on the point from which the fugitive had departed, gazing out as though savouring a victory.

Coming back down the trunk of Mid Tree Notchear would approach the remaining glider, but this animal never fled from him. Instead it simply moved a little away from the feeding site, either waiting passively for Notchear to feed and depart, or going to lick sap at a nearby, less productive excision.

The gliding flap is well seen when stretching.

By watching these interactions I was guessing that the glider which fled from Notchear was a male, while the other animal, which showed little fear, was a female. Hoping to confirm this I asked a friend, Alex, for help to capture either or both of the strangers, which also used Learning Tree at times.

On the evening of our visit only one Yellow-bellied Glider was feeding at Leaning Tree. This animal, by the outline of its right ear, was the one not much intimidated by Notchear. Alex trained a spotlight on the glider while I reached up to cover it with a landing net. I had hoped that the glider, when it found itself encircled, would climb into the net, but instead it pushed strongly under the rim and walked calmly up out of reach. Each time the glider returned to feed I repeated

Reifem named for right ear indented, female.

the process, but with no better result. After my third fruitless effort, Alex, who was much taller than I, used the net to shepherd the glider down until I was able to seize its tail. The glider then pulled so strongly against me that I could not just tug it down for fear of tearing its claws. This impasse was solved when Alex pushed the net up from below, obliging the animal to step onto the mesh.

Our captive was a female, as I had guessed. We ran our fingers over the outside of her pouch but no tell-tale lump could be detected. When we set this glider free she walked back to her feeding spot, stared at us briefly for a moment, and then began to feed as calmly as before. After having handled Notchear I was half expecting this casual reaction, but Alex remarked in amazement that her behaviour seemed *against all the laws of nature*. Although we waited quite a long time, the glider which commonly accompanied her did not make an appearance.

I chose Reifem as a name for the female Alex and I had caught, her name being constructed out of right-ear-indented-female. At the same time I allotted the name Reima to her companion, as its ear was similarly indented and I had tentatively classed it as a male, which later proved to be the case.

Catching and tagging

Being able to recognise individual gliders during the period when they fed at low sites on tapped trees was most valuable for my efforts to learn about their behaviour and interactions. Yet I knew that their identities would no longer be distinguishable once they made excisions higher up the trunks. I thought of ear tags as a way of marking the gliders, and was given several small, shiny 'fingerling' tags by John Winter, a friend and senior zoologist with National Parks and Wildlife Service. When John and Lester Pahl, a zoology student from James Cook University in Townsville visited Herberton I hastened to ask for their help with tagging the gliders.

We went to the forest on February 24th, 1979, where we saw Notchear and another glider licking sap about seven metres up on Main Tree. There was no need to catch the easily recognisable Notchear, but John, by drawing a long, crook-tipped pole down from above the other glider, began to shepherd it down the tree. All of us circled the tree several times as John manoeuvred our quarry lower and lower until finally he

reached up a hand to catch the glider's tail. I helped him to prise our captive off the tree and into a pillow case.

This glider was one of Notchear's group, an animal I knew as Rono, a contraction of rough nose as she had a small patch of bare skin above her pink nose. We took a record of her weight – 450g, head length – 57mm, the length of her ear – 58mm, hind foot – 46mm and tail – 450 mm.

Then, while I held her still and Lester shone a light on the operation, John set a tag on the margin of her left ear. After checking that Rono's pouch was empty we replaced her on Main Tree.

We moved from there to Mid Tree where Reifem was feeding about three metres above ground. I had already set a ladder against the tree, so all that was required was to climb up quietly in order to catch her by the tail. She weighed 430gms and her measurements were all a trifle smaller than those recorded for Rono. The inside of her pouch had a frothy appearance, possibly due to subcutaneous fat globules, but it contained no joey. Looking into the pouch is very difficult for there are four sharp clawed feet and a set of capable teeth to be avoided. A struggling Yellow-bellied Glider can keep several pairs of hands fully occupied while the tiny pouch opening, almost hidden in belly fur, is located and gently pulled open. Reima's left ear was equipped with two tags, one in the top, one on the lower margin.

Back at Main Tree the next glider we caught was Lefnik, a female named for a small nick on the tip of her left ear. The upper margin of her left ear was marked with two tags before her pouch was examined. The three of us were by now operating as quite a good team and Lefnik was perhaps more relaxed than either Rono or Reifem had been, so John was able to examine her pouch more thoroughly. This resulted in an unexpected discovery, for her pouch was found to be divided into two compartments by a longitudinal septum. None of us had heard of such a thing in any other marsupial, so the discovery was of much interest. There

Pouch septum on a captive Victorian female. Photo: Steve Craig.

is only one record of a Yellow-bellied Glider carrying twins, but I think that the pouch septum may be a relict from an era when they regularly nourished twins. Another possibility is that because these gliders spend so much time in a head-down position when feeding on a tree trunk the septum may serve to hold the pouch tight when the mother is carrying a joey.

Our last capture on that memorable night was Reima, caught at Mid Tree. He proved to be a male, as expected, but had only a single testicle in his scrotum. As Notchear carried a mark in his right ear we had resolved to mark all males in the right ear and all females in the left. Consequently Reima was given two tags on the upper margin of his right ear.

On my next visit to the gliders after we had tagged four of them, it was most satisfying to be able to record interactions amongst the marked individuals with certainty. Only one untagged glider was seen, feeding peaceably beside two tagged animals on Main Tree. This behaviour showed it to be the fourth member of Notchear's group, which I hoped to catch and tag as soon as possible.

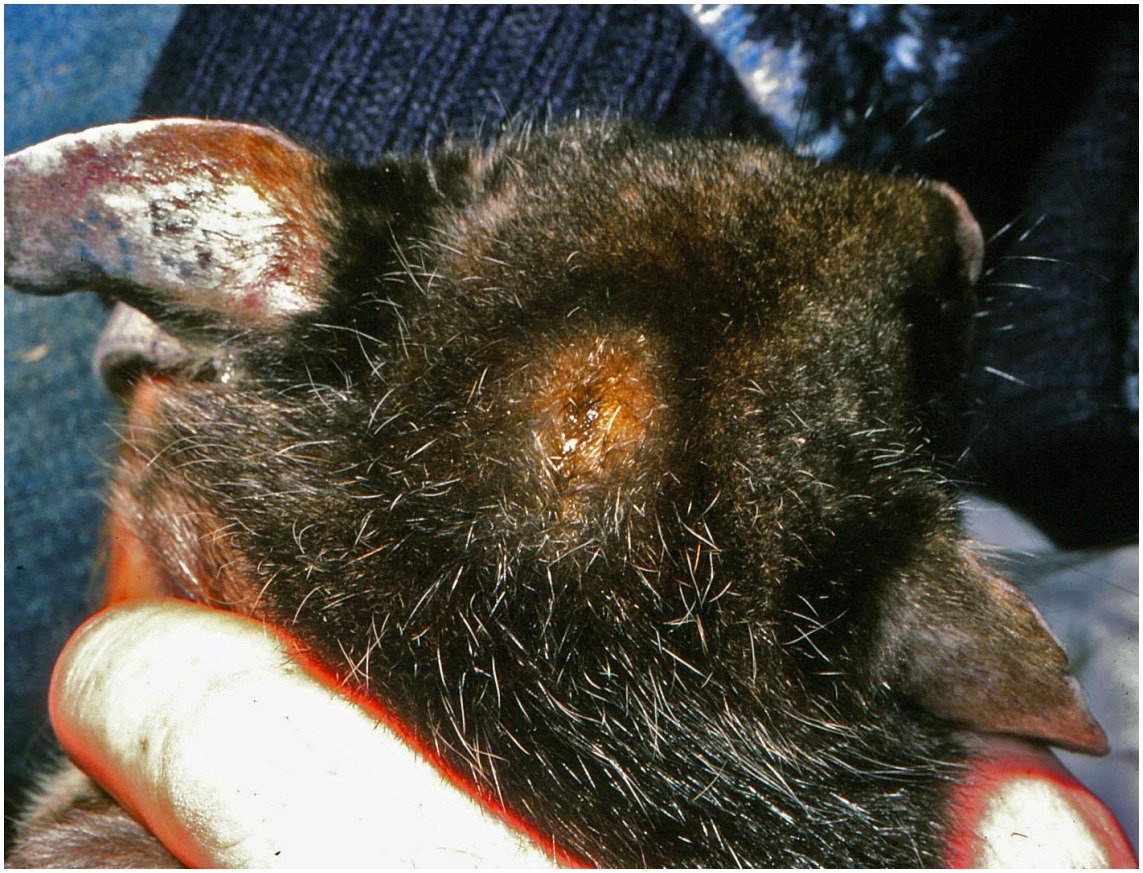
My companions for the second ear tagging expedition were Alex and Keith, another Herberton friend. A six metre ladder I had borrowed for the occasion was set up at Main Tree. Rono was soon feeding near the uppermost rung, having shown only mild curiosity about the shiny, metallic intrusion. Then down came the glider we hoped to catch. I went up as quietly as possible, although the ladder rattled and grated quite audibly. Despite the noise our quarry scarcely looked around so once I was within reach it was a simple matter to lean out and catch the invitingly long tail. The glider immediately rounded on my arm to sink its teeth into the sleeve of my overalls. This was a comfortable result for both of us as the animal's pride was indulged and my skin was saved.

Our captive was a female. Alex managed to open her pouch sufficiently for us to see the septum which I had been describing and then, to our almost reverent delight, we spied a tiny joey, furless and no bigger than the proverbial jelly bean. Sighting the joey fixed its mother's name as Mum, not imaginative but an honourable title for the first of the three female gliders in Notchear's group found to be carrying offspring. We put two tags in the lower margin of Mum's left ear before setting her free.

As we had found on other nights, this glider too had proved extraordinarily easy to capture. I felt sure that this was not because Yellow-bellied Gliders were dim-witted or slow moving. The alert and nimble behaviour they displayed during interactions amongst themselves was proof enough of their speedy reflexes. I was left to presume that the novel situation of a person creeping up a ladder or using a pole to shepherd a glider down a tree failed to trigger any instinctive reflex or fearful withdrawal.

Scent exchange and rank order

While watching Notchear one evening I noticed a small patch on the very top of his head where the fur was sparse and appeared to be moist. I made a guess that this was a scent-secreting gland, later confirmed when Reima was caught. The partially bare patch on the very top of his head yielded a very strong and, to our senses, unpleasant smell from a slightly greasy exudate. This gland is active on the



Head gland on a dominant male. Photo: Steve Craig.

heads of adult male Yellow-bellied Gliders, probably only on that male holding a dominant position in its group. The gland is indistinct – possibly vestigial or quite absent – on the heads of females. Yet adult females and sub-adults of both sexes *behave as though* they have a functional scent gland on the very top of the head – the poll.

All animals in each group of gliders share the scent of the dominant male by a procedure I have termed head-rubbing, half accurate, half euphemistic. While the dominant male is the only glider with an active scent-producing gland, all others in his group gain his scent through a two-stage scent exchange process frequently used as a sociable contact amongst group members. When – as a form of greeting, the dominant male pushes its head under the tail of a group member – usually an adult female, the recipient is supplied with his scent on the underside of her tail. Subsequently, when any other group member pushes its head beneath the female's tail as a way of greeting it will gain scent on its poll *exactly as though it had a scent gland in that position*. By this head-rubbing procedure every animal in the group achieves a scent-annointed head. Head-rubbing can be quite vigorous, the initiator waggling its head against the underside of the recipient's tail while holding its rump with one or both paws to deliver the address with maximum gusto. The target area for delivering a head-rubbing address is three or four centimetres from the base of the tail. As the recipient does nothing to pull away from such an address I feel sure that head rubbing is pleasurable.

It was to be a couple of years before I learned that the dominant male Yellow-bellied Glider *also* has a scent-exuding gland on the underside of his *tail*, about three cm from the base. I owed this revelation to Dick Whitford, a zookeeper who had examined a captive animal in New South Wales. Thus the strong smelling exudate from the male's tail gland adheres to the *head* of any glider which initiates a head rubbing contact. Having learned about the tail gland I realised that every group member acquires and shares the scent of both the male's glands, gaining scent on head and tail at locations corresponding exactly to that of the dominant male's glands.

By watching numerous instances of head rubbing performed by various members of Notchear's group I learned that this address is most often initiated by a lower rank animal, directed to a group member of higher rank. Thus Notchear received many more head rubbings than he initiated. In general he used head rubbing as a technique for nudging a female away from any feeding site he wished to occupy. Approaching from the rear he would thrust his head briefly against a female's tail. If she did not move aside he might then push his way between her legs, burrowing right under her body until he reached the desired feeding site, quite displacing the female who would be forced to clamber off his back. Nearly always a displaced female would then go around to apply a head rubbing to the male.

Scent gland on the underside of the male's tail, a few centimetres from the cloaca. Photo: Steve Craig.

Rank order amongst the females of Notchear's group during 1979 could be judged according to the frequency with which any female *received* a head rubbing from any other. Thus Lefnik, who received most head rubbings, was the top ranking female, and Rono, who initiated most addresses but received fewest, was the female of most junior rank.

Head rubbing seems to be a sociable and affectionate contact on most occasions that it is proffered, but there are instances when it is used as an appeasement gesture. An example of this is seen when a low ranking member of a group is slow to give way at a feeding site and receives a slap as a consequence. If the slapped glider does not hurry quite away it may move quickly to the rear of its senior, there to apply a thorough head rubbing, then going to another tapped site. Head rubbing is conducted by all members of a group of gliders, directed at times even to the lowest ranking adult or sub-adult, even by the dominant male. It is not uncommon to see a third glider join in a head rubbing address, either rubbing its head beneath

"Head-rubbing": the top of the head is rubbed against the underside of the tail. Photo by Yvonne Dymock.

the tail of the animal second-in-line or pushing up alongside it to add its greeting to the tail of the initial recipient.

Although head rubbing by Notchear was nearly always a skimped performance, there were times when he addressed a consort most thoroughly and repeatedly. One memorable occasion was in mid-February 1979, when, judging by his extraordinary attentiveness toward Lefnik, I assumed that she was approaching sexual receptivity. Notchear, Rono and Lefnik were at Main Tree, with Notchear almost continuously beside or behind Lefnik, nuzzling her, nibbling her back and tail and addressing her with head rubbing every few minutes. Rono, inspired by the male's enthusiasm and by Lefnik's friendliness, was almost as attentive as the male, pressing up against Lefnik, grooming her fur, and rubbing her head beneath the senior female's tail. So ardent was Notchear that Lefnik had only to move a few paces to incite a fresh round of activity, with the female scarcely given time to perform head rubbing herself. Both Notchear and Lefnik climbed slowly higher, the male sometimes restraining Lefnik with a paw across her shoulders. This was strongly reminiscent of the preliminaries to mating I had watched a year earlier, but on this occasion I lost sight of the pair. On the following night I was back in Gilbey Forest particularly interested to see how affairs stood between Notchear and Lefnik. Lefnik was on Main Tree with Rono, who addressed her. Then Notchear arrived and went by without a pause. All the excite-

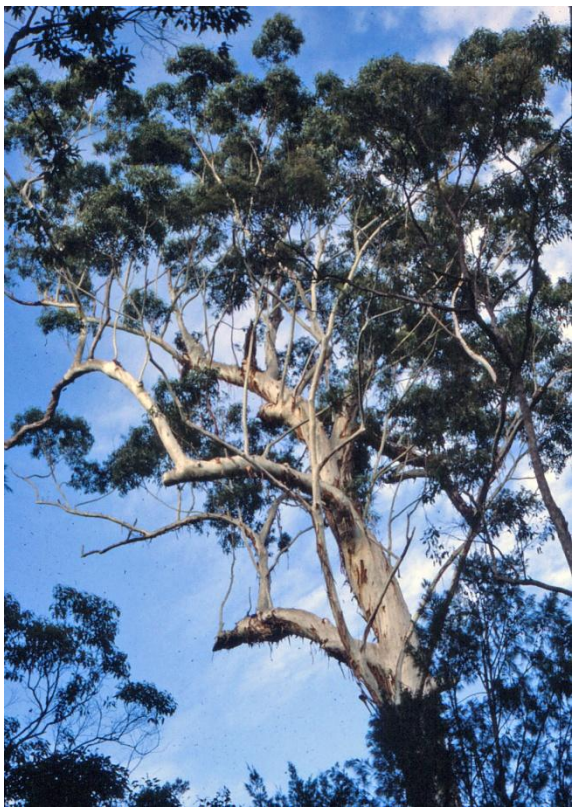
Head rubbing transfers scent from a glider's tail to the top of the head.

ment of the previous evening had vanished; instead Notchear, paragon amongst sexists, simply began feeding.

Dens

Within their home range Northern Yellow-bellied Gliders move from one den to another quite often, but the entire group may not always choose to rest together. The only glider den I knew of until well into 1979 was the one I discovered on my first visit to Gilbey Forest. This I called First Den in my notes, but although the Notchear group used it frequently they had at least three other dens in their home range.

Second Den was located by back-tracking the gliders from the first tapped tree they visited in the dusk. As they were arriving from the direction of Gilbey Creek I kept watch from a spot above the creek which allowed a view of several likely Rose Gums.



Living Rose Gums provide dens when big branches break off.

By 6.35pm on a mid-April evening bats were already turning cartwheels in the air and a nightjar was afloat across a lovely rain-washed sky. Then a Yellow-bellied Glider popped out of a dead branch on a Rose Gum and began to climb a tall vertical shoot. To go up this thin stem the glider did not use a hand-over-hand action but a sidling motion, holding its body obliquely across the stem while its feet slid rapidly up. Once near the top the glider faced downstream and was suddenly airborne.

Swooping steeply at first, levelling off and then gradually ascending until its body was adjusted to an almost vertical position, the glider reached out with all four feet to clutch the smooth trunk of a Rose Gum. From my viewpoint near this staging tree the glide appeared so breathtakingly slow that it was amazing to see the distance covered so easily. I later measured the distance between Second Den and this customary landing tree to be 44 metres. I went again and again for the joy of watching all four of the Notchear group skim between the trees, sometimes two of them in the air simultaneously. But when a friend – responding to my invitation – came out to watch the gliders in this performance not a single glider emerged. They had changed dens.

Third Den was in a tree thirty metres downstream from Second Den, and Fourth Den was in the shattered crown of a huge Rose Gum not far from First Den. Early in 1983 the entire limb which provided the site for First Den crashed to the ground but happily there were no gliders in it at the time. The gliders took up another retreat in the same tree, so far up that I named it High Den.

All known glider dens in Gilbey Forest – over the years I found eight dens used by

gliders of three different groups – were situated in hollow branches of aged but *living* Rose Gums. One factor which may favour the choice of living trees may be the glider's use of leaves to line their dens; the convenience of being able to choose leaves from the home tree instead of having to transport them across any greater distance must be considerable.

Notchear was once observed collecting leaves for his den. He was upside down in the foliage, nipping off leafy twigs which were passed from front foot to hind foot and then to a coil of his tail. It was intriguing to see that he was able to collect additional sprays, one by one, adding them to the store in his tail without dropping any. Finally, he hurried towards his den, even taking half metre leaps as he went, looking decidedly odd with his coiled tail bristling with foliage.

Unless disturbed by some unusual occurrence Yellow-bellied Gliders stay out till surprisingly late in the pre-dawn. For instance, one September morning (20th) Notchear visited a tapped stringybark at 5.23 am, before going on to First Den just as an Eastern Yellow Robin began announcing daybreak.

The most vocal of possums

Northern Yellow-bellied Gliders usually hurry out of the den, each animal leaving the home tree silently and with a minimum of delay. Commonly a glider will sound its full call soon after it arrives at a tapped tree, which is often the first destination of the night. Another of the group, still on its way to feed at the tapped tree is likely to respond with a full call, and rarely a third member of the group may also be heard. A full call usually starts with a couple of shrill syllables, tailing off into a series of throaty sounds. A written approximation could be presented as *Skree-skrr-skree-skrr-chuga-chuga-chuga-chuga*. There is a great deal of variation in the sounding of this call. The total number of syllables, the volume and pitch, rapidity and emphasis are all subject to modification by any one animal, while certain gliders habitually deliver the call in a higher or lower range than most.

It seems to me that the full call is basically sounded to announce the location of the caller and occupancy of the area in which the call is given. No response is sought, and a full call may pass into silence, though at times, particularly in the early evening, one full call will prompt a burst of calling from several animals, both group members and outsiders barely within earshot. A full call will carry for as much as 500 metres on a still evening and although there may be no vocal response, any glider within hearing will be seen to prick up its ears and may gaze in the direction from which the call was heard. If an animal is upside down on a horizontal branch when it hears a call it may swing *down* to its full length, suspended by just the hind legs while the forebody is rotated so the head points in the direction of the caller. This suggests an upside down equivalent to that of an earth-bound animal which leaps to its feet in order to give close attention to some occurrence.

In addition to the full call there are several more sounds used by Northern Yellow-bellied Gliders. At the moment of take off a glider often utters a single soft note which sounds like a ghostly 'whoo'. The whoo is not heard at the start of every glide and I do not think it is invariably used, but at times it may be unheard because of the relative positions of the glider and listener.

Another call used while a glider is in the air is a soft pulsating 'whoop-whoop-whoop' repeated for a few seconds during a glide. There is a soft, ethereal quality to both the foregoing calls but another in-passage call is a raucous 'chuga-chuga-chuga-chuga' which I refer to as rattling. Most often sounded during a long glide this rattling sound shifts rapidly amongst the trees. When the gliders are speeding about as they sometimes do on young-moon nights these calls may erupt from many parts of the forest.

"Jabbering" is a call repeated over and over again while the caller moves restlessly about in the crown of a tree, its actions apparently random and slightly agitated. I once recorded jabbering by two female gliders which repeated this calling for 25 minutes with scarcely a pause. Another time I walked quickly along a track through a different forest inhabited by gliders, flashing a bright spotlight from side to side as I went. The gliders nearest me began jabbering, and as I traversed the forest more and more gliders on either side and those ahead began jabbering, creating a sort of sound-tunnel through which I was passing. When a Yellow-bellied Glider has been jabbering for some time it may add a low, vibrating sound at the end of each phrase. This sound resembles a noise like teeth chattering rather than a vocal sound. "Juddering", my name for this sound, has a penetrating quality, even though the volume is low.

If frightened or enraged, these gliders emit a loud grating chatter, very similar to the noise heard from possums such as the Sugar Glider and the Striped Possum. A spasm of this chattering is usually heard when two males grapple in a fight or when a glider is seized by a human. This chattering does not seem to alarm other nearby gliders, as for instance when a bagged animal once chattered loudly. Of two gliders which had been feeding close beside it, one simply looked mildly interested while the other never so much as paused in its sap licking.

Whereas the full call is an emphatic, joyous sound, young Yellow-bellied Gliders cannot sound it with gusto. A full call from a female sub-adult is a thin, squeaking version of the adult's and I have never known a young male to attempt a full call while it shared its father's home range. The difference between an adult's full call and that of a young female is exploited at times by an adult female. If she comes under attack from another member of the group, or even from a strange male, she may sound a thin version of the full call to indicate an unaggressive or submissive attitude, by which she hopes to escape further attacks.

When the dominant male of a glider group arrives at a tree on which an adult female is already stationed, the male sometimes utters a series of soft squeaking notes which I call 'purring'. While purring the male will usually approach the female very closely, perhaps actually rubbing against her body, or walking over her, reminiscent of a sensuous cat. This performance seems to express eager affection and may precede head rubbing or mutual grooming.

A commonly heard non-vocal sound used by the gliders can best be compared to panting. A glider walking down a tree, hoping to take its place at a tapped excision, may pant all the way down, as though to announce its coming. This sound appears to be used as much by a nervous as by an aggressive animal, with any difference in delivery not apparent to me.

Another non-vocal sound is a sort of hiss, the expelled air making a sound like 'pheeah'. An animal makes this sound emphatically when claiming or proclaiming immunity from attack by an angry companion in hot pursuit of a third party. For example, a Yellow-bellied Glider running in pursuit of an intruder may sometimes be distracted by a member of its own group, which tries to save itself from a misdirected attack by sounding the 'pheeah'. At the same time the group member will cling fast to its position, while the intruder will keep on running, which helps to point the pursuer in the right direction.

Diet

In most months of the year Northern Yellow-bellied Gliders start their night with a visit to a tapped Red Stringybark. The sap, sweet to the human palate, appears to serve as a staple and reliable source of food. Many hours are sometimes occupied with licking sap, perhaps when other food sources are in short supply or when the weather is very wet. A popular feeding tree will have at least two feeding excisions open at one time. Typically, a glider licks rapidly from one then moves across to the other, feeding at the second excision while more sap accumulates at the first. The fresh sap coming from the upper edge of the cut-away bark is most sought after, but a hungry glider will even lick at the dried sap which has oozed during the day, soaking into the bark below the feeding site.

Sap is also sometimes obtained from thin branches of Red Stringybark trees by ringing the bark off branchlets about one centimetre in thickness. When feeding on sap in the crown of a tree the gliders ring a large number of twigs, moving hurriedly from

Sap from Red Stringybark is an important staple.

one to the next to collect the tiny amounts of sap from each site. I have only recorded this activity on 'Ring-twig trees' during July and August.

Yellow-bellied Gliders feed on nectar and pollen from the three eucalypts occurring in Gilbey Forest – Rose Gum, Pink Bloodwood, and Red Stringybark – and also use the flowers of Turpentine. Many mammals are unable to digest pollen, but glider scats collected while Turpentines were blossoming heavily were examined under a microscope, showing the scats were packed with pollen grains, the protein-rich contents of which had been fully extracted. For this project I sent the scats to Andrew Smith, then of New England University, who did the microscope work.

Protein is also obtained from a variety of insects. About November each year the outermost bark of Rose Gums lifts away from the trunk. Beneath the lifted bark large numbers of tiny sap sucking insects called psyllids shelter, feed and breed. Yellow-bellied Gliders can often be heard clattering amongst the drying ribbons of

bark as they fossick for insects. A glider can sometimes be seen stationed head down on the smooth Rose Gum trunk, anchored only by the grip of its hind feet while holding a ribbon of peeled bark in its front paws. The strip of partially curled bark, as much as a metre in length, is passed from one end to the other to collect consumables. Any insects are captured or scraped off the underside of the bark, then the strip is nonchalantly released to clatter down to earth. Remains of psyllids of the kind which shelter under bark have been identified in glider scats.

One summer when cicadas were plentiful many of them ended in the grip of a Yellow-bellied Glider. I never managed to see the moment of capture so how this was managed remains a mystery, but I was able to watch while the glider, clinging only by its hind feet, broke open the cicada. Holding part of the insect in each paw the glider scooped out the innards with its bayonet-like lower incisors before chucking away the remains. Because I wanted to be sure that it was a cicada that was being consumed I used to hurry forward whenever I saw a remnant being tossed away, until I was able to satisfy myself that the leftover was indeed a piece of cicada. Perhaps the glider overhead sympathised with the extent of my hunger for leftovers, or with my inability to catch cicadas for myself. The remains of tree crickets were also identified in glider scats.

Another species of sap-sucking psyllid feeds on the leaves of eucalypts. This tiny insect builds a shelter for itself by exuding some of its sap intake to make a small white shield that covers the soft body. The covering, termed a lerp, is likely to be made from a combination of waxy matter and sugar, the latter imparting a faintly sweetish taste. Because Yellow-bellied Gliders can convert any accidental fall into a glide they go confidently to the ends of leafy branches without hesitation. Again, while gripping the twigs with only their hind feet they feed on both the lerp and the psyllid concealed beneath. Notchear was once observed foraging head down while holding a leaf along which he scraped his teeth. Having dealt with one leaf he would take hold of another, not plucking it from the twig but holding it so it could be rapidly scraped. His paws moved along the edges of the leaf with dexterity, so that the exact section of leaf to be scraped was held most firmly. The glider attended to leaf after leaf in this way, occasionally taking hold of a leaf but putting it aside to take up another one, which perhaps hosted more lerps. Every now and then he would pause to chew rapidly before this head-down foraging was resumed. A sample of foliage collected next day showed there were many lerps sticking to the upper surface of most of the Rose Gum leaves. Beneath each lerp was a tiny greenish psyllid, looking like a minute, flattened cicada.

Northern Yellow-bellied Gliders were also watched feeding on another species of psyllid on the *underside* of bloodwood leaves.

Partakers

The sweet sap of the Red Stringybark attracts a variety of other creatures – insects, birds and mammals – to sites tapped by Yellow-bellied Gliders. Ants can usually be seen; a large and peaceable species is commonly at the sap but these ants also carry away fragments of glider faeces from where it collects at the base of a tapped tree. Another species of ant has

Three species of glider on a tapped tree.

an abdomen the size of a pinhead when it ascends a tapped tree, but if all goes well with its feeding aloft, the tiny abdomen will double in size, and appear almost translucent.

The most fearsome ants in Gilbey Forest are the Jumping Ants or Jumpers. They really do jump short distances and anyone bitten certainly jumps with alacrity. Luckily, of all the tapped trees in Gilbey Forest only one had a Jumper Ant colony close to the butt of the tree, of which fact I received sharp intimation on occasion. Jumpers forage on tapped stringybarks, but as far as the gliders are concerned the most obnoxious ant seems to be a quite small, black-bodied type. If these ants begin using a tapped tree the gliders try to drive them from an excision by swatting and clawing, with much muzzle flicking and brushing until the ants are removed.

In summertime a copiously oozing stringybark may attract several species of brightly coloured flies, occasional wasps, an opportunistic assassin bug and feral European bees, yet no insect-eating bird such as a Grey Fantail or Eastern Yellow Robin ever seems to take up a post near a tapped tree in order to pick off the insects. One insectivorous bird – the White-throated Treecreeper – does occasionally visit a tapped tree, but to feed on sap rather than on insects. The way in which the bird presses its beak into the rim of an excision

Scaly-breasted Lorikeets at a tapped tree.

is distinctly suggestive of a bird imbibing fluid rather than picking up an insect.

Nectar-seeking birds seen at a tapped tree include a variety of honeyeaters, and, more seasonally the Rainbow and Scaly-breasted Lorikeets. In Gilbey Forest the most usual honeyeaters are the Bridled, Lewin, Yellow-faced and White-naped; Noisy Friarbird, Noisy Miner, and Eastern Spinebill are also recorded.

As dusk approaches the daytime feeders retire, replaced by the crepuscular and nocturnal. The Evening Brown butterfly lifts from its cryptic posing on the forest floor, and Shawl Moths fly in flocks from their gloomy retreats, settling in a ring about the excisions to probe for sap with their long tongues. An insectivorous bat will quite commonly fly up to inspect the clustered moths, and sometimes flies rings around the tree, presumably taking small insects attracted to the sap.

An insectivore which runs up the tree in the dusk but not to feed on insects is the Yellow-footed Antechinus, one of the 'marsupial mice'. This fierce but nervous little predator is only intent on licking up as much sap as can be imbibed before any larger mammal arrives. Although the antechinus is timid and consequently hard to observe, I have noticed that it does not flinch at all if a late-feeding Bridled Honeyeater comes for sap. Rather it was the Honeyeater which carefully moved to feed from a different excision. As a Bridled Honeyeater is quite domineering towards small avian competitors at a tapped tree it was interesting to see how cautiously it avoided the tiny carnivore.

The tiniest mammals to visit tapped stringybarks are Feathertail Gliders. They arrive early, race along to an excision and, between many alarms and retreats, feed as fast as possible before the larger glider arrives. Ever erratic and alarmist, they rush about at innumerable disturbances, many of them imaginary, I think. Their hasty leaps often seem quite undirected, terminating on the ground or in a low bush. One evening a bat flew up to investigate a Feathertail Glider, which promptly leapt from the tree, landing in a Lantana thicket. After the Feathertail had re-climbed the tree the bat returned to hover once more in front of it. This time the tiny possum showed great resolve, staring closely at the bat but not leaving the tree.

Sugar Gliders are commonly seen on tapped stringybarks. I believe that very rarely these much smaller gliders make their own excisions on trunk or twigs of Red Stringybark in order to procure sap, but on most occasions they simply avail themselves of Yellow-bellied Glider excisions. They usually frisk away when approached by the much

Attracted to the sugary sap, a timorous Feathertail Glider darts about a tapped tree.

bigger glider, either before or after a slap, but it is not rare to see a stalwart Sugar Glider hold its position even though repeatedly cuffed by a glider three times its size. A Sugar Glider which is determined to stay and feed may even lunge and snap at an approaching Yellow-bellied Glider, forcing the larger animal to go elsewhere.

Common Brushtail Possums will at times visit a tapped tree with regularity for a few weeks. Large and lumpish compared to the gliders, they never appear comfortable on the tree, clinging beneath the excision for an hour or more, almost stupefied between sap licking sessions. Yellow-bellied Gliders usually leave sap sites when a Brushtail approaches but I once saw Notchear drive a Brushtail away by repeatedly striking it with the extended claws of a lunging front foot, much like a boxer leading with a left.

A few Striped Possums live in Gilbey Forest and are sometimes seen licking sap from a tapped site. Like the avian treecreeper and the marsupial antechinus, the Striped Possums, even though much of their diet is insectivorous, showed no interest in the concourse of insects gathered around the sap. Although equipped with powerful teeth and a pugnacious disposition Striped Possums I have seen on tapped trees were quick to give way when a Yellow-bellied Glider approached.

One night I discovered a Spectacled Flying-fox clinging head down to the trunk above a glider excision. It not only licked sap from an excision but gouged out the sap-sodden fibrous bark from all around the site. This bark it chewed and sucked hard against its palate, then spat out so that numbers of small fibrous pellets appeared around the base of the tree, commemorating the bat's visit. When a glider approached the fruit bat repelled it with a fusillade of threatening noises and gestures. A barrage of sound was effectively repeated each time the possum drew close, but the bat was not at ease and skied away after a short while. Fruit bats (flying-foxes) and gliders are not strangers to each other, as they sometimes compete for blossom in the crown of a eucalypt or Turpentine. At such times the fruit bats advance upon the gliders with threatening noises and brandished thumb claws, forcing the gliders to shift to another cluster of blossom, which they do with far more agility than the bats can manage.

Accidents and predators

Most animals active after dark have an adaptation which increases their ability to see in very low light conditions. This adaptation is a layer of light-reflecting cells – the tapetum – behind the retina. All light entering the eye and passing through the retina is reflected by the tapetum so it bounces back out. This provides the animal with a nearly instantaneous second look at all visual information. Reflectivity of the tapetum varies with different species of nocturnal animals. Torchlight shone on a cat's eyes is brilliantly reflected and some possums have very bright 'eyeshine', most notably Greater Gliders and Lemuroid Possums.

Surprisingly, Yellow-bellied Gliders have weak eyeshine, duller for instance than reflections from the eyes of the much smaller Sugar Glider, and much duller than the eyeshine of a Greater Glider. Yet this lack of a highly reflective tapetum does nothing to inhibit their gliding ability. Yellow-bellied Gliders are easily the best of Australian gliders, taking off without hesitation, able to cover a hundred metres in a glide at will, and to alter course mid-air

if necessary. How this is managed without possession of a well developed tapetum is a mystery.

Part of a Yellow-bellied Glider's ability in the air may depend upon memorising the treescape of its range. Young gliders are noticeably slow at getting about; many of their early journeys are made as spread-eagled leaps from the crown of one tree to the crown of the next before they learn to sail off a firm branch to reach the trunk of another tree. It may be that the confidence to leap off freely comes with learning, first memorising the most common routes and finally the whole treescape of their home range. It is known that certain terrestrial mammals and even many birds learn routes so thoroughly that they run or fly almost blindly, and I think Yellow-bellied Gliders may develop a similar ability. If they do learn to operate in this way some of their accidental crashes may be due to lapses of memory or absent-mindedness.

An aerial mishap may be no more serious than striking a twig or a bunch of leaves in passing, with no observable consequences, but at times a glider will crash headlong into an obstacle and plummet downwards. The momentum of the fall may be converted into a secondary glide which carries the animal to a convenient tree trunk, but at times the glider falls all the way to the ground with an audible thump. Crashes I have seen have all been by adult animals over a familiar route, not by inexperienced juveniles.

An airborne glider could be expected to suffer injuries to its face or forebody, but happily wounds of this type were extremely rare. The greatest danger seems to be that of becoming impaled on some sharp, jutting piece of wood during a fall. I once found a female Yellow-bellied Glider dead in Gilbey Forest with a large rent in a gliding flap. When found she had already been lying dead for a few days during a period of heavy rain, so I could not learn much from the appearance of her body, but I supposed she died from hunger and secondary infections after her gliding flap had been ripped. I later rescued another adult female from a slow death by starvation and infection after her gliding flap had been perforated and then infected. This particular female probably suffered her injury due to falling in the course of a fight, for her domineering behaviour often involved her in serious clashes with other gliders in her group.

Fighting between Yellow-bellied Gliders often results in one or both animals falling to the ground. The risk of being impaled or severely bruised is a risk for both combatants, as the more effective combatant is just as likely to make an unfortunate landing. Falls also occur when a glider is walking along the underside of a stout, smooth Rose Gum branch, searching I think, for insects which they scrape off the bark with their teeth. One night I followed a glider which was moving from one Rose Gum to the next, finding something edible on the underside of many of the lateral branches as it walked along upside down. The forest was glistening wet in a steady drizzle which made the Rose Gum branches slippery. Twice the glider fell off. Each time it rolled over in the air and went straight down, limbs spread wide and tail streaming, averting landfall with about five metres to spare by converting the fall into a glide.

Two of the Yellow-bellied Gliders in Gilbey Forest suffered inexplicable injuries to their tails. One November the female Lefnik was seen to have a small bare patch

This glider lost about 100 cm off her tail. As she scratches her ear a pouch joey can be glimpsed.

on her tail, about 10cm from the tip. This site became infected and within a few days the glider lost all control over the end of her tail, which thereafter hung at awkward angles for the rest of her life. At times the infection on her tail looked so severe that I contemplated amputating the infected end but did not for fear of causing some new problem. Some years later I was to laugh at my timidity when another female in Gilbey lost the last 10cm off her tail but showed no detectable ill effects.

To my lasting relief, predation of Yellow-bellied Gliders in Gilbey Forests seems to be rare. Rufous and Sooty Owls inhabit Gilbey Forest, as does the Boobook. Both Rufous and Sooty Owls are large enough to take a Yellow-bellied Glider. I have seen Rufous Owls with Greater Gliders in their talons, and they are known to kill adult Herbert River Ringtail Possums, almost wholly devouring the kill in a single meal, and the ringtail weighs about twice as much as a Yellow-bellied Glider. The Sooty Owl can kill Bandicoots and Green Possums so there is little doubt that it could take a Yellow-bellied Glider, yet magically, the gliders seem to escape the attentions of owls in Gilbey Forest. I once watched a Sooty Owl fly to a perch within about five metres of a tapped tree on which a

Lefnik with damaged tail. Her fur shows a bit of the "moth-eaten" problem.

number of Yellow-bellied Gliders were feeding. The owl took scarcely any notice of the gliders which were moving around roughly level with its perch, paying attention instead to the sounds which reached it from the ground below. After a short while the bird drew up one leg, closed its enormous eyes and took a nap.

When Yellow-bellied Gliders are active on a tapped tree in dry weather the sounds of their claws on a tree trunk are plainly audible to human ears from as much as 30 metres away, so a Rufous Owl could quite easily locate the animals as they feed. I have found the tails of four Sugar Gliders in the vicinity of tapped stringybarks, so the technique of picking an animal off the trunk of a tree seems well within an owl's ability.

An animal that does seem to be a more likely predator of Yellow-bellied Gliders is the Carpet Python, which sometimes takes up a position beside a feeding tree, apparently in the hope of catching some daylight or after-dark visitor. At one time I was making nightly visits to a tapped stringybark at which a number of nocturnal animals were gathering. It was not unusual to see two Feathertails, six Sugar Gliders and three Yellow-bellied Gliders all on this tree at the same time. Then one evening I arrived to find the tree completely deserted.

This was so eerie and depressing that I stood about glumly, hoping a glider would arrive to lift my spirits. Next I began to circle the tree, studying the upper branches where a Yellow-bellied Glider might be grooming. The light passed over a Casuarina branch which leaned towards the tapped stringybark, and there I saw a Carpet Python, its underside gleaming in the light. The snake was positioned so as to be able to lunge at any animal which went along the trunk of the stringybark opposite. Its tail was tightly coiled about a branch, on which the rest of the two metre length was gathered in a zig-zag, ready to spring forward.

Perhaps the snake had made an unsuccessful strike early in the evening, frightening the mammal assembly or perhaps – by some unknown skill, its presence had been detected by the possums before one of them had provided a bulge for the python's belly. Because the Yellow-bellied Gliders of Gilbey Forest were too precious for me to accept an avoidable hazard I climbed up the Casuarina and removed the snake which was liberated in another forest the next day.

On the evening after the snake was removed there were two Sugar Gliders and one Feathertail back at the sap, but I saw no Yellow-bellied Glider at this tapped tree until five nights after the python incident, and as much as eighteen nights later a Yellow-bellied Glider displayed great nervousness. After reaching the crown of the tree she took a full fifteen minutes to come down to the main trunk. She descended in small stages, all her concentration focussed upon the casuarina in which the python had lurked. Repeatedly she cancelled a nervous advance with a jittery withdrawal. She stared into the Casuarina, nose and ears straining forward, front feet propped and hind legs ready to pull the quivering body back in a flash. Dozens of times the glider took fright, spinning around to go up a little way, then overcoming her fear so she came down once more, head bobbing, body weaving and flinching as she took small steps of the way down to the sap.

Two gliders were seen to give the Casuarina their nervous attention for a full month after the python incident. I was astonished that their caution persisted for

such a long period, in contrast to their carelessness toward me, such that I have been able, as an experiment, to lift the same glider off a tree twice within an hour. There have been other occasions when I have seen (and removed) Carpet Pythons waiting in ambush on or near a tapped stringybark, and my observations suggest that Yellow-bellied Gliders make a great effort to detect and avoid snakes.

Any stealthy scratching sound resembling the noise which could be made by a quoll, a cat or a big snake climbing a rough barked tree causes a fearful reaction in the gliders. I have twice watched Yellow-bellied Gliders make a cautious withdrawal when they could hear, but not see a Leaf-tailed Gecko climbing up a tree on which they were feeding.

Another time I caught sight of a Leaf-tailed Gecko which had positioned itself, by coincidence, on a path always used by the gliders when running up a particular branch. I waited to see what would happen. Along came a young male glider, heedless until its paw touched the motionless gecko. In that same instant the glider flung itself off the tree, pitching down to sprawl on a Casuarina. There it remained for more than half an hour, grooming and fiddling, before making its way back to the tapped tree it had left so precipitately. By then the gecko had moved away.

There are some situations in which a Yellow-bellied Glider almost always shows caution. One such occurs when a glider on its way up *any* tree approaches the point where a major branch forks from the trunk. Before advancing any further the glider will usually pause to direct its concentrated attention on the way ahead. The ears are pricked forward, the muzzle thrust out, and the stance is such that a very quick withdrawal can be affected. Only after several tentative moves, half advance and half retreat, will the glider proceed, but more often the situation is bypassed by the glider climbing along the outside of the junction rather than by hauling itself into the crotch of the tree. In time I came to the opinion that this caution was directed towards avoiding any python that might be curled in the fork, a position which these snakes have been seen to take up.

Notchear's group

Spring 1979

Spring was well established in September, as was my interest in the lives and social organisation of Yellow-bellied Gliders. Birds were nesting, centipedes running about and beetles mating. By the third week of the month there were big cicadas in the trees, setting up their din at about 6.40pm.

October was hot and dry. The gliders left their dens early, 6.42-6.50pm, hurrying to Mid Tree where they licked sap avidly for ten or fifteen minutes before dispersing. Turpentine trees blossomed for a short period in mid-October, attracting squalls of Little Red Flying-foxes. The gliders clambered about beside the fruit bats, collecting nectar and pollen from the flowers.

On October 22nd Notchear and three females assembled at Mid Tree, fed hurriedly and were off to forage elsewhere by 7.10pm, but late in the night there was another Yellow-bellied Glider at Mid Tree. Unlike the animals which usually fed there and which had become so accustomed to my presence that they scarcely bothered to glance at me, this glider behaved timidly, looking down nervously, hopping up a short way, then looking down again.

The markings on its hind feet and thighs were very black, with the dark patch on the rear part of the thigh so extensive that it almost merged with the median thigh stripe. In addition, this possum had a wonderfully neat and bushy tail, and its torso showed prominent 'guard hairs', standing out from the main body fur.

I guessed this glider to be a youngster, reared by one of the three females in Notchear's group. Over the next few nights the new arrival became more relaxed about my presence, but remained very attentive to every sound, most of which came from fruit bats squabbling in the surrounds. Feeding on sap from Mid Tree occupied this glider for most of each evening while I was present; I supposed that it was not yet confident in its ability to glide amongst the trees in company with the adults of its group.

Being alone at Mid Tree the youngster was eager for company. One evening a glider which was not of Notchear's group came to Mid Tree. The youngster hurried up to the stranger but was repulsed by a threatening lunge. The stranger fed for a short while before starting up the tree with the juvenile following, puppy fashion, until the former leapt from the tree. It seemed that the youngster was unable to distinguish between group members and strangers or was heedless of any distinction. On the other hand, the intruding glider, which would have shown anxiety and likely fled at the approach of an adult, was apparently able to identify the youngster as harmless, treating it with careless intolerance. I was later to observe more instances of an intruding glider promptly establishing dominance over any sub-adult member of the range it was raiding, although the intruder took care to dodge any adult resident.

The lonely youngster was effusive when Notchear came to the tree. The dominant male showed complete tolerance while the youngster climbed over him, mouthed the

fur of his shoulders, nudged its way beneath the male's belly, pushing half out of sight, then once more across the male's back. On this occasion the young glider made no attempt to offer a head rubbing, possibly because it was not yet acquainted with the procedure.

It was three weeks before the youngster – I recorded it as 'Blackfoot' in my notes – was making it to Mid Tree quite early, suggesting increasing skill as a glider, and it grew more exploratory on the tree, walking out to various limbs. But instead of grooming by hanging from a branch either head up or head down while flourishing the grooming claws as the adults do, this glider hunched carefully around a stub while scratching and nibbling through its fur. When one of the females came by Blackfoot rushed up to her, this time pushing under her tail in a semblance of head rubbing. Before she left the female also addressed the youngster, pushing her head under its tail with vigour sufficient to almost lift Blackfoot off the tree while providing it with a scented tail.

Six in Notchear's group

Drizzle and mist, so characteristic of tall eucalypt forests, are romantic phenomena for me, life giving and protective. When the forest was damp and gentle with rain in January 1980 frogs of several species hopped abroad and Leaf-tailed Geckos stationed themselves at low positions upon their chosen tree trunks.

I watched for Yellow-bellied Gliders coming from First Den on the 9th January, without success, so on the following evening I watched at Second Den. Two gliders ran out at 7.23pm, followed by two more at 7.28pm. A few minutes later a fifth glider came out but instead of making a prompt take-off as these animals usually do, it stopped not far from the entrance. It crouched for a long time, a small hump on the branch, motionless except that its long tail swung in the breeze. Then, unexpectedly a sixth glider popped out of the den, stepped over its fellow and made its way along to the launch point. To have recorded six gliders on this occasion could only mean that not just one but two sub-adults had been successfully reared in the second half of the previous year.

Playing and fighting

The Pink Bloodwoods in Gilbey Forest had not flowered much in 1978 and not at all in 1979, but they bore a heavy crop of blossom in 1980. By the end of January the honeyed scent of large flower clusters filled the air. The Yellow-bellied Gliders took to these blossoms with alacrity, making it very much harder to find and watch them. They were very quiet, and because so many trees were flowering it became almost a matter of luck to locate a glider. They fed from the clusters while clinging upside down beneath them, so a glimpse of their eyeshine was a rarity. Flying-foxes attracted to the flowers complicated my search, as quite often patient study of a waving clump revealed not a possum but a bat.

With an abundance of nectar and pollen available and lots of insects about it must have been a time of plenty for the gliders. The bountiful season and the fact that there were two sub-adults in Notchear's group may have been why many instances of play were recorded during January and February. One playful exchange began when two gliders were foraging in a Rose Gum while a third animal fossicked in an

A game about to begin.

adjacent tree. Of the two gliders one suddenly ran along a branch which connected with the adjacent tree, while at the same time the glider in that tree ran to meet the oncoming animal. An instant before the two collided one of them, still at full speed, swirled beneath the branch while the other ran past, above it. Next the upper animal spun around and swung down. Now both gliders, suspended by hind legs only, tussled in mock battle. Each animal tried to nip its opponent's neck, sides and thighs, while each did its best to foil the other by wriggling about or by parrying and thrusting with its paws. That it was only a play fight was clear, for between bouts of wrestling and nipping the animals groomed each other affectionately. 'Tug-grooming' I called it, one glider takes some of its companion's fur in its mouth, combing it through the teeth with a small jerking movement of the head.

A short time later the gliders ran higher up the tree, then grappled again close to where the third glider was busy amongst some twigs. The playmates were twice joined by this third glider, the trio appearing as a rolling ball of fur from which three tails protruded in various directions, twitching and waving as the animals tussled. It seemed that one, or even two of the gliders sometimes retained their positions in the game by hanging off the third player, which itself hung by perhaps just one paw. A churring, chirruping sound was heard now and then, and sometimes a short, soft squeal, presumably when the game got too rough for one of the players.

Play between youngsters was frequently recorded and instances of play between sub-adult and adult – even the dominant male, Notchear – were observed. Amongst non-predatory animals play probably helps to establish rank order in the group, serves as training in the skills of attack and evasion for intra-specific fighting, and may help with dodging predators.

On one February night a commotion broke out amongst some of the gliders in Notchear's Lower Gilbey Range. I was watching one glider feeding on bloodwood blossom when suddenly two more came running down the branch of a nearby tree. Thinking that this was the start of another game I turned to watch the pursuit which turned back up the tree at tremendous speed. At times one glider would come

streaking down, stop, slip partly around the limb and race upwards again, all in an instant. These manoeuvres were accomplished with marvellous speed and fluidity. A distinctive call was audible during the pursuit, a fairly high pitched 'wook' and 'wook' again, every few seconds, and two or three times there was the long, hissing 'pheeah'. At one time there were three gliders involved, all clinging to a big branch, one of them somehow held captive by another while several pained protests were sounded. Then two of the gliders fell off the tree, parted in the air and skimmed safely away to separate trees. One of them I recognised as Notchear but the other glider was gone before I could see it clearly.

As the encounter had taken place in Notchear's range I concluded that he had been repelling an intrusion by another male. Raids into Lower Gilbey Range by gliders from outside the Notchear group's territory were not uncommon. In general the expelling of a male intruder was left to Notchear, while group females would set about the pursuit and expulsion of any female intruder.

Notchear's group down to four

Only once, on that memorable January evening, had I counted six animals in Notchear's group. Since that time I had not seen any more than four animals emerging from any den, or gathered to feed at any tapped stringybark. It was two of the adult females – Rono and Mum – that I no longer saw on my visits. By the end of March 1980 I gave up recording their absence, without any clue to explain their departure.

The two youngsters were frequently seen, apparently well settled into their parent's range. They had been seen to address each other with head rubbing and frequently addressed both Notchear and Lefnik in this way. Notchear had not been seen to reciprocate, but Lefnik was once observed delivering a head rubbing address to one of the sub-adults. Both sub-adults would of course have acquired the dominant male's scent through rubbing their heads against his tail, and then rubbing their heads against each other's tail.

Relations between Lefnik and the youngsters were not always settled and amicable. She would nudge or slap a youngster away from a coveted excision if it did not voluntarily give way. Yet there were times when she would bypass a youngster at a feeding site to keep the peace, I felt, rather than risk an altercation, as I had once seen her repulsed from a choice feeding site which she had advanced to occupy.

Notchear, perhaps because his position in the group was assured, was very tolerant of the youngsters. One evening at Main Tree I saw him lying comfortably atop a big bump on the tree with a youngster leaning over his body to nuzzle and groom him. The affectionate glider licked and nuzzled Notchear's neck and shoulders and rested its muzzle against his face. Next it drew still closer to place a front paw squarely on Notchear's head, then reached forward to touch noses, followed by more nuzzling beneath his chin and against his throat. All this while Notchear lay prone, seeming thoroughly content to be the recipient of these attentions. He continued to lie flat on the knur, ears splayed sideways, for a full minute after the youngster left.

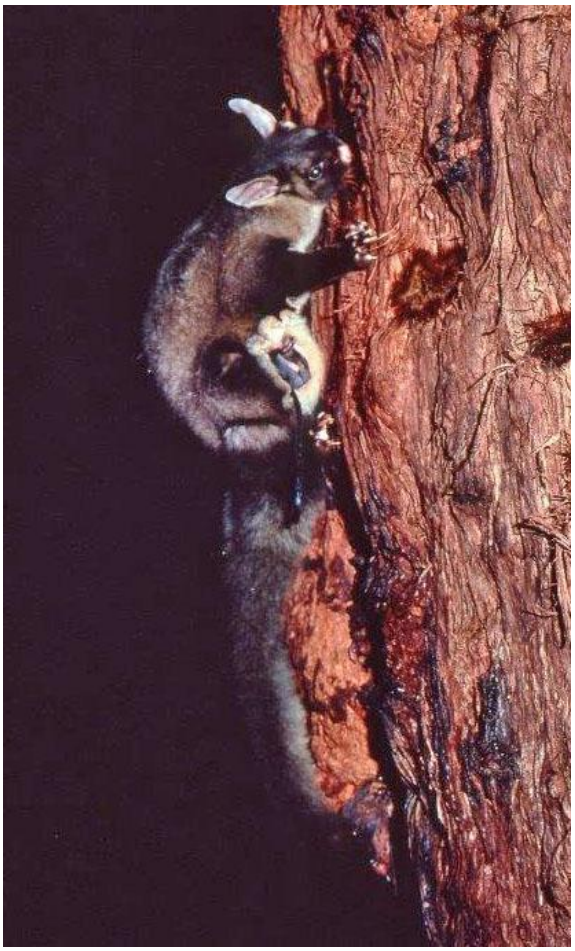
Rono reappeared in Lower Gilbey Range in late June 1980. She behaved with unremitting aggression towards both

youngsters from the moment they arrived at the feeding tree. She chased them without hesitation and they ran with maximum discretion. Each time the youngsters returned to test their reception the performance was repeated.

When Notchear arrived he and Rono appeared to ignore each other at first, but when she later attempted to deliver a head rubbing address he moved away. Last to arrive at Main Tree was Lefnik whose pouch was so distended by a joey at this time that her gait was noticeably awkward. However, this did not stop her from pursuing Rono as soon as she was discovered. Lefnik chased Rono far up the tree, doing so again and again every time Rono returned, trying to feed.

By the time of my next visit to Gilbey Forest two nights later, Rono had so thoroughly established her dominance over the two sub-adults that she no longer bothered to chase them away from vacant feeding excisions, and I observed one of them giving her a head rubbing address. But Lefnik was no more tolerant than before; she pursued Rono vigorously until at last the one-time member of the group withdrew and was not seen again.

By the middle of 1980 the sub-adults had become quite used to my presence and it became possible to catch both of them for examination and marking. I confess that I had come to expect both would be females because Notchear was so very tolerant of them, so it came as a surprise that both youngsters were males, leaving Lefnik as the only female in the group. By August 1980 the young males were no longer seen in their parent's home range, presumed to have gone to live elsewhere, although neither Notchear nor Lefnik had ever been seen to treat them with any significant hostility.



Lefnik carrying a large joey at the time Rono reappeared.

Virginia

With Notchear's range now tenanted by just a single pair of adult Yellow-bellied Gliders I looked forward to the appearance of the joey which had been recorded as a bulge in Lefnik's pouch in mid-1980. I had by now worked out that Yellow-bellied Glider youngsters remain in the pouch for 90-100 days and are then hidden away in a den for about 50 days before they begin venturing out by themselves.

By rough calculation Lefnik's joey could have been abroad by August 20th but it was not until 4am on the morning of September 19th that a characteristically dark limbed animal was seen at Mid Tree.

It went quickly out of sight with a timidity not shown by adults of the range. Half an hour later there were two gliders near the entrance to First Den, one of them trying to climb onto the other's back. These two were almost certainly Lefnik and her joey, with the latter being a little too affectionate, as some irritable chattering was heard before it was dislodged.

The new joey became accustomed to my trampings quite soon and was caught in mid-October 1980. It proved to be a female which I marked in the left ear, naming her Virginia to commemorate the month of September when I had first sighted her.

Mum re-visits

On the 13th November 1980 Lefnik's tail appeared to be lightly injured, with a small patch of fur missing about 11cm from the tip. Her tail was then fully mobile but three days later the patch had spread to encircle her tail, with the distal portion distinctly kinked. Despite this Lefnik was quite active and able to glide without any difficulty.

In January 1981 all three animals of Lower Gilbey Range – Notchear, Lefnik and Virginia – were suffering some disorder of their skin, particularly noticeable in the fur of the hindquarters. This disorder, which I termed 'white rump' gave the gliders a moth-eaten appearance, as though the fur had been carelessly cropped with blunt scissors allowing pale under-fur to show where the grey tips had been irregularly shortened.

The tip of Lefnik's tail looked still worse. It was no longer groomed, so that it now hung bedraggled, flopping at awkward angles from the point at which it remained attached to the rest of her tail. It seemed to hang by no more than a thread of raw, glistening skin or sinew and the glider seemed to suffer discomfort due to the problem. It was to be another two months before the tip of her tail looked more firmly attached and better groomed, even though it was still out of muscular control, flopping about for the rest of her life.

The white rump disorder was persisting in early March, so that the presence of a well-groomed glider was immediately noticeable. The stranger was instantly aggressive towards Virginia over whom it was completely dominant but the well-groomed glider was careful to give way to Lefnik who was surprisingly tolerant of the newcomer.

The only time I saw the stranger pursued and attacked by Lefnik was when the former had been chasing Virginia who accidentally ran headlong into her mother. The enraged Lefnik was just recovering from the collision when the stranger ran past, still in pursuit of Virginia. Lefnik charged after the stranger and caught it near the top of the tree; a good many squawks were heard until the stranger broke free and leapt into the dark.

The episode was reminiscent of Rono's visit eight months earlier, when she had taken instant dominance over the two young males who were part of Notchear's group at that time. A few nights later I caught the stranger. She no longer wore the tags but they had left marks in her left ear which satisfied me that this was Mum, once a full member of Notchear's group. I last saw her on the 22nd March, when she and Virginia fed at a tapped stringybark. Virginia circled Mum timidly, then advanced to apply a very thorough head rubbing address to the senior glider who had left, returned, then went again so mysteriously.

Ferox and Julius

When the Rose Gums flowered in April of 1981 the gliders fed less frequently on stringybark sap. Notchear's trio continued to look moth-eaten, but Lefnik, despite the white rump problem and her crippled tail, was seen to again be carrying a big joey in her pouch on the 26th May. As her pouch was empty a few days later I calculated that this joey, her third since I had started glider-watching, might be abroad in late July.

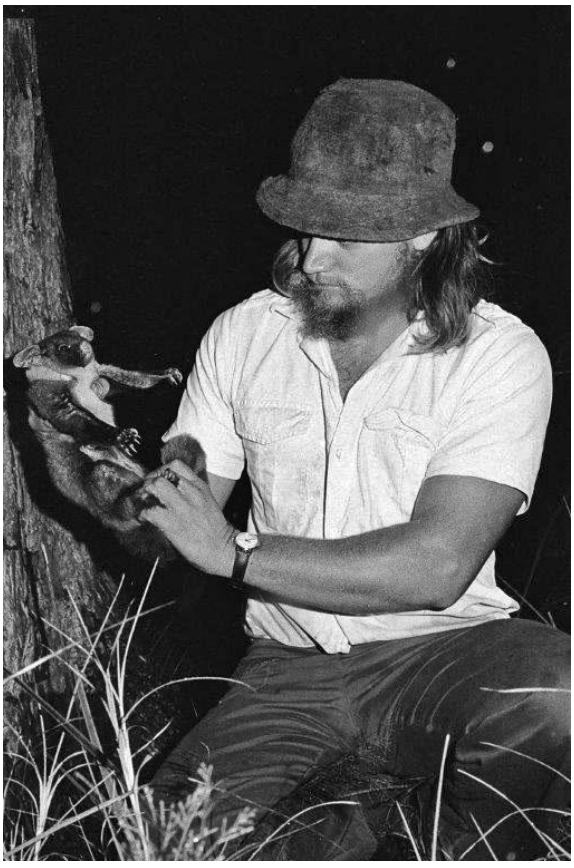
The winter of 1981 was very mild, neither as cold as usual, nor dampened by pro-longed drizzle.

Mid Tree was tapped in August, and on the 16th of that month the yield of sap was so prolific that by holding out a hand I could receive a drop of delightfully sweet sap every few seconds. Notchear and Virginia came to the tree while I was there, now looking almost recovered from the white rump disorder. They exchanged head rubbing and then pawed each other affectionately.

On the 27th August, while Notchear and Virginia fed at Mid Tree a young glider gazed down at them from the main fork. It was Lefnik's newest joey, ears-a-twitch. When Notchear stopped feeding and moved up the tree the youngster sidled up close beside him until the adult moved off. Lefnik came to the tree soon after, called, then went promptly up, too quickly for the joey running after her.

A short while later a Greater Glider alighted on Mid Tree and set off for the upper branches, as this tree was simply along its route to somewhere else. The young Yellow-bellied Glider followed it eagerly, much more able to keep up with this slower-paced animal. When the Greater Glider propped near the end of a branch to position itself for a take-off the youngster crowded up beside it, almost pushing the larger animal off its perch. The Greater Glider, far less agile than a Yellow-bellied Glider and less competent in the air, showed some aggression, with some scuffling and chattering taking place before the animals separated. It surprised me that the joey failed to recognise the difference between a glider of its own species and a quite different glider, in a forest where Greater Gliders were not uncommon.

A ladder went up in mid-September and the young glider was caught and bagged. Having fetched it down my companion Keith Smith and I arranged ourselves to examine, weigh and mark the animal. When we opened the bag to peep inside the youngster, which had been reclining on



Keith Smith with Ferox.

its back in a corner, launched itself at us, chattering fiercely while lunging with teeth and claws. This was a male which I named Ferox as a comment on his bold attack. Many months later I caught Ferox again, to see how much weight he had put on, and to examine the development of his scent glands. His behaviour on this occasion was just as fierce as that which had earned him his name. When first caught, on Sept. 15, 1981, Ferox weighed 300gms. On June 14, 1982 his weight was 450gms. Examination on this second occasion showed he had a small chest gland, a faint smear on the underside of the tail but with no gland discernible, and a slight parting of hair to mark his head gland, but with not enough exudate to cause a smear. On December 5 of that year, while still living in the home range of his birth, Ferox weighed 475gms. My last sighting of this bold glider was in late June 1983. At that time he was the dominant male in a range east of Gilbey Creek in company with two females.

On July 13 1982 Lefnik was feeding at Mid Tree and near her, goggling down at me, was her most recent joey, her fourth in four years. When this youngster ran off up the tree it ran into elder brother Ferox, who playfully patted and pawed at his sibling. There were several occasions on which I was able to watch Ferox with the new joey. One evening Notchear and Lefnik were at the sap along with two Feathertail Gliders which scampered about, appearing to consume more energy than sap. Content to wait for a view of the youngster I lay down on the ground and let the spotlight wander over the crown of the tree. Far up on a branch I spied two Yellow-bellied Gliders at play. Gradually, between frisking and wrestling they came down the tree, Ferox and the new youngster.

Another time the youngster was alone on Mid Tree when Ferox glided to the trunk and paced deliberately towards the younger animal. Once beside it he began tug-grooming the fur of its rump, jerking tuft after tuft through his teeth while the youngster clung tightly to the tree. A moment later Ferox attempted to proffer a head rubbing address which lifted the sub-adult's hind legs right off the tree, nearly knocking it to the ground.

When this glider was caught (July 22, 1982) it too was found to be a male which I named Julius to mark the month of his capture.

Six again in Notchear's group

Virginia was born in 1980 and was foraging independently by September of that year. She had continued to live in her parent's home range – Lower Gilbey Range – as third ranking member of her group. In August 1982 I saw that Virginia was carrying a large joey in her pouch. This meant that a female Yellow-bellied Glider is capable of reproduction at about 26 months of age. It may also have meant that Virginia had mated with her father, Notchear, the dominant male of the range, but it is possible that she may have visited a male in an adjacent range or – though less likely – a male from outside Notchear's range may have gained access to Virginia.

Her joey appeared alongside the adults at Main Tree in early December. The sap of this tree was attracting many visitors at that time – as many as six Feathertails, two or three Sugar Gliders and up to six Yellow-bellied Gliders each night. On the evening that I set out to catch the joey my companions were Ralph and Daffi Keller, photographer-naturalists from Melbourne,

along with my sons Jaimie and Konrad. While we waited for the gliders I made a few experimental attempts to catch Feathertails, achieving only one success out of about 20 attempts. My technique was to poise a cupped hand about 6cm from their bodies and then attempt to imprison the little possums against the trunk of the tree. On all but one occasion the little animals dodged me with such ease that I suspected myself senile. Finally I altered my method, simply pressing the glider's tail against the tree, which worked every time.

I made no attempt to catch either of the Sugar Gliders, being quite familiar with their energetic biting, plus the loud chatter they make when angry could have warned off the Yellow-bellied Gliders. I did however discover that it is possible to take gentle liberties with a Sugar Glider's tail without disturbing the wearer. The tail could be lifted by the hairs at the tip and bent one way or another without the owner seeming to take any notice. I felt especially fond of one little possum when it absently coiled its tail around my finger in a prehensile reflex.

When Virginia's joey came along it was easily caught and brought down in a pillow-case. There is a moment of particular delight when the bag is opened and the beautiful head of a young glider peers out. The delightful appearance draws involuntary murmurs of admiration from all those peering in. The captive joey was a female; she weighed 320gms and was named Daffi to commemorate the Keller's visit to Gilbey Forest.

As 1982 was overtaken Red Stringybarks began to flower, the lovely Rose Gums gleamed in newly revealed bark, cicadas clanged loudly and the heavens spared a little rain.

Seesaw

A glider named Seesaw

During 1978 my visits to Gilbey Forest were fully occupied with observations of Notchear's group. Most visits during 1979 were also concerned with the Notchear group and any other gliders which entered Lower Gilbey Range. But I had also begun to pay some attention to a second group of gliders occupying an adjacent area which I named Mid Gilbey Range. One of these animals – which I judged to be the dominant male – had a magnificent full call, loud and distinctive. The first syllables of the Skree-skrr-skree-skrr were so strongly emphasised that in my notes I named the caller "Seesaw" and referred to the animals of Mid Gilbey range as Seesaw's group.

I had tagged but not named one of the animals in Seesaw's group in mid-1979, and set out to capture Seesaw himself in late December of that year, when he was using a conveniently low excision on a tapped stringybark. A ladder was placed against the tree and the tagging party settled down to wait. Seesaw arrived and was still surveying the ladder and the humans when he was joined by a second glider, the female which had already been tagged. To judge by the enthusiastic way in which she was greeted by Seesaw I guessed the female was approaching sexual receptivity. Her responses to the male's advances varied between amorous dalliance and coy withdrawal. When both gliders began to feed I went up the ladder but they sensed my approach and climbed to the higher branches.

Seesaw stayed close to the female and from one or the other a succession of soft clicking noises could be heard, similar to 'buccal clicking' heard from some other possums. This sound is produced by a sort of tongue-in cheek procedure, independent of the vocal apparatus. Both animals were so eager to address each other with head rubbing that they once performed the manoeuvre simultaneously. This occurred when both gliders were on the same thin branch, one perched on it while the other was hanging upside down beneath the branch, facing in the opposite direction. By coiling their bodies each glider rubbed its head against the other's tail, the butting action causing both animals to twirl around and around the branch.

After some time a third Yellow-bellied Glider arrived at the tree, called softly and then descended to feed. Eventually Seesaw also came back to lick the sap, his tail within my reach. When lifted off the tree he wriggled in the air but made no sound until I began to put him in a cloth bag. At this he burst into an angry chattering which continued for some time after he was encased. Rather than examine him immediately I decided to keep Seesaw prisoner for a short while as there was a good chance of catching the other untagged glider still on the tree. The second capture was effected in the next few minutes and – as guessed, this glider was a female. A tiny joey was seen in her pouch, a first record of a small offspring in December. A single tag was fixed in her left ear, which generated the name of Onetag for this glider.

Onetag was set free, then Seesaw was taken from his bag to be marked with two tags in the right ear. Before he was set free

I took the opportunity to examine his chest for the presence of a scent gland. This examination was prompted by a small patch of super-white fur I had once seen on Notchear's chest while he was grooming. On Seesaw this patch was an elliptical shape about 1 cm long, the short white fur being matted by a pleasant, musky-smelling exudate. Scent from this chest gland may be used for rubbing on selected branches, but I had only once seen such an action. At other times a male glider has been seen to coil around certain twigs, perhaps in order to apply scent from the chest gland. A zoologist from Victoria, the late Steve Craig who visited as a guest, recorded the following observation: " . . . *the glider known to RR as Notchear, vigorously rubbing its chest backwards and forwards on a branch of Main Tree . . . This behaviour suggested that this animal was in fact scent marking via the chest gland, one of the prominent olfactory glands these animals possess.*"

Sharp-clawed hands and feet restrained to photograph the chest gland on an adult male. Photo: Steve Craig.

Having named Onetag I settled on the name Lostag for the second female in Seesaw's group as this glider had initially been fitted with two tags, but when seen in December she had lost one tag, leaving a slot in the margin of her ear. This plus the remaining tag allowed identification.

Seesaw and Notchear fight at Bow Tree

At one point close to the boundary between Notchear's and Seesaw's range stands a Red Stringybark I called Bow Tree because of a distinctive bend in the upper trunk. This tree bore no scars of tapping until March of 1980 when Notchear and some of his group, particularly the young males of that year, began to use it.

On March 27, 1980 I found Seesaw feeding at Bow Tree. While I watched, Lefnik, the senior female from Notchear's group, alighted on Bow Tree and was immediately chased by Seesaw! He overtook her as she fled along a branch and both gliders fell as they fought. They broke apart in the air in time to reach another tree from where Lefnik hurried further into Lower Gilbey Range with Seesaw in pursuit. Lefnik went to Bridge Tree, where a sub-adult of her group was already feeding. She arrived ahead of Seesaw but as soon as he got to Bridge Tree he chased both Lefnik and the sub-adult away before commencing to feed. Seesaw made no calls during this incursion and was still feeding at Bridge Tree when Notchear arrived. Before he could be caught Seesaw sped to another tree, clinging motionless to the trunk, wary perhaps that any movement might produce a tell-tale sound.

Notchear fed at Bridge Tree until he was drawn away by a Yellow-bellied Glider calling from another tree. Very soon after he had gone Seesaw reappeared at Bridge Tree but fled the instant Notchear returned. This time Seesaw went right back into his own range from where he sounded two loud full calls. To my ears Notchear's shrill response had the quality of a jeering wolf whistle.

Throughout the first two weeks of April various members of Notchear's group were seen at Bow Tree, but on the 16th Seesaw reappeared accompanied by the female Onetag. The female went off quite soon but Seesaw remained, announcing his presence with a loud call. Almost immediately two more gliders were seen bobbing about in the crown of a nearby tree. These were Lefnik and Notchear. Notchear crossed into the crown of Bow Tree and came running down toward Seesaw who advanced to meet him. The two males grappled and fell. They parted in the air, each one grabbing at the same thin Casuarina limb on which they sat, facing each other at less than a metre apart.

Neither animal advanced its feet but each made small to-and-fro movements of the body, as though caught between conflicting impulses to advance or retreat. Neither made any vocal sounds but Seesaw began to bite small shreds of bark from the branch he was on. Very gradually Notchear pulled back just a few centimetres, turning aside onto a thin side shoot of the branch he shared with Seesaw. With tiny steps Seesaw began a slow advance toward the other, at which Notchear turned to face him, advancing a little himself. The gliders stopped when about 15cm apart, without posturing or making any sound. Then suddenly Seesaw reared up and lunged forward, using his front feet to grab Notchear by the shoulders, sinking his

head as though to bite the nape of Notchear's neck. At this Notchear moved forward to clutch his opponent and both of them fell off the branch.

Because my hands were occupied with spotlight and binoculars I could not reach out to intercept the falling gliders in order to set them gently on the ground. The best I could do to break their fall was to put out a foot. Both animals struck the side of my shin and slid to the ground, the impact separating them. Each one lay completely still, awkwardly splayed amongst twigs and bracken, facing – by chance – in opposite directions. Very slowly both prostrate bodies pulled themselves onto a fallen log and set off in opposite directions with tottering steps, as though in the last stages of exhaustion. Just then a glider call from nearby galvanised both males. They leapt away from the log, each to climb the tree it found nearest. Seesaw went up Bow tree while Notchear went up another, nearby. Now Seesaw began calling over and over again, but Notchear made no sound until he had travelled a good way into his range.

After the fight with Notchear, Seesaw and female members of his group were quite frequently seen on Bow Tree. Seesaw used to announce his presence but Notchear avoided any further encounter. Despite his victory and consequent take-over of Bow Tree, Seesaw penetrated no further into Lower Gilbey Range, and Bow Tree itself fell into disuse after some weeks.

Julia

One hollow limb often used as a den by Seesaw's group is in a very large Rose Gum, about six metres in girth near the ground, a tree which I refer to as Big Gum. The runway in and out of this den is not straightforward but angular, bending first down and then up in the form of an elbow. The point of the elbow had broken out, providing a peephole by which to view the ground below and also an aperture large enough to let the gliders through. Although the residents sometimes used the end of their runway from which to glide away, the elbow aperture was more commonly used even though leaving the den by this route seemed more difficult to negotiate.

This den branch on Big Gum could be watched in silhouette from about 70 metres away, allowing a view of the gliders leaving in the dusk. On one occasion a glider launched from a high branch of Big Gum, sailing along a noticeably flat trajectory. It came towards me, whoop-whooping steadily as it sped along to clap onto a tree 20 metres past where I was seated. The butt to butt distance between the den tree and the tree the glider reached was 90 metres, with the target tree actually uphill of the den tree.

The jelly bean sized joey which had been in Onetag's pouch on December 31, 1979 when the female was tagged was not seen again until an eventful evening on July 18, 1980. This sighting came about because Big Gum also provided a roost for a pair of Sulphur-crested Cockatoos. These raucous birds usually returned to the tree at about the time that the gliders emerged from their den. On the 18th one of the cockatoos was already home before the first of the gliders lowered itself backward out of the elbow exit, coiled around the branch and set off up the tree. Soon after this the second cockatoo arrowed down, choosing a perch on a dead tree near Big Gum, roughly level with the gliders' den. A second Yellow-bellied Glider popped out and

scampered off, then a third lowered itself from the hole but paused half way out, its long tail waving in the breeze.

Without warning the Cockatoo flew from its perch and caught the glider's tail in its feet. Flapping and squawking, the bird hung from the glider's tail while it can be imagined that the glider clung to its den with desperate strength. After a few seconds of commotion the Cockatoo released its grip and flew back to its perch. The glider disappeared into its den but popped out an instant later and began to run up the tree. Once more the Cockatoo flew at the glider which turned, tried to re-enter its den, but lost its hold on the branch and fell headlong from the tree. It pitched down out of sight, leaving me to hope that it had suffered neither a bitten nor a broken tail, nor been injured by striking something sharp as it fell.

Later in the night I found Seesaw feeding at a tapped stringybark – Lane Tree. Beside him there was an untagged glider, not noticeably smaller than Seesaw but wonderfully fluffy and dark furred. I believed this glider to be Onetag's joey and guessed that it was the animal harassed by the cockatoo earlier in the evening. Perhaps being young and relatively awkward it had hesitated when leaving the den, inviting an attack by the destructive cockatoo. On the following evening I watched Big Gum again, but it was a cloud-packed sky so dull that I saw only one of the gliders leave the den at 6.18pm. When I walked over to Lane Tree Seesaw and Onetag were already feeding, but the young glider did not reach the tree till 7.47pm.

It commenced a vigorous panting sound as soon as it arrived in the upper branches of Lane Tree, having crossed into it from the adjacent branches of a nearby sapling. After brief pauses to feed at the highest excisions the youngster came down the trunk where it encountered Onetag. Approaching her without hesitation, the youngster placed a paw on her back and nuzzled along her ribs and flanks. Moving briskly Onetag scampered up the tree with the youngster following as fast as it could but in its hurry to keep up the young glider took a wrong turn. Before it had time to run back and find the right path Onetag had glided from the tree. Her departure was followed by a weak call from the youngster, a thin squeaking and churring parody of the full call of an adult. As though to emphasise the difference Seesaw immediately sounded his grand version of the full call.

Not many nights later I climbed a ladder to catch the youngster while it fed at Lane Tree. The bag in which I had encased the captive was opened amongst a cluster of friends gathered like thieves around a sack of booty. This glider was a female, the youngest I had handled, so we checked to confirm that her pouch also showed a septum. Beneath her long and fluffy coat the youngster was tiny, her ribs all too easily felt beneath the skin. She weighed only 270g, compared to the 450-520g weight of an adult. Her tail measured 39cm, about 4cm shorter than the average for an adult. I notched the tip of her left ear with a sterile surgical scalpel. The glider did not flinch and the operation was bloodless. Although I was a little squeamish about this form of ear marking I had resolved not to use any more tags because by now the pulling out of one tag had occurred, leaving a tear in Lostag's ear. The new addition to Seesaw's group was allotted the name of Julia to mark the month in which she had first taken to the air.

Jan and Jay

The Seesaw group reared no more offspring until the second half of 1981, and it was not until January 1982 that I saw a youngster alongside the adults. This was when the gliders opened excisions low on the trunk of a stringybark in a far corner of their range. This was 'Python Tree' where a python had once been found waiting in ambush on a nearby Casuarina. On the first evening that I set a ladder against Python Tree Seesaw and the youngster came along, but the latter was much too nervous to be caught. On the only attempt I made, creeping up in thick socks, taking the utmost care not to let my clothing rustle, I got by Seesaw without alarming him, but the sub-adult retreated out of range. The only satisfaction I had was in being able to pass by Seesaw again, on my way down, without causing him to move off.

On the next evening the first glider to arrive was Onetag, followed shortly by Seesaw and the youngster. Evidently Onetag had not been to Python Tree at all during the previous night for now the sight of the ladder seemed to surprise her and her nervousness was imparted to the other two. Each animal approached with utmost alertness, front feet dancing nervously during every moment of the descent as its quivering body weaved from side to side. With neck outstretched and ears cocked forward, each glider stared down, yearning for the sap even while its hind legs appeared ready to tug in the opposite direction, anxious to keep safe.

Watching this highly nervous performance, as though every rung was a two-headed python, it was difficult to believe that the gliders would ever relax enough to be approached and caught by a human. Gradually, after more than an hour, the desire to feed and urge to examine the ladder brought each animal nearer and nearer. They did not simply bypass the ladder but sniffed, clawed and even nibbled it before going to the sap. The young Yellow-bellied Glider came within reach a little after 8.30pm. I caught it by the tail and then encased it within a soft bag. The captive chattered loudly from within its prison but this had very little effect on either Seesaw or Onetag, each of whom scarcely looked up from their meal. The captive was a female weighing 385g. I marked the tip of her left ear and named her Jan to remind me of the month in which she had been marked.

Twelve days later I was surprised to see another sub-adult on the tree at which Jan had been caught. This sighting meant that Seesaw's group had reared two joeys in the previous year. The female Onetag was seen quite frequently but the other adult female – Lostag, had not been seen since October of the year before. While it was just possible that the unmarked sub-adult had been born to Julia, it seemed more likely that Lostag had carried it, although I had not seen her for several months. The youngster was joined at the tree by Julia, Onetag, Seesaw and then Jan, giving me the pleasure of seeing five gliders on the tree at the same time, all in excellent condition. Seesaw was addressed with a head rubbing by the un-marked junior, and only Julia got a slap when she was slow to move from a tapped site which her father wished to monopolise.

On the evening that I set a ladder against the tree the unmarked adult came along quite early and was easily caught. It too was a female which I named Jay, another contraction of January. She weighed only

340g although her tail was already 45cm long, which is the adult average. The rearing of Jan and Jay by the Seesaw group took Yellow-bellied Glider numbers in Mid Gilbey range to six, and that number was maintained throughout 1982, although Onetag – most dominant of the females, and Jay, the most subordinate, were often not found in the company of the other four.

Knur Tree

Of the half dozen or so Red Stringybarks in Mid Gilbey Range used by Seesaw's group, one stood quite near the boundary of Lower Gilbey Range. This tree, age-weakened and fire scarred, carried large woody protuberances on the trunk – burls or *knurs* – so I recorded it as Knur Tree in my notes. I had seen the scars of earlier tapping on this tree but it had not been used in the years 1979 to 1981. Fresh excisions were opened in February 1982, and Onetag was recorded feeding here on a night in early February. Seesaw was alongside her three nights later, and then Lostag made an appearance. I had not seen Lostag since the previous October and had begun to wonder if she had disappeared in the same way as Rono and Mum had gone from Notchear's group. Now, at Knur Tree Lostag was nervous but nevertheless approached Onetag to whom she delivered a head rubbing address.

Although Onetag accepted the address she prevented the other female from feeding. Lostag was chased some way up the tree each time that she moved down to feed at an excision. At the conclusion of each chase Lostag sounded a soft, squeaky call, similar to the weak full call produced by a very young female. I came to believe that this weak call, when used by an adult female, is used in an attempt to dissuade or appease an attacking glider by pretending to sub-adult status. However, on this occasion Lostag's efforts at appeasement did not work on Onetag, so the junior female moved off after some time.

I saw Julia at Knur Tree in March, feeding alongside Seesaw and Onetag. She suffered no hostility, yet four nights later her presence was not tolerated. Whenever she approached to within about 40cm of Onetag the latter would lift her head slightly to direct a stare at Julia. Generally the younger glider would pull back a few paces, but if she failed to withdraw then Onetag would run at her. Each chase lasted only a few metres, and Julia usually got away unscathed. Julia would then pant loudly as she worked her way gradually down the trunk again. Twice she skirted around Onetag in order to get further down the tree, aiming for an excision where Seesaw was feeding. But he too showed aggression, for when he performed the preliminary to a charge – head up and intent stare – Julia seemed to be insufficiently cautious and was twice caught by his rush. The male lunged with a front paw, stabbing his sharp claws into her thigh, at which Julia gave a burst of angry chattering as she pulled away.

Julia was not at Knur Tree the following night but Jan was there, and now she was twice chased by Onetag. Jan sounded the thin full call and for her this appeasement worked successfully, for within a short time her approach was permitted, and the two females rubbed cordially against each other. On this evening Seesaw was feeding lower down the trunk of Knur Tree. He did not chase Jan at all, but he ran at Onetag, at which the senior female ran rapidly up the tree, chattering irritably as she went.

I had no explanation for these hostile interchanges amongst members of Seesaw's group; a shortage of food did not seem to be the cause because Knur Tree was yielding well, and there was some Pink Bloodwood blossom available during February and March.

By the end of March five of Seesaw's group had been recorded at Knur Tree, with only Jay absent. Rank order amongst the females was quite clear, with Onetag at the top, then Lostag, Julia and Jan. It rained heavily throughout the first week of April, bringing much needed water to the forest near the end of a very droughty wet season. Knur Tree was disused on the 10th April and two days later I noticed the Rose Gums flowering. The gliders took to the tree tops and I caught only rare glimpses of them.

On the 3rd of June there was a lovely half moon on a balmy evening brightened by countless stars and numerous calls from the gliders. I was visiting Notchear's group but when I heard a burst of calling from Seesaw's range I was tempted across. Knur Tree had stood unused for eight weeks, but now Onetag was licking sap from a small excision.

While I watched her there was a 'whoo' overhead and a glider clapped onto the trunk. It was only an instant ahead of another arrival which swooped in to alight almost on top of the first. Of these two, one started off up the tree while the other came down toward the feeding Onetag. I was delighted to recognise Jay who had not been seen for the past four months. She appeared to be in fine condition but was timid of me because we saw each other so seldom. While Jay stared at the human two gliders called from a short distance away, at which Jay turned about to frisk up the tree.

By going in the direction of the calling animals I caught sight of a glider scampering along a Rose Gum branch. Suddenly it was joined by a second animal, then a third and a fourth, all of them spinning and curling around the same branch so rapidly that I found it easier to count the jutting tails than the bobbing heads.

Abruptly one of the four dived off the branch and those remaining followed quickly. I hurried after them, guided by a glimpse of a glider now and then, the sound of a 'whoo', the slap of a glider reaching a tree trunk, or a full call. The party of four gliders arrived at a huge Rose Gum dominating a ridge. They frolicked over the crown of the tree, involved in what seemed to be a follow-the-leader game – at one moment all four would crowd onto the tip of a stubby branch, then run down it and up another, leaping away from the same take-off point like children from a diving board. I enjoyed trailing after them in their high-spirited circuit, which now returned downhill, back towards Knur Tree.

By the time I reached Knur Tree Seesaw and Jan were there with Onetag, but calling by two gliders from about sixty metres away showed all five of Seesaw's group were around, even though I had only sighted four of them. On Knur Tree Jan addressed Onetag with head rubbing and then reached out a paw to momentarily restrain the senior female, before all three gliders went up out of sight. There were a few departing 'whoo' calls from the top of Knur tree as the gliders sailed off, leaving me well pleased to have observed such high spirits.

Notchear disappears, enter Seesaw

Seesaw moves to Notchear's Lower Gilbey range

The last day of January 1983 brought two surprises. Julius, reared in Notchear's range, was found feeding at Lane Tree in Mid-Gilbey range, with Jan, a female of the Seesaw group feeding beside him. And then Seesaw was found feeding on a tapped tree in Lower Gilbey Range.

The tree on which Seesaw was feeding was not one normally used by the Notchear Group but now Lefnik hovered near Seesaw, as though she wished to feed but was too timid to share the excision. Seesaw pretended to ignore her proximity. After some time he went off up the tree, simply sniffing distantly as he passed the female who now went to feed at the site he had vacated.

These two surprises, together with the fact that Notchear had not been heard nor seen since January 12 strongly suggested that he was no longer alive. His passing had evidently been noted by Seesaw and at least one other male Yellow-bellied Glider which was moving about in the range formerly controlled by Notchear. I was certain this glider was a male for I had glimpsed a tag shining in its right ear, but whether this was Reima, now missing one tag, or one of the sub-adults tagged in 1980, I never learned. Whenever I sighted this male Seesaw was also quickly on the scene to chase it, with more than one heavy fall occurring as a result of a tree-top fight.

Notchear's absence, presumed death, came five years after I had first seen him. The arrival of two adult males contesting Notchear's range may have been the reason why both the young males – Ferox and Julius – left their parental home range. Ferox I had not seen for many months but Julius was displaced to Mid-Gilbey range because Seesaw was now so busy in Lower Gilbey Range.

During February 1983 Seesaw was seen feeding alongside Lefnik and Virginia, all three quite relaxed in each other's company, with Seesaw receiving head rubbing addresses from both females. But Seesaw also continued to visit and feed at Knur Tree, so it seemed he had annexed this part of his former range to his newly acquired Lower Gilbey Range. However, because this tree had been part of Mid Gilbey Range it was also freely visited by female gliders of that range, who had been part of Seesaw's group. One evening I saw Julia giving Seesaw a thorough head rubbing address, which was particularly interesting because earlier the same evening I had seen her greeting Julius in the same way.

During March a few bloodwoods flowered so the gliders largely ignored stringybark sap. In April there were still a few bloodwoods flowering and some of the Rose Gums also bloomed. The only stringybark to be tapped during this month was Knur Tree, visited by *all* the gliders of Lower Gilbey Range.

On the May 18 I was watching Lefnik, Virginia and Daffi feeding at Knur Tree when a noise behind me suggested that a Yellow-bellied Glider had made a clumsy landing. Turning I saw a glider on a tree not

normally used along the route to Knur Tree. When the glider turned its head in my direction it was alarming to see that the spotlight was reflected unequally by its two eyes, the right eye giving a very dull reflection. A few minutes later Seesaw came down Knur Tree to feed, and it was clear that he was in trouble. Most of the right side of his face was so much inflamed that his right eye was almost obscured. I supposed that he had struck an obstacle while gliding, so either his eye or the flesh near it had been severely injured. It was worrying to guess at how his ability to steer when airborne, and his ability to judge distances might be affected if the sight of one eye was lost altogether. Although he did not appear much distressed on the first evening that I observed the injury he did behave with bad temper towards Virginia when she approached him, lunging aggressively at her before she got too close. This could have been to forestall any friendly or accidental nudging which he was too sore to tolerate.

Seesaw with a severely infected eye. Two tags visible in his right ear.

Two nights later Seesaw's face was greatly swollen and his right eye was entirely closed. He paused frequently in the course of feeding to stroke the inflamed area with a front paw, lick the paw and then repeat the action. This was a time of persistent drizzle in Gilbey Forest, which provided poor conditions for wound healing. A few days later I set a ladder against Knur Tree in order to have a close look at Seesaw's eye. By then the swelling had abated a little, so that the eyeball was just visible between barely parted lids. There were no signs of an external injury and because the eyeball itself did not appear to be ruptured I now supposed that the inflammation may have been due to an internal infection with massive result.

Because of Seesaw's eye trouble it was not a happy time for watching gliders, but I enjoyed one sweet interaction with Lefnik at that time. I had seen a slight bulge in her pouch, suggestive of a joey, so when I was up the ladder at Knur Tree and she came within reach I leaned out to feel her pouch. To start with I used a knuckle to imitate the contact of a head rubbing address against the underside of her tail. Lefnik seemed completely tolerant of this so I then introduced two fingers between her legs in order to rub the outside of her pouch, which definitely provided the feel of a small bump within.

This liberty allowed me by Lefnik was modelled on behaviour I had watched when a female with pouch young was addressed by another glider – the initiator frequently delivers not just a standard head rubbing but proceeds to burrow up between her hind legs, as though to satisfy itself about the contents of the female's pouch.

While Seesaw was disabled by eye trouble his temper was further tried by the surprise arrival of Onetag, looking totally dishevelled. The fur of her back and tail was matted into dreads, quite unlike the appearance of a well-groomed glider. I thought she had perhaps been feeding on pollen and nectar in the Rose Gum crowns all through the drizzly weather or that she had been living in an unsatisfactory den. Despite her unkempt appearance her vigour seemed in no way diminished as she quickly chased Lefnik and Virginia from Knur Tree, which she, of course, was accustomed to use as part of Mid Gilbey Range. Seesaw, however, charged her repeatedly, and would not let her feed. I saw her briefly at Knur Tree a few nights later, looking far better groomed, but her reception by Seesaw was no kinder.

Seesaw dies

Seesaw's eye healed slowly, but it never again reflected a spotlight with as much brightness as the left eye, and it often showed discharge around the rim. In the middle of June he developed a severe inflammation of his right front paw. It was so painful that he could not touch it to the tree trunk, instead holding it stiffly beside his body, except when he lifted it to his mouth in order to lick the inflamed digits.

The infection intensified rapidly – all the fur was shed from his paw, the flesh of which was red where it was not yellowish or greenish. The once delicate, almost bony toes were now so swollen that each one looked like a miniature carrot. The gliding flap along his right side hung bedraggled, either because of inflammation or because it may have actually become detached from the paw.

Onetag with dishevelled tail; cause unknown.

Yet Seesaw still occupied a high den in a tall Rose Gum. How he withstood the pain of scrabbling out of a den and of the impact of landing on Mid Tree where he spent each night, was beyond understanding. After reaching Mid Tree he would stumble down the trunk, three legged, to reach the best sap yielding excision where he clung beneath the sap as best he could. To climb up the tree Seesaw heaved and lurched pitifully, his sore foot waggling haphazardly in the air.

Seesaw with right forefoot heavily infected, not long before he died.

It seemed certain than the infection was not only taking a direct toll on his metabolism but it was also preventing him from feeding adequately due to the difficulty of getting to and from the tapped tree and exhaustion due to clinging to it, three legged. Yet the stricken Seesaw still found energy enough to sound his loud emphatic call, and on one night he even made a short journey towards Main Tree.

The females of his group appeared healthy and well groomed. Lefnik was still carrying the joey I had felt in her pouch, and Virginia's pouch was now also clearly occupied. In the sense that Seesaw had, by taking control of Lower Gilbey Range, spread his genes through a larger number of females and over a wider area, his shift from Mid Gilbey Range could be considered a success for him. But the females did not feed beside him on Mid Tree and offered no head-rubbing address, which may have been because Seesaw was obliged to protect himself from any physical contact by a show of bad temper.

Seesaw suffered yet more. By the 23rd of June his first toe had dropped off and his right eye was weeping heavily. The anguish of identifying with his pain night after night made me wish that he would either make a speedy recovery or succumb quickly. On the 1st of July I was with friends in Gilbey Forest, heading first to Mid Tree to see how Seesaw was doing. He was not at the sap but as I stood about I heard a scrab-bling in the grass nearby. Seesaw was on the ground. I picked the grand animal up and passed him to one of my friends. For the next few days, while in care, Seesaw fed avidly on a mix of milk, peanut butter and honey, reaching out to grasp the spoon with his left paw. He was snugly housed amongst soft blankets but after some days Seesaw developed what appeared to be pneumonia and died.

Seesaw had been the dominant male in Mid Gilbey range in 1979 when I first recognised his voice, so if he had been at least a year old before reaching dominant status, his death in mid-83 suggested an age of not less than five and a half years. I surmised that the effort of repelling other males in the take-over of Lower Gilbey

Range took too heavy a toll of his advancing age, and the infections he suffered may have been brought on due to a weakened immune system.

Netu and rejected pouch young

Even before Seesaw was taken from Gilbey Forest another male had become dominant in Lower Gilbey Range. Four nights before Seesaw was found struggling on the ground I saw a strange male feeding beside Lefnik who was seen to perform a head rubbing address. Being unused to my presence the male withdrew up the tree.

Lefnik continued to feed unperturbed. After licking sap for some time she walked a short way up the tree, then stopped, leaned back and appeared to groom within her pouch. She continued thus for about a minute, during which time a few muffled noises were heard, coming either from her or from her joey. When Lefnik resumed her journey up the tree her gait was hampered and to my dismay I saw her joey hanging outside her pouch, presumably still gripping her teat in its mouth. Lefnik climbed with considerable awkwardness, stopping at intervals, but without showing the joey any further attention. My last glimpse of the mother on that evening showed her hopping from the top of Mid Tree into the branches of an adjacent tree with the dark form of her joey dangling beneath her.

On the following evening Lefnik's pouch was empty. As her joey – the bulge I had felt at Knur Tree – was by now only about 50 days old this was far short of being old enough to be settled in a den, normally around the age of 90 days. Lefnik's joey was dead, possibly because of a deliberate act by the mother, which may have had to do with Seesaw's exit and the arrival of a new male in Lower Gilbey Range.

The strange male was seen each time I went to Gilbey Forest. About a fortnight after he was first sighted I watched him come down Mid Tree where Daffi was feeding. Daffi and the male addressed each other with head rubbing after which the male pushed himself against her chest. Daffi leaned back to accommodate him, rested a forepaw on his back and began to nibble the fur of his shoulders in an affectionate grooming.

On this night Virginia was seen with an empty pouch, again much too early for her joey to have been successfully transferred to a den. Thus, although Seesaw had successfully impregnated both Lefnik and Virginia during his domination of Lower Gilbey Range, neither of these two joeys survived. It is possible that the joeys were dumped by their mothers because their former bond with Seesaw was replaced by bonding with the incoming male.

When I caught the newly established male of Lower Gilbey Range in August 1983 he weighed 520g, a good weight for a Northern Yellow-bellied Glider. I took a piece off the tip of his right ear so it resembled the right ear of the departed Notchear, and called him Netu, made up from Notchear II. On the 1st November both Lefnik and Virginia were again carrying pouch young, supposedly sired by Netu.

Onetag leaves Gilbey Forest

There was never any doubt that Onetag was the senior ranking female in Mid Gilbey Range, whenever she chose to use this area. Yet in the years that she inhabited Gilbey Forest there were many periods during which I could not find her

Onetag, with tag and a large piece of her left ear missing through some mishap while she lived away from her group.

anywhere in what I assumed to be her home range. Where she went, and why, I never learned, but she may have lived an arduous life while outside Mid Gilbey Range. After one of her absences she showed up with a large piece missing from her left ear. At another reappearance she was utterly bedraggled, with the fur of her back and tail matted into dreads.

Yet she was always full of vigour and confidence, and whenever she came back to Mid Gilbey Range she attacked any female or youngster slow to recognise her superior claim to a feeding site. Onetag had been at Mid Gilbey Range during February 1983 after Julius had arrived, occupying the vacuum left by Seesaw's move, but I never recorded any close interaction between Onetag and the young male. I next saw her in May at Knur Tree when Seesaw had the bad eye, and again on October 18.

On that night I was accompanied by two naturalist friends. The three of us were watching Julius and Jan feeding on a Red Stringybark when I caught sight of Onetag in a nearby Casuarina. I was pleased to see her after yet another of her many absences. Looking bright and well, she groomed for some time, but when she began to move up the Casuarina there was clearly something amiss.

The gliding flap on her left side was hanging a little loosely from the wrist and each of the short jumps she made between branches were surprisingly clumsy. When she leapt across the short distance from

the Casuarina to the tapped stringybark she lost a great deal of height and it was plain that something had happened to her. Onetag climbed slowly towards a tapped excision where Julius was feeding but as soon as she got near him Julius rushed at the female. Onetag was pursued all the way to the tip of a high branch, from where she leapt outward but came steeply down, luckily reaching the top of a bushy sapling.

My companions and I ran up and bent the sapling over in order to lift the glider off. Inspection showed Onetag had a large, festering hole in the left flap which was swollen and likely very tender for she flinched at the lightest touch. I supposed that she had been involved in a fight with another glider on her return to Mid Gilbey Range, had fallen and been snagged on a sharp stake. Having seen that she could not glide and would not be allowed to feed peacefully in Gilbey Forest we decided to take her home rather than to leave her lingering.

Onetag licked honey off my fingers in my friend's home, and quickly settled into their household on a staple diet of honey and granulated pollen from a health food shop, supplemented with vitamins and insects in season.

Losing touch

1983 was a bad year for senior Yellow-bellied Gliders in Gilbey Forest. It began with Notchear gone, then Seesaw died. Onetag left Gilbey Forest in October. By November Lefnik, who had mothered four offspring — disappeared at an age of at least six.

Julius had been lucky to move into Mid-Gilbey Range after Seesaw took over in Lower Gilbey. His brother Ferox was sighted across Gilbey Creek in mid-1983, in the sector between Gilbey and Chunum, a creek flowing from hills to the south-east. I had sometimes seen Reima – a male tagged in 1979 in this area, but I could not know if he had died or had been displaced by Ferox who was feeding alongside Rolltip, a female who had formerly been with Reima. Also with Ferox was another female which I named Narelle when I caught her for examination and marking.

In 1984 I moved to Cairns, so visits to Gilbey Forest became fewer. Julius sired two youngsters, Iggy and Tober, while Netu sired Tavy. As well, I could see joeys making bulges in females of both Lower Gilbey and Mid Gilbey Range towards the end of '84, so I looked forward to a good glider population in 1985.

Instead I lost touch with several animals – Julia, Narelle, Tober and Tavy, as well as the senior female Lostag who had lived for at least seven years. Amongst the dominant males there was a shuffling of positions. Netu moved from Lower Gilbey to Mid Gilbey, displacing Julius and his son Iggy who moved to where I had seen Ferox, now disappeared. The dominant male in Lower Gilbey was now an animal I named Al, who may have come from upper Chunum Creek where I had seen sign of gliders but had seldom spotlighted.

After Lostag's disappearance Virginia became the oldest known resident of the study area. Born and earmarked in 1980, she was still active in 1986. In mid-85 she lost the use of one eye and lapsed into poor condition. She lost rank to her daughter Daffi whom she appeared eager to placate by frequent head rubbing and tug-grooming, while at times Daffi was

seen to nudge or chase Virginia from a feeding excision.

In July 1985 I saw Virginia forcibly mated by Al. My notebook reads as follows: *I heard two gliders as though in quarrel or play, small sounds of squeals or chattering. Next Al and Virginia arrived at a tapped Stringybark where they began to feed. The male suddenly caught Virginia who bucked and chattered and bit or tried to bite. But Al held on with all fours, and while pressing down with his head – I don't know if he used his teeth – I believe he made intro-mission with quite a long penis, perhaps three cm long. Virginia had one quiescent period of about five minutes but for the rest of the 15 minutes she struggled either mildly or energetically, pulling herself slowly up the tree all the while. When Al got off and moved aside to groom Virginia went slowly up the tree.* I was pleased that Virginia did not carry any young as a result of this incident, such a poor contrast to a very amiable mating I had recorded eight years earlier on my first night in Gilbey forest.

In early 1986, Virginia, although still blind in one eye, appeared to have regained her confidence and was active and noisy in Lower Gilbey Range along with Al, Daffi and an un-named youngster reared by Daffi.

Subdividing glider habitat

Part of the terrain used by the gliders is under direct Government control as State Forest. This area had been logged at least once and had just escaped logging when – in 1978, David Cassells of the Forestry Department agreed to protect the gliders. The remainder which included a large part of Mid Gilbey Range is privately owned as freehold. Parts of the freehold have been fenced, logged, burned, patchily cleared, bought and re-sold – usually in smaller portions and always at higher prices. For example, one 58 hectare portion was logged, then subdivided into five lots, four of which were quite small, the fifth – still forested, was sold as a 40 hectare block.

When the 40 hectare block came up for sale I spoke of it to a middle-aged man, an acquaintance who presented himself as a caring conservationist, someone who would preserve the land as forest habitat while occupying a minimal area for his home. Those of us acquainted with this man referred to him as *Wheatgrass*, because he was a fervent health-food addict who expounded the virtues of consuming large quantities of wheat-grass juice. It therefore came as a surprise to one day discover him buying several packets of Tim Tams in a supermarket. A portent, for a few years after buying the 40 hectares, Wheatgrass announced his intention to subdivide the land into five lots, each one to be marketed for more than the price he had paid for the entire 40 hectares. One motivation, he claimed, was that he could not afford the rates on the 40 hectares.

Because Wheatgrass had originally proclaimed his desire for privacy and his belief in conservation I suggested that he could reduce his rates and protect the habitat by donating most of the land to the National Parks and Wildlife Service, just keeping a small portion for himself. I also offered him an annual payment to subsidise his rates. These suggestions were rejected and a rezoning application was made to Herberton Shire Council. Because at least half of Mid Gilbey Range lay within this subdivision proposal I lodged an objec-

tion, as did some Queensland conservation groups. Regardless, the Council allowed the subdivision while imposing some conditions as a concession to the natural values. No dogs or cats were to be kept as pets, no block could be further subdivided, no trees could be felled without permission of the Shire Engineer, and all powerlines were to be put underground.

In the 1980s these conditions were widely acclaimed for their excellence as conservation measures, and real estate agents actually used the rarity of the glider habitat and forest type as inducements when advertising the blocks. But human settlement inevitably degrades forest habitat. Trees are cleared for house sites and garden plots, new fences are installed, people kill snakes and "chicken hawks" and vehicular traffic will leave a wake of smashed animals – frogs, snakes, bandicoots, echidnas and possums, run down by unseeing, uncaring or malicious drivers. The conditions imposed would save most trees and would save habitat for the most hardy of forest inhabitants but this would not include Yellow-bellied Gliders.

A few decades later Herberton Shire was abolished, becoming part of a greater Tablelands Regional Council. Dogs can be heard barking, cats have been seen prowling, lines of trees are felled to make way for new barbed wire fences and cars – mostly 4WDs, go by, day and night. Thankfully, there are still Yellow-bellied Gliders using Mid Gilbey Range but . . . .

Occasional visits to Gilbey Forest continued. In 2021 Yellow-bellied Gliders were still to be seen and their joyful calls still to be heard in this tiny forest. In 2022 the remainder of Mid Gilbey Range – which had also changed hands – was heavily thinned of all saplings, casuarina and other understorey growth, apparently to prepare the ground for seeding with pasture grasses to feed cattle. Knur Tree had stood on this property and it was in this portion of the glider's range that I had found one Rose Gum den used by the Seesaw group. While the best grown trees have been left standing, the value of the land as wildlife habitat has been decreased, and the long term effect on Yellow-bellied Gliders cannot be known. In March of 2023 I made a quick visit to lower Gilbey Range. Two Red Stringybark trees showed fresh tapping with a Sugar Glider and a Yellow-bellied Glider licking sap on one of them, while a Feathertail scampered on the other.

In 2022 much of Mid-Gilbey Range saplings and shrubs were felled, heaped and burned.

Counting gliders in the upper Daintree

In 1989 Dr John Winter, zoologist and biogeographer, was requested by ANZSES, a senior schools exploration group, to suggest some forest-based projects. One expedition John mapped out for a bunch of students was to walk east off the Windsor Tablelands Road to reach upland country in Daintree National Park where they would make observations on the forest and record signs of wildlife including Yellow-bellied Gliders. The students found their walk tough going but they made it into wet sclerophyll forests of the upper Daintree and did note trees tapped by Yellow-bellied Gliders.

This information was passed to John, from whom I subsequently acquired it. About 1995 my wife Juliana and I took much the same route as had been used by the ANZSES students, heading east off Windsor Road to walk into Daintree National Park. We agreed with the student's verdict that it was a tough walk. One steep hillside we climbed was crowned with the skeleton of a cow. Laughing at ourselves, we imagined that the cow had probably wandered to this spot from easier country further east but on looking down the steep, rocky slopes of the knoll it decided there was no way that it wished to continue. This generated the name 'No-way Knoll' for the hill we had just surmounted, which we were to stagger up many more times in years that followed, as it was part of one of our routes into 'the upper Daintree'.

On that short holiday I explored along an upper section of Daintree River, sometimes walking with Juliana and sometimes by myself. Walking up a tributary of the main stream one day I was surprised to see the

Juliana in a head wind atop No-way Knoll on the route from Windsor Road to the Little Daintree River.

sawn end of a branch that would have otherwise reached out across a patch of flat rock. Not far from the sawn branch, partly hidden under a bush, I found a gas bottle and up the far bank, stacked against a log, were several large bags of commercial fertiliser. Plainly, the patch of rocks had served as a landing ground for a helicopter while the fertiliser could only mean that someone intended to grow drugs in this remote part of the National Park. Further upstream I was happy to begin sighting Red Stringybark trees tapped by Yellow-bellied Gliders, extending knowledge of the area formerly visited by ANZSES expeditioners.

As a Ranger with Queensland National Parks and Wildlife Service, planning for fire management in Daintree National Park was one of my responsibilities. This employment gave me many opportunities to walk throughout the National Park, and "Gas Bottle Flat" as I named the exposed rocks became a landmark incorporated into many subsequent walks. At times helicopters chartered by National Parks have landed at Gas Bottle Flat. On one trip we loaded all the fertiliser bags into a cargo net which was then hauled out by a "chopper" to be lowered beside Windsor Road for transfer to a waiting National Parks vehicle. This avoided the risk of the bags deteriorating, allowing a huge amount of nutrient to run into the Daintree.

One of my roles as a Ranger with National Parks was to look for walking routes into the Park. After the vacation walk over No-way Knoll which discovered Gas Bottle Flat I planned a work-sanctioned walk from Mount Spurgeon on the Carbine Tablelands to go west into the country we had previously reached by coming east off the Windsor Tablelands. Combining map reading with guesswork, Juliana and I, together with a junior ranger and another bush-walking friend drove to a deserted hut near Mt Spurgeon on the Mount Carbine Tablelands, from where we made our way west, planning to reach the Daintree tributary, upstream of Gas Bottle Flat, where I had seen glider-tapped trees.

Coming down onto Gas Bottle Flat beside the Little Daintree River.

Before long we were seeing small bits of flagging tape, sometimes alternating with spots of orange paint on trees along the route we had planned, indicating that this route had been earlier used by persons unknown. Walking over a high but gentle hill which I nick-named Green Mountain, 1337m, and then the equally high Black Mountain, we were well pleased to reach the "Little Daintree" glider area in the afternoon, after a walk which was mostly through rich rainforest country. Poking about the next day in company with Will, my fellow ranger, I spotted the stump of a sapling that had been cut off at about knee height. Going cautiously up a gentle rise, alert for possible booby-traps, Will and I came across a beautifully built little hut, part log cabin and part plastic sheeting, surely a drug-grower's hut. Inside was a heavy calibre rifle and another gun, both supplied with plenty of ammunition. As well, there were many oddments, even a manicure set. There was also a petrol-operated pump, intended, I supposed, for irrigating the proposed crop. However, the more I looked around the more I felt that the builders of the hut had not gotten around to planting their intended crop. My guess was that they had gone to town meaning to return but something had occurred to disrupt their plans; perhaps, I thought, they had been arrested in town for some other unlawful involvement. I smashed both rifles on the afternoon I found them. On a subsequent trip a couple of rangers and I took the hut apart, and most of the heavy items were later flown out in a cargo net by the same chopper which earlier had carried out the fertiliser. We never heard from the drug growers, but we now had an easier walk into the glider country from Mt Spurgeon rather than by walking in off Windsor Road.

In 1997 I was asked if I could suggest a field excursion for a bunch of students from Sweden. I got in touch with John Winter and we soon worked up a plan to walk the students and their professor in to the Yellow-bellied Glider area of the stream I now referred to as Little Daintree. John and I had once before involved several persons in what I called a Listening Post survey of gliders in a patch of Windsor Tablelands country, and we thought we should be able to do a similar survey in the Little Daintree.

On a September Monday in 1997 three National Park 4WD vehicles from Mossman drove the rough track to Mt Spurgeon, needing almost two hours along a track which was very rough in those days. Two vehicles went back down but we kept one at Spurgeon just in case it should be needed. Our party of 13 – the 9 students, their professor Per Lundberg, John Winter, Juliana and I began the walk at about 9am, but only 11 of us completed it on that first day.

This was because one of the students, Asa, a willing and able girl, had the misfortune to stumble and pitch forward, driven by the weight of a full pack on her back. By strange chance as Asa went down she struck a stick which penetrated her cheek! Fortunately, John had placed himself at the tail of our long file of bushwalkers; confronted with Asa's injury he made an instant decision to escort the girl back to our vehicle, and from there to Mossman Hospital to make sure the wound was properly dealt with. Before turning back John explained his intention to the nearest of the students in our long file, but it was not until we took a rest break that this lad explained what had become of Asa and John. I was thoroughly grateful for John's

prompt decision to turn back with the injured girl, as this had spared the rest of us pondering about what should be done.

It was 6pm before we reached a small natural clearing beside the Little Daintree, overlooked by a grand veteran Rose Gum. Leaving the rest of our party to select tent sites I hurried off to search for an active glider tapped tree, which was fortunately found not far away. Nearing dark all of us gathered at the tree to see and hear Yellow-bellied Gliders. Many factors were against success: as we were late to position ourselves at the tree the nearest gliders were fully informed of our presence, there was a larger moon than is best for glider watching, and Turpentines were flowering early that year, attracting gliders to their blossom. I had just begun to apologise for these difficulties when a glider sailed to our tree and gave a grandly loud call.

By afternoon of the next day we had located several active trees which would be watched for 90 minutes beginning in the late dusk. Recording the time at which the greatest number of gliders were simultaneously present on a tapped tree, plus any glider calling very close by at that time, cross checked with results from each of the other observers, would provide an estimate of glider numbers in the area we surveyed.

In the late afternoon of our second evening, shortly before we set off to count gliders we heard a loud hail from the crest of the Great Divide. Several of the students recognised this call as being an Asa accomplishment and not long after we were welcoming John and the sturdy, cheerful Asa, now with her cheek mended. We excused them from watching and listening for gliders on that evening, while the rest of us, much heartened by their

Volunteer tents in the foreground of a flat dense with Rose Gums beside the Little Daintree River.

return, headed off to count gliders at our appointed trees.

During the following two days more active trees were found for glider counts each evening. On Friday morning we woke while it was still dark, ate, packed and were ready for the walk back to Spurgeon by 7am, carrying lighter packs in high spirits.

That first survey of glider numbers over three nights in the Little Daintree showed the population to be nearly as strong as the Windsor Tableland population John and I had once surveyed. The success of this first census led John and myself into discussing the possibility of repeating the survey every two years, which is how the biennial Daintree Glider Census was generated. We selected an area of 246 hectares threaded by the Little Daintree River, and at the next census we discovered more tapped trees within our appointed area. In time not less than thirty-five tapped trees, both active and inactive were located, each one numbered and marked with a stainless steel tag. The best count we have recorded came in 1999, with 26 gliders, while the most recent count – in 2022 – scored 16. This was a bit lower than counts from 2015, 2017 and 2019 with 18 gliders counted each year, which may suggest that 18 is around the carrying capacity of the census area.

Factors which influenced our choice of the glider census area were the good glider population, within a National Park and the World Heritage Area so it was safe from logging, and understorey vegetation on opposite sides of the Little Daintree is markedly different. The southwest side of the census area experiences fire which seldom crosses the stream. Consequently on the southwest side the tall eucalypt forest has a grassy ground layer, while across the stream the understorey in the northeast portion is occupied by rainforest shrubs, trees and vines, as well as some Lantana.

The role of fire in maintaining tall eucalypt forest – also known as wet sclerophyll forest – is debated. If fire burns through wet sclerophyll forest standing above a grassy understorey this tends to kill off any rainforest ‘invaders’: these are plants carried as seed by wind, birds or fruit bats from the nearest rainforest which commonly forms the eastern, uphill boundary of most wet sclerophyll forest in North Queensland. If fire does not occur in wet sclerophyll forest the grasses are steadily over-shadowed by rainforest species which thicken the understorey. Eucalypt trees dominating the canopy will flower and set seed as before, but eucalypt seedlings will not persist, dying off due to fungal infection in the heavily shaded under-growth. If the canopy eucalypts are not replaced by healthy descendants the time will come when the dominant trees die out and rainforest will replace wet sclerophyll forest.

However, the dominant eucalypts will continue to flower and produce seed for a century or two, leaving open the possibility that during such a long period phenomena as varied as prolonged drought, a severe frost or a strong cyclone followed by wildfire might kill off enough of the rainforest understorey to allow eucalypt seedlings to spring up and start a new generation of trees. Yet many forest managers believe that deliberate introduction of hot fires at frequent intervals is necessary to maintain a grassy understorey and to replace invading rain-forest with grass.

Tall eucalypt forest above a grassy floor is aesthetically very pleasing and is easy to walk in but maintaining such a forest by deliberate use of fire at quite frequent intervals has disadvantages. Some veteran trees will burn down, some of the potential replacement saplings will be killed and most will be set back. Additionally, the species composition of the dominant trees can be altered. Rose Gums may steadily disappear because they are less fire tolerant, and Red Stringybarks may be steadily replaced by Tindal's Stringybark (*Eucalyptus tindaliae*) and Turpentine (*Syncarpia glomulifera*), neither of which are tapped by Yellow-bellied Gliders. Therefore whether to burn at all, how frequently to burn and how hot to burn wet sclerophyll forests are all debated amongst forest managers and conservationists.

As a ranger with National Parks charged with using fire to maintain existing grassy forest, both in wet sclerophyll forest and in drier forests and woodlands wherever I had responsibility, there was no escape from this debate. Nor could I refuse to burn. We set some fires while walking the forests, but most were started by dropping incendiaries from helicopters. After each fire I walked the forest, usually alone, once with my immediate boss. Arguments will go on for decades, but both my boss and I were surprised and saddened to see how frequently big eucalypts were brought down with each fire. The ranger who took over my work after I retired mentioned burning from a helicopter along a grassy ridge on the wetter side of the census area. On a subsequent walk he found that big trees had gone down "like matchsticks".

Inevitably, those visiting the census area over twenty years have compared Yellow-bellied Glider use of the tall eucalypt forest on each side of the Little Daintree River. Over this period it has always been the case that more active trees have been found on the "invaded", wetter side of the stream than on the grassy side. This is despite the fact that for people searching for tapped trees, getting around on the grassy side is a lot easier than on the other. And we have always recorded a greater number of gliders on the tapped trees of the wetter side. The gliders seem to be retaining their preference for the forest on the wetter northeast side of the Little Daintree, although in each of the three most recent census years, 2017, 2019 and 2022, glider numbers have been lower on both sides. It is noticeable that on the wetter side gliders had tapped a few relatively skinny trees, not previously used, and on previously tapped trees they were now making excisions higher up the branches rather than on the main trunk. I have wondered if they might be seeking sections of the tree where the bark is thinner, or whether they are feeding higher to reduce the chance of being ambushed by Carpet Pythons climbing up through the surrounding understorey. But even though the gliders could readily exploit Red Stringybarks on the grassy side of the stream more than half the animals in the total count at each census are recorded on the trees of the wetter, rainforest-invaded side.

Although there have been gaps at times, with State politics or lack of funds causing census years to go by, this valuable project has persisted, maintaining a long term watch over a rare glider. The 2022 census was the 11th time that National Parks rangers and volunteers conducted the survey. Queensland National Parks and Wildlife Service now operates in partner-

Glider counters of 2017, including (back row) the author at far left, Dr John Winter 2nd from left, and National Parks Ranger Andrew Hedges fourth from left.

ship with Kuku Yalanji rangers, four of whom – two Kuku Eastern Yalanji and two Kuku Western Yalanji took part in the 2022 census, meeting Yellow-bellied Gliders in Daintree National Park for the first time and – having arrived at my 83rd birthday on the banks of the Little Daintree, I declared it to be my last trip.

Looking back over the more than twenty years that I have been walking both sides of the Little Daintree River, the rainforest understorey on the wetter side is not noticeably more dense than it was when I first visited with the Swedish students in 1997. One inescapable factor in the debate about deliberate burning in order to maintain a grassy understorey in eucalypt forests is that every fire adds methane and nitrous oxide to the greenhouse gases in the atmosphere, so worsening global warming. While the carbon dioxide sent up in smoke can in time be taken up by a fresh growth of plants, methane and nitrous oxide remain aloft, and the stature of big standing trees and the hulk of big logs consumed by fire will never be regained wherever frequent burning to keep grassy forests continues. I have come to accept that it is better for our planet to abstain from burning in forests and to take measures against wildfires, even if this means that some eucalypt forests will be overrun by rainforest and the end of Yellow-bellied Gliders. Other species of native wildlife will probably benefit; more tree kangaroos, more Musky Rat-kangaroos and more of those rainforest-ringtail possums less sensitive to an over-heating earth.

Northern Yellow-bellied Glider gains subspecies status

I had long supposed that the Yellow-bellied Glider of North Queensland, separated from those further south by about 400 kilometres and seldom showing a yellow or orange 'belly' was not an isolated population identical to the southern species, *Petaurus australis,* but more likely a distinct subspecies. I had made a mistake years before by adopting the name *Petaurus australis reginae* for the northern animal, this name having been applied to Yellow-bellied Gliders collected around Gin Gin in central-coastal Queensland, and therefore not specific to the north Queensland population. My incorrect use of *P. a. reginae* was dropped after the error was pointed out by John Winter and others, and since then the subspecies name erected for the central Queensland population was also dropped by the scientific community (Brown *et al*. 2006). Even so, zoologists thought the northern animal was most likely a distinct subspecies which was referred to as an 'un-named Wet Tropics subspecies of Yellow-bellied Glider, *Petaurus australis*.'

In 2004 a researcher from South Australia, Meredeth Brown, travelled to North Queensland to collect DNA samples from the North Queensland Yellow-bellied Glider population. I had by then retired from National Parks, but my successor in QPWS, Andrew Hedges, invited me and another glider enthusiast, Jane Blackwood, to join a trip to Windsor Tablelands which I had long considered to be home of the best Yellow-bellied Glider population in the north. Our objective was to find suitable glider-tapped trees on which Meredeth and her SA colleague could set cage traps.

We explored amongst Red Stringybarks in the wet sclerophyll forest, looking for currently active tapped trees with excisions low enough to make it likely the gliders would come down within the six or so metres at which cage traps would be set and baited. In a few days Meredeth had caught three Yellow-bellied Gliders, from each of which small bits of the ear were removed and stored in ethanol for DNA analysis back in South Australia. Subsequently, Jane Blackwood who was well acquainted with a population of Yellow-bellied Gliders in Tumoulin Forest, not far from Ravenshoe, helped Meredith to trap a fourth glider for sampling. The DNA work, done in a research laboratory run by the South Australian Museum, satisfied Meredeth that the northern Yellow-bellied Glider was sufficiently distinctive to be classed as an Ecologically Significant Unit (ESU). Her findings were published as part of her PhD thesis and were also set out in a peer-reviewed science journal. Meredeth's work, published in 2006, was at that time the only DNA analysis comparing northern gliders to the rest of the Australian Yellow-bellied Glider population, although based on a sample of just four gliders.

There matters stood until the 2012 advent of Campbell Newman as premier of an LNP government in Queensland. Under Newman's rule, State Forests in north Queensland were threatened with logging regardless of the endangered status of wet sclerophyll forest and the vulnerable status of its northern Yellow-bellied Glider inhabitants. Although northern Yellow-bellied Gliders could now be ranked as an ESU,

thanks to Meredeth's work, and were regarded as an un-named subspecies of *Petaurus australis* I felt that their political status might benefit if they received a formal subspecific name.

In discussion of the political advantage of gaining a subspecific name for the northern gliders John Winter pointed out that a larger sample than the four animals which Meredeth had trapped would likely be required, and he said there was a risk that further DNA analysis might actually show that the northern Yellow-bellied Gliders did not merit subspecific status! This was a risk I was prepared to take so John agreed to help with capturing more gliders to provide a larger sample for DNA analysis. John was then a part-time employee in the Threatened Species Program of the Queensland Environment and Heritage Department, which equipped him with the authority to catch Yellow-bellied Gliders for DNA sampling. After some enquiries we made contact with Professor Steve Cooper, leader of a research laboratory in the South Australian Museum where the work on samples from Meredeth's four northern gliders had been carried out and where DNA analysis of a range of mammals was continuing.

In July of 2014 Professor Cooper sent us several small vials of 100% ethanol in which bits of glider ears were to be preserved for transport to SA, and we accepted a target of six Yellow-bellied Gliders to be sampled. John and I decided that we would attempt our glider catching in Gilbey Forest. In the range once occupied by Notchear's Group Mid Tree was still being tapped 35 years later, and when we found our way back to Python Tree, in the range once occupied by Seesaw, it was good to see that it too was still in use.

I had never trapped Yellow-bellied Gliders, preferring to catch them by hand for a quick process of weighing, ear marking and pouch checking so the animal could be released as soon as this was done. I decided this was what I would do again, but there were two differences. The gliders were no longer accustomed to my presence and I was now 75 years old, while John was pushing 80!

In the winter of 2014 we set up a 12m ladder at Mid Tree, and a 6m ladder at Python Tree. The process of catching a Yellow-bellied Glider is simply described … climb the ladder, wait, wait, wait, eventually the glider will come closer and closer, wanting a feed. Wait, wait. At some point the glider will turn to face up the tree, which may bring its tail within grasping distance. Grab the tail, lift the glider off the tree, allow the animal to turn about and sink its teeth into whatever part of hand or arm it finds convenient. Wincing and grunting, come carefully down the ladder while holding the captive well away from your face. Once on the ground gratefully accept the assistance of your companion/s who will help to place the captive in a soft cloth bag.

There were many enjoyable parts to each evening's efforts. John and I would settle near the ladder well before the gliders were expected to emerge for the evening. My path to the foot of the ladder would be raked absolutely clear of every leaf and twig so there would not be the slightest creak or crackle on the walk to the ladder in soft-soled shoes. I wore a black jumper above dark overalls. On my hands I wore black mittens from which I had cut away the thumb to allow me the best possible

grip. My nearly white hair and beard was concealed by a black balaclava, and on my head was an LED torch the light from which was turned to a minimum and masked in a double thickness of red cellophane such as can be bought from a newsagent.

Each evening when a glider or gliders first arrived we sat tight so they could begin to feed with a minimum of anxiety. Once they were feeding close to the top of the ladder I would go up rung by rung, moving only when the gliders were not looking down toward me. Once near the top I kept my head down and my light off the gliders while John, using a red-filtered spotlight and binoculars provided a softly spoken commentary on their movements. When a glider we were aiming to catch turned its head away from me I would step up higher to get close enough to my quarry. It was important not to make a false move, yet my first attempt was mistimed and the next was clumsy so the glider stepped briskly away. On our first evening John and I went home without success but with more patience on the next evening I had one by the tail.

Down the ladder and into a pillowcase went the captive so the two of us could get ready for the next steps. Sterile scalpel ready, forceps ready, vial ready to receive the sample. Then the glider's head uncovered and held steady by me so John could hold the tip of an ear in forceps, slice off a small bit with the scalpel and drop it into the ethanol without contact from our fingers. Then a little piece off the other ear into the same vial. As I had learned in past years, cutting a piece off a glider's ear causes no bleeding and, astonishingly, the captive never flinches or squeals. I was so anxious to cause the glider a minimum of upset that we did not delay its release by checking sex or taking any measurements but set it back on the tree as soon as we had capped the vial. Predictably, the liberated glider did not rush away at top speed but paused not far above us while we gathered up our gear and removed ourselves for the night, pleased to have secured the first of the six animals we aimed to catch. John took care of the meticulous labelling of our prized vial before it was stored in a refrigerator.

One of the wonderful things about Yellow-bellied Glider behaviour is that after an animal has been caught for examination or for ear-marking it then seems to be less rather than more concerned by the proximity of an intruding human. It is as though the glider decides that whatever had previously happened was not so obnoxious that it should avoid feeding within arms-reach of the nuisance on the ladder. This delightful trait raised a difficulty at Python Tree after the first animal had been caught for ear sampling. As I literally kept my head down and still for most of the time that I waited on the ladder it fell to John to tell me if the animal nearest me had already been caught or whether it was one we needed to catch to provide the next ear sample. So John, using red light and binoculars, provided a soft commentary as one or another glider moved about not far above my head. And of course it was precisely one of the gliders we had already sampled which repeatedly stuck its face within 15cm of mine, or turned about to dangle its tail within easy reach.

Another complication was a Striped Possum that began visiting Python Tree to feed on the sap; this particular animal was so bold that it would chase the Yellow-bellied Gliders away from the excisions. The

A bold Striped Possum discouraged gliders needed for DNA sampling. Photo: Geoff Spanner.

Striped would arrive early which meant that the gliders would stay out of reach as long as the interloper was present. Striped Possums have fearsome teeth so I was not keen to do any more than give it a light slap but this scarcely moved the possum. Finally I caught it by its wonderful long tail and tossed it into the nearest shrub before it had time to turn and bite. As Striped Possums make prodigious jumps between trees, I knew that landing in a nearby shrub would be no great inconvenience to this interloper but served to keep it from the tapped tree for the next while.

After catching three of the four gliders visiting Python Tree John and I moved to the range where Notchear had once roamed. We caught one glider at Mid Tree and two on another tree nearby which gave us our quota of six. The biopsies were eagerly despatched to Professor Steve Cooper's laboratory in August of 2014, and

in the new year we had welcome news that DNA analysis showed the northern gliders had been separated from the rest of the Yellow-bellied Glider population in Steve's words "for hundreds of thousands of years, or more". John and I then had a 3-way telephone conversation with Steve when – in February 2015, he agreed to our request to take on the writing of a paper giving his support to subspecies status of the northern animal. Steve warned us that he had a great many unfinished tasks and papers to write, but that ours would eventually appear.

It was not until 2022 that a paper detailing the DNA work supplemented by careful skull measurements by two of Steve's colleagues, plus glider weights and measurements, all compared with animals of the main population, went to *Australian Mammalogy* where it was accepted and published online in January of 2023. The Northern Yellow-bellied Glider has the title of *Petaurus australis brevirostrum*, distinguishing it from Yellow-belied Gliders (*Petaurus australis australis*) – the main population. *Brevirostrum* can be translated as "short muzzle" and is based on skull measurements which set it apart from *P. a. australis*.

The short-muzzled Northern Yellow-bellied Glider, Petaurus australis brevirostrum*.*
Portrait by Jonathan Munro.

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Finding these gliders in a second patch of forest is owed to the late Frank Wieland of Herberton, who described the location of a tapped tree he had seen.

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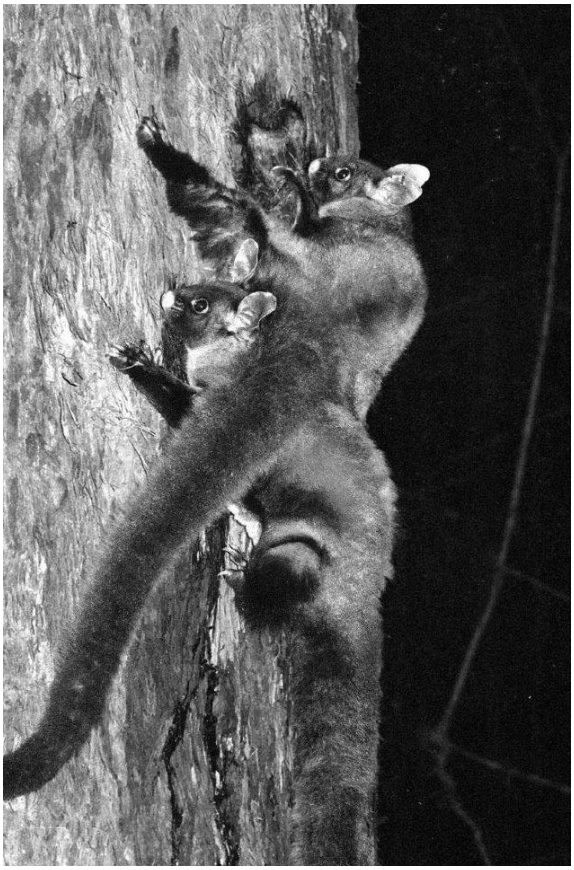
Without an immense outlay of time, patience and skill by Don Franklin, *Nights with Gliders* would not have progressed beyond an early manuscript.



The female Rono and a companion hoping to feed alongside.

On a young glider the inner surface of the ears is usually dark, the fur is extra fluffy, and darker markings are extra dark. Photo: Jonathan Munro.