FAUNA *of* AUSTRALIA

27. BURRAMYIDAE

VIVIENNE TURNER & G.M. MCKAY

Mountain Pygmy-possum–*Burramys parvus* [L. Broom]

Eastern Pygmy-possum–*Cercartetus nanus* [J. Wombey]

DEFINITION AND GENERAL DESCRIPTION

As presently understood, the family Burramyidae consists of seven species in four genera. Three of these genera (*Acrobates*, *Burramys* and *Distoechurus*) are monotypic; the fourth (*Cercartetus*) has four species. One species of *Cercartetus* occurs in both Australia and New Guinea, *Distoechurus* is endemic in New Guinea and the remaining species are endemic in Australia. As discussed below, recent evidence suggests that this family is not monophyletic and a new family may have to be proposed for two of the genera.

Burramyids are small scansorial or arboreal mammals ranging in size from 50–120 mm head and body length and 10–60 g in weight. All have short pointed snouts, large forward directed eyes and large ears which are either membranous or lightly furred on the outer surface. The head is long relative to the length of the body, giving a dumpy appearance. The long prehensile tail is lightly furred in the Mountain Pygmy-possum, *Burramys parvus*, and in *Cercartetus* species, but in the other two genera bears lateral fringes of long stiff hairs giving the tail a feather-like appearance. The hind feet are syndactylous and the clawless hallux is opposable as in other phalangeroids. Otherwise, the feet show no special modifications. In the Feathertail Glider, *Acrobates pygmaeus*, a narrow patagium or gliding membrane extends from the forelimbs to the hind limbs. The pouch opens anteriorly and contains four or six teats.

The skull is fragile with a narrow pointed rostrum and a slender zygomatic arch. Large posterior palatal vacuities are normally present. Variation in the structure of the basicranium is indicative of the proposed subdivision of this family (Archer 1984b).

The dentition is diprotodont with a general trend toward reduction in size and number of the teeth. Three upper incisors are present, the first larger than the other two. The large procumbent first lower incisor is followed immediately by a small tooth possibly representing a second lower incisor. The upper canine is frequently no larger than the first upper incisor. Three upper premolars are present in all but the Mountain Pygmy-possum, which has lost the first. In this genus the third premolar is greatly enlarged and blade-like with a serrated cutting edge (Fig. 27.1). Three lower premolars are present, the third corresponding to its upper counterpart in the Mountain Pygmy-possum. The presumed transitory first molar has not been described (Archer 1984b). The molars, which show a simplified crown pattern compared to other diprotodont marsupials, decrease in size from front to back. The fifth molar is either a tiny tooth or entirely absent.

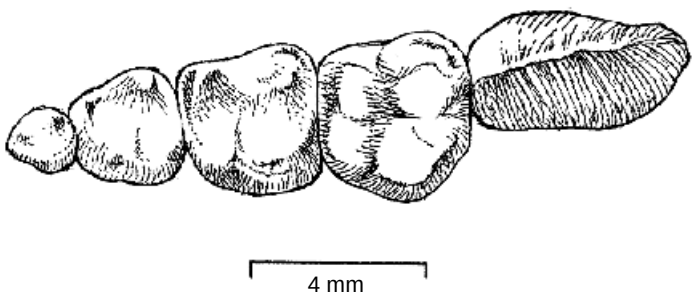

Figure 27.1 Cheek teeth of *Burramys parvus* showing the large premolar. (© ABRS) [F. Knight]

Diagnostic characters are: size small; tail prehensile, sparsely or distichous haired and occasionally incrassated; skull delicate with short pointed rostrum and slender zygomatic arch; molars with simplified crowns decreasing in size posteriorly with fifth molar either very small or absent.

HISTORY OF DISCOVERY

The first species of burramyid to be discovered, the Feathertail Glider, was described by Shaw (1794) as *Didelphis pygmaea* from a specimen obtained in the Sydney area. The first *Cercartetus* was discovered in Tasmania by Péron and Lesueur and described as *Phalangista nana* by Desmarest (1818). In the same work, Desmarest proposed the new generic name *Acrobates* for the earlier described species. Gloger (1841) proposed the name *Cercartetus* for *Phalangista nana*, but this name largely was ignored and the generic name *Dromicia* Gray (1841) was used widely for this genus. The western species was first described as *Dromicia concinna* by Gould (1845b). The tropical species was first described by Milne-Edwards (1877) as *Dromicia caudata* and was based on specimens from New Guinea. This species was not discovered in Australia until 1913. The fourth species of *Cercartetus* was not recognised as a distinct species until described by Thomas (1888).

Perhaps the most exciting discovery of any Australian mammal was that of the Mountain Pygmy-possum. This species was first described as a Pleistocene fossil by Broom (1896a), who considered it to be a distinctive and important species which might form a link between the phalangerids and the macropodids. Broom's material was limited and *Burramys* remained an enigma until the work of Ride (1956) demonstrated clearly that its affinities were with *Cercartetus* and not with the macropodids. The accidental discovery of a living specimen in a ski-hut on Mount Hotham, Victoria in 1966 confirmed beyond all doubt that this species was not a miniature macropod. It is known now from populations around Mount Hotham, Victoria and Mount Kosciusko, New South Wales.

MORPHOLOGY AND PHYSIOLOGY

External Characteristics

The diagnostic external features have been described above. Colour varies from fawn to grey tinged with either brown or a rusty red dorsally and from pale grey to white ventrally. In general, older animals exhibit a warmer coloured pelage. All burramyids have darker fur surrounding the eye which is especially well developed in the Long-tailed Pygmy-possum, *Cercartetus caudatus*, and the New Guinea Feathertail Possum, *Distoechurus pennatus*. *Cercartetus* species and the Feathertail Glider have expanded apical pads on the digits of fore- and hind feet (Jones 1924) (Fig. 27.2).

Body Wall and Skeletal System

Most species have a generalised mammalian body plan. The only specialisation occurs in the Feathertail Glider, where a patagium extends from the elbow to the knee (Russell 1983). The patagium is relatively narrow compared to the gliding petaurids, but is fringed with long hairs which extend its effective size (Jones 1924). The patagium (Fig. 27.3) consists of a fold of skin cemented together with connective tissue, which is invaded with muscle fibres and extensions of muscles from the shoulder girdle (Johnson-Murray 1987). The marked differences between this structure and those of the petaurids are indicative of the independent origin of the patagium in these groups. Unlike the gliding petaurids, the Feathertail Glider shows no marked elongation of vertebrae or limb bones

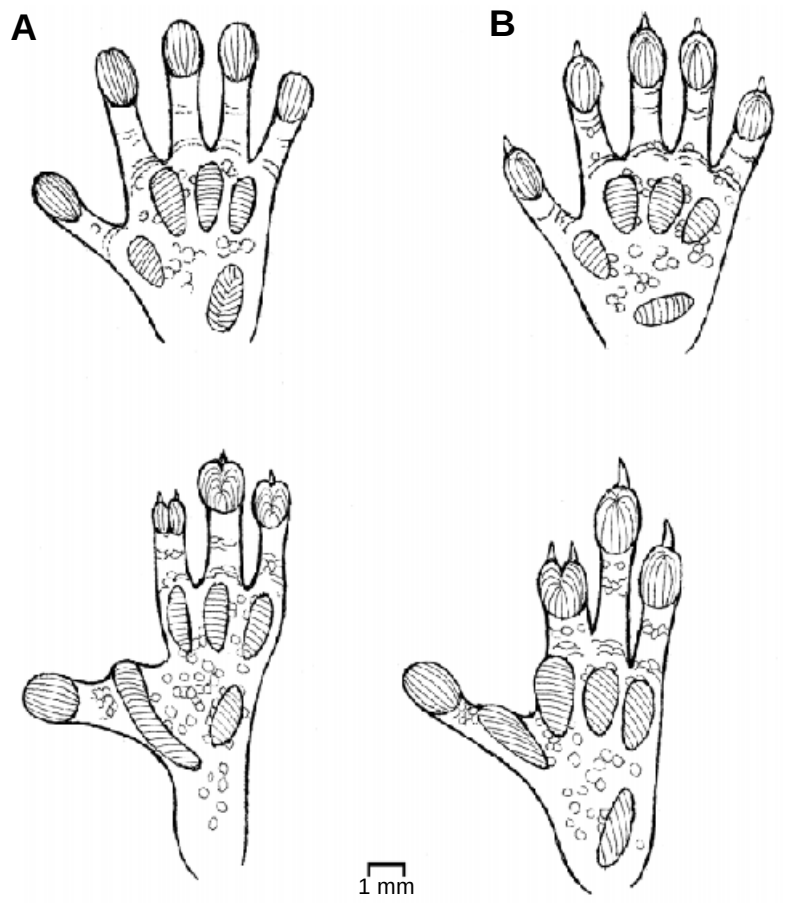

Figure 27.2 Expanded apical pads on the digits of the fore- (top) and hind (bottom) feet of *Cercartetus* spp. **A**, and *Acrobates pygmaeus* **B**. (A, After Jones, 1924; © ABRS) [F. Knight]

associated with the evolution of volplaning. In such a small animal, the presence of the patagium alone presumably is sufficient to provide the necessary increase in surface area.

Locomotion

Burramyids are agile animals, able to negotiate the smallest branches of trees and shrubs using the prehensile tail as a 'fifth hand'. Russell (1983) stated that the expanded apical toe pads of the Feathertail Glider allow it to cling to smooth vertical surfaces, including glass. While only this genus can glide, members of *Cercartetus* can leap considerable distances (see, for example, the photograph in Smith 1983).

Feeding and Digestive System

Burramyids rely to varying degrees on a mixed diet of invertebrates, soft fruits, seeds, nectar and pollen (Smith 1980). Preferred diet items are sought actively, but they will utilise unusual abundances of less preferred foods (Turner 1985). Although burramyids will eat small prey whole, the wings, head and much of the exoskeleton of larger insects and the claws and scales of lizards, are usually discarded (Hickman & Hickman 1960; Troughton 1966; Woolley & Allison 1982). The Burramyidae are adept killers and can seize moths in flight. Prey are usually killed by bites to the head and thorax with the upper canines and lower procumbent incisors (Woolley & Allison 1982).

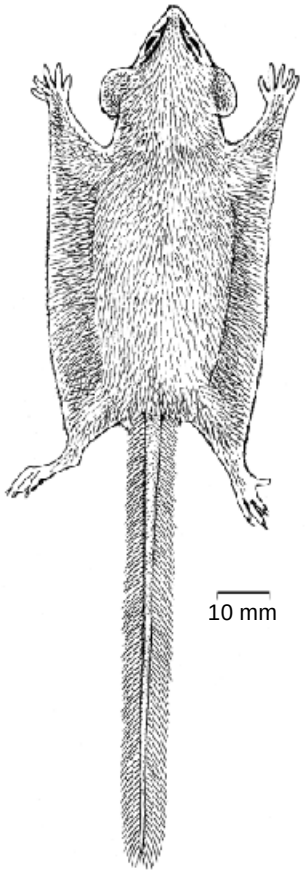

Figure 27.3 Dorsal view of *Acrobates pygmaeus* illustrating the narrow patagium which extends from the elbow to the knee on each side of the body. Scale 3/4. (After Jones, 1924; © ABRS) [F. Knight]

The feeding behaviour of the Mountain Pygmy-possum has been described in detail. After testing with the nose, it picks up an item of food with the incisors before transferring it to the forepaws where it is held while the animal squats on its hindquarters. The incisors are then used to bite off fragments of soft bodied insects, remove the skins from soft fruits or to extract seeds. The large, grooved and serrated premolars enable it to obtain access to foods with a hard exterior such as large chitinous insects and seeds with thick coats (Troughton 1966; Dimpel & Calaby 1972; Kerle 1984a). With the exception of the use of the specialised premolar, feeding behaviour in other burramyids is probably similar.

The Feathertail Glider and *Cercartetus* species use their forepaws to hold floral parts open in order to obtain better access to nectar (Fig. 27.4), which they extract with their long, brushed tongues (Figs 27.5 & 6; Turner 1985). The papillae on the tongues of these burramyids are longer and finer than those found on the tongue of the New Guinean Feather-tailed Possum, *Distoechurus pennatus*, (Woolley & Allison 1982) and the Mountain Pygmy-possum (V. Turner personal observation). Turner (1985) suggested that the increased surface area of these narrow, elongate papillae might increase the efficiency of uptake of liquids such as nectar and small particles such as pollen. The flower-visiting burramyids occasionally lick pollen straight from flowers, but it is ingested primarily during bouts of fur grooming. Pollen is transferred from the fur to the claws and the teeth extract the accumulated pollen from under the claws.

All burramyids have a simple gut structure, typical of omnivorous animals (Hume 1982; Turner 1985) and the well-developed caecum undoubtedly plays a role in the digestion of plant material.

In some populations of the Feathertail Glider and *Cercartetus* species, protein-rich pollen and energy-rich nectar are major components of the diet (Turner 1984a, 1984b). Pollen grains are too small to be cracked by the teeth and mammalian gut enzymes are incapable of degrading the cellulose walls of

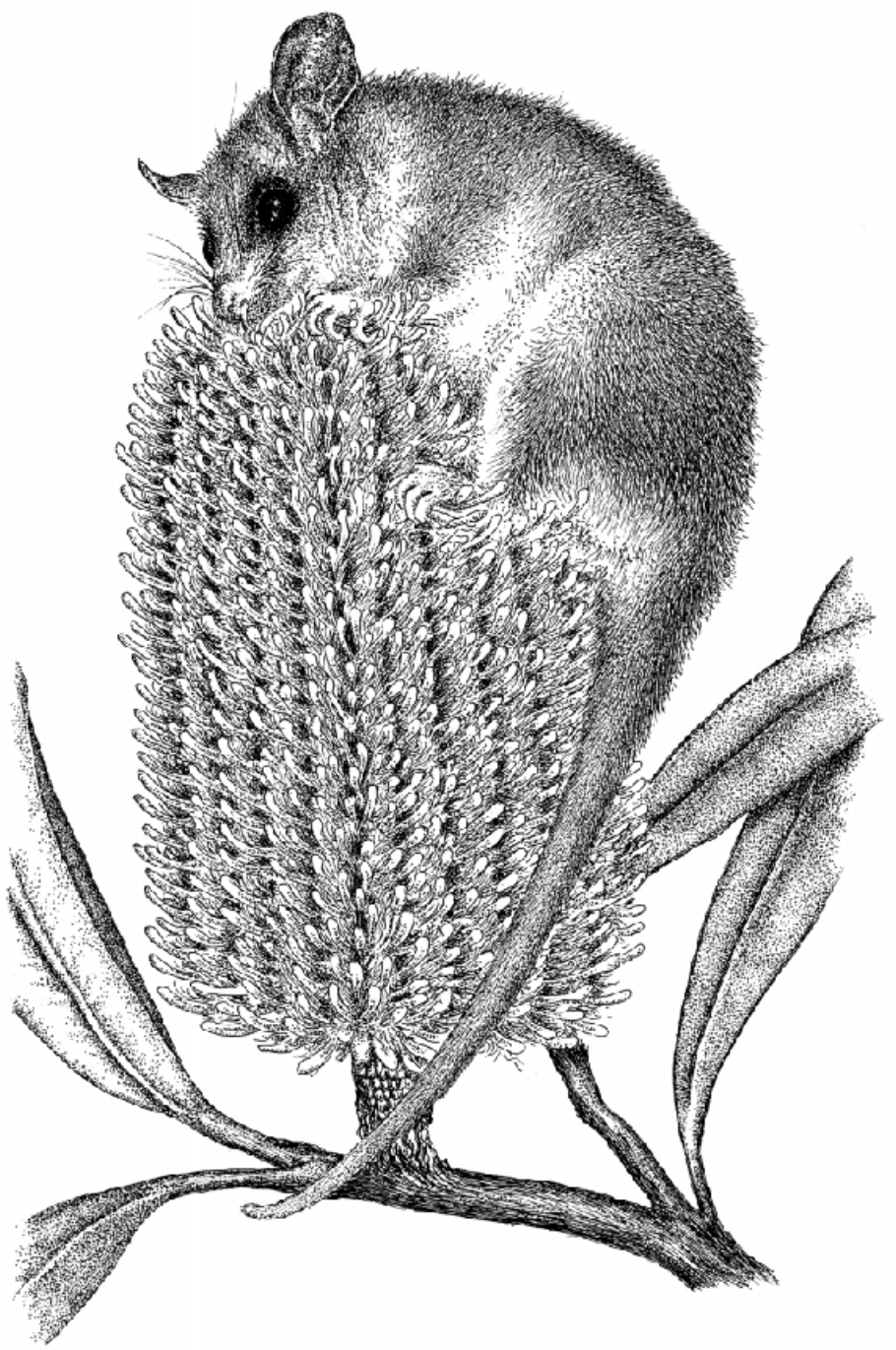

Figure 27.4 *Cercartetus nanus* collecting nectar from the inflorescence of a *Banksia*.(© ABRS) [K. Hollis]

pollen. Protein, however, may be liberated by microbial fermentation in the caecum. Although the liberated protein may be largely exploited by the microbial population in the caecum, the reingestion of caecal-derived faecal material (caecotrophy) and subsequent digestion of the contained microbes provide these small marsupials with an easily digestible source of protein (Turner 1985).

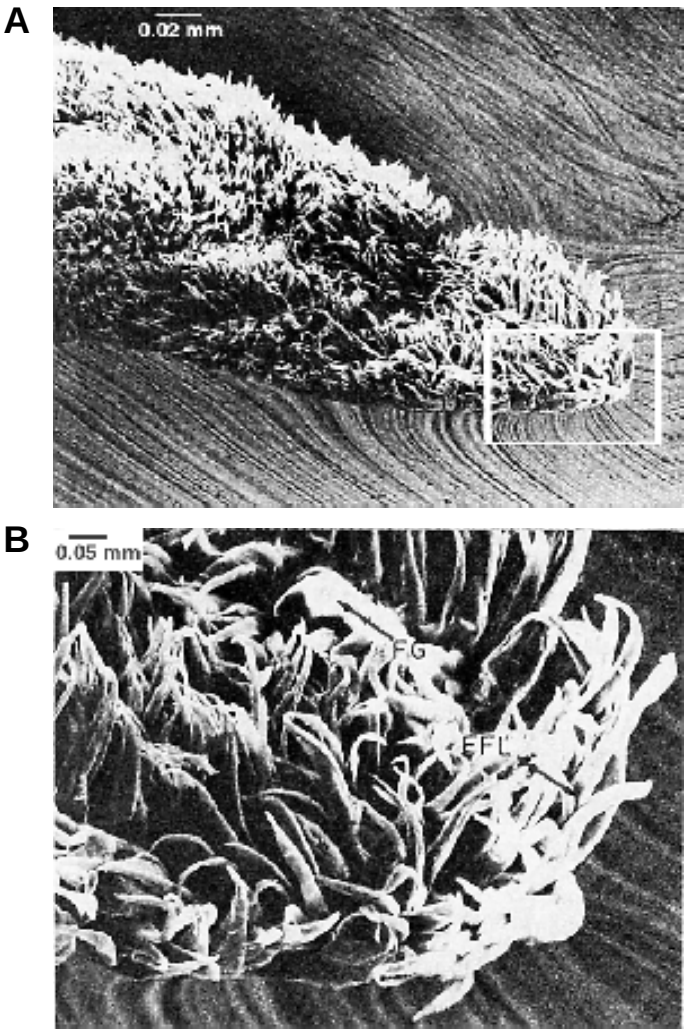

Figure 27.5 Scanning electron micrographs of the dorsal surface of the tongue of *Acrobates pygmaeus*. **A**, End of tongue; **B**, Tip \emdash FG = Fungiform Papillae, FFL = Fine Filiform Papillae.

Respiration

The thermal physiology of burramyids has been studied in some detail. The Feathertail Glider, the Mountain Pygmy-possum and *Cercartetus* species have a standard metabolic rate (SMR) which is lower than that predicted by models drawn from studies of other marsupials of a similar size (Hudson & Bartholomew 1964; Fleming 1985a, 1985b; Lee & Cockburn 1985). This lower SMR may both facilitate entry into torpor and reduce energy expenditure at high ambient temperature (Hudson & Bartholomew 1964). Further, lowered metabolism would reduce absolute food requirements. This may be an advantage to small homeotherms living in heathlands where they typically experience fluctuating and unpredictable foraging conditions and food resources (Turner 1985).

The body temperature of these small possums stays between about 35°–36°C over a wide range of ambient temperatures and the thermal neutral zone is typically described by a fairly narrow range of ambient temperatures. The Mountain Pygmy-possum, however, is intolerant of ambient temperatures over 28°C (Fleming 1985b). Although *Cercartetus* species and Feathertail Gliders do not show the typical mammalian responses of panting and licking the fur in order to dissipate heat, they are known to survive temperatures as high as 38°C (Bartholomew & Hudson 1962; Fleming 1985a). At high ambient temperatures, some burramyids have been observed with their bodies extended, with conspicuous vasodilation of the nose, ears, feet and tail (Bartholomew & Hudson 1962; Fleming 1985a, 1985b).

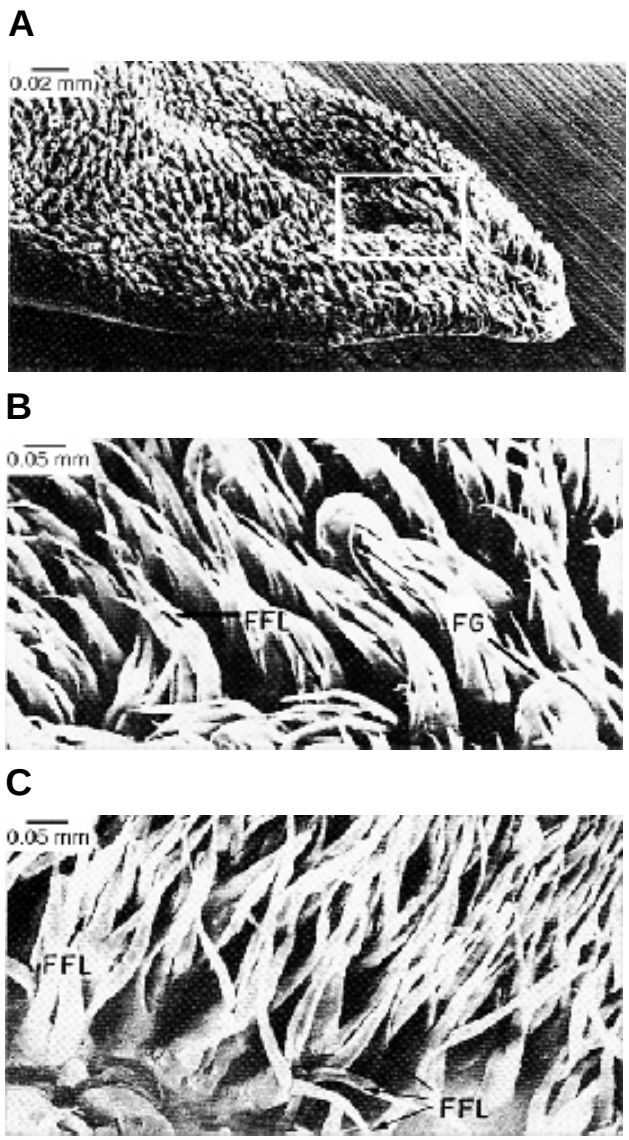

Figure 27.6 Scanning electron micrographs of the dorsal surface of the tongue of *Cercartetus nanus*. A, End of tongue; B, Near tip (Detail of A) \emdash FFL = Fine Filiform Papillae, FG = Fungiform Papillae; C, Near Back \emdash FFL = Fine Filiform Papillae (eight filaments).

The Feathertail Glider and *Cercartetus* species have a labile body temperature whereas the Mountain Pygmy-possum does not (Bartholomew & Hudson 1962; Fleming 1985a, 1985b). There is some controversy over the correct terminology for the states of dormancy exhibited by the Burramyidae (Fleming 1985a); it commonly is referred to as torpor. The labile body temperature exhibited by the Feathertail Glider (Fleming 1985a) and the Eastern Pygmy-possum, *Cercartetus nanus* (Bartholomew & Hudson 1962), however, can sometimes make it difficult to distinguish between states of adaptive hypothermia and torpor. This problem does not arise with the Mountain Pygmy-possum, which strictly regulates its body temperature close to 36°C in ambient temperatures from 2°C–28°C (Fleming 1985b). The Mountain Pygmy-possum and Eastern Pygmy-possum probably qualify as true marsupial hibernators (Hickman & Hickman 1960; Bartholomew & Hudson 1962; Wakefield 1970; Fleming 1985b).

Torpid burramyids express reductions in the following suite of behavioural and physiological responses: surface area to volume ratio; responses to external stimuli; heart rate, body temperature, oxygen consumption and metabolic rate. Prolonged periods of apnea (non-breathing) also are exhibited.

Torpor may be induced in captive Feathertail Gliders and *Cercartetus* species by reducing the ambient temperature or by food deprivation (Wakefield 1970; Fleming 1985a). Low temperatures (Hickman & Hickman 1960) and

high rainfall (Wakefield 1970) markedly increase the incidence of torpor in captive *Cercartetus* species and free-living Feathertail Gliders (Frey & Fleming 1984b). Low temperatures do not always induce torpor in the Burramyidae and the Eastern Pygmy-possum has been recorded active at ambient temperatures as low as 2°C (Bartholomew & Hudson 1962). Further, the Feathertail Glider and *Cercartetus* species can become torpid despite a T_a of 27°C and with abundant food available (Conway 1939; Hickman & Hickman 1960; Bartholomew & Hudson 1962; Perrers 1965; Atherton & Haffenden 1982).

In contrast, torpor is difficult to induce in captive Mountain Pygmy-possums. Starvation does not induce torpor in this species and Fleming (1985b) has limited data which suggest that this species must weigh at least 50 g before becoming torpid. Although this requirement is not shared by other Burramyidae (Frey & Fleming 1984b; V. Turner unpublished data), several eutherian hibernators have a body mass threshold which must be exceeded before torpor can be induced (Lyman 1954; Wang & Hudson 1971).

The Feathertail Glider, and to a lesser extent the Eastern Pygmy-possum, show an unusual rise in oxygen consumption directly before entry into torpor (Bartholomew & Hudson 1962; Fleming 1985a). Whether this is also characteristic of other burramyids is unknown. The Feathertail Glider also exhibits a unique and rapid decline in oxygen consumption on entry into torpor (Fleming 1985a).

The Mountain Pygmy-possum and *Cercartetus* species often stay torpid for several days. The longest episodes recorded are 7 days in *Burramys* (Dimpel & Calaby 1972) and 12 days in the Eastern Pygmy-possum (Hickman & Hickman 1960). Between bouts of torpor, Mountain Pygmy-possums are usually active for 3–5 days (Fleming 1985b) whereas *Cercartetus* species may be active only briefly and, therefore, be in an almost continuous state of dormancy for periods lasting over a month (Conway 1939; Wakefield 1970). Feathertail Gliders rarely stay torpid for longer than 24 hours and the longest bout recorded is 44 hours (Fleming 1985a). In the Feathertail Glider, and possibly *Cercartetus* species, the length of an episode of torpor is largely a function of ambient temperature (Hickman & Hickman 1960; Fleming 1985a).

Feathertail Gliders always arouse from torpor following disturbance (Fleming 1985a), unlike *Cercartetus* species (Hickman & Hickman 1960). The intense shivering noted throughout arousal for Feathertail Gliders (Fleming 1985a) has not been recorded for the other burramyids. These are aroused from torpor much more slowly than similar sized eutherians (Wang & Hudson 1971; Heldmaier 1978) and the rate of arousal is to some extent temperature dependent (Bartholomew & Hudson 1962; Fleming 1985a, 1985b). Although *Cercartetus* species can recover from torpor within 30 minutes, arousal may take several hours (Bartholomew & Hudson 1962; Wakefield 1970) which suggests that arousal from torpor in this genus may not be a smooth process and that bursts of arousal may be interspersed with periods of physiological plateauing (Hickman & Hickman 1960).

Reproduction

The cytogenetics of burramyids has been reviewed by McKay (1984) and Westerman, Sinclair & Woolley (1984). All species have a diploid karyotype of 14 chromosomes which, apart from two inversions in the Feathertail Glider and three in the Mountain Pygmy-possum, appears to be the primitive marsupial condition.

The morphology of the female reproductive system has been described only for the Feathertail Glider (Hill 1900a) and *Cercartetus* species (Clark 1967; Smith 1984) and it conforms to the typical marsupial pattern. The vaginal system consists of two separate vaginal culs-de-sac and a pseudovaginal canal which opens at first parturition. In parous animals, the vaginal culs-de-sac remain open but the pseudovaginal canal closes. Unlike the Western Pygmy-possum, *C. concinnus*, and the Feathertail Glider, the Little Pygmy-possum, *C. lepidus*, lacks a posterior vaginal sinus.

Female burramyids have well-developed, forward-opening pouches. The Feathertail Glider, the Mountain Pygmy-possum, the Little Pygmy-possum and the Long-tailed Pygmy-possum all have four teats whereas the Western Pygmy-possum and the Eastern Pygmy-possum have six teats (Smith 1980; Turner 1985). Detailed descriptions of the pouches of non-breeding and breeding burraymids are given in Turner (1985).

Burramyids are polytocous and polyoestrous (Tyndale-Biscoe 1984b) and there is some evidence for post-partum oestrus (Smith 1980; Ward & Renfree 1986). Embryonic diapause has been inferred from the following observations: Bowley (1939) and Casanova (1958) reported that a Western Pygmy-possum, which had young in the pouch when brought into captivity, gave birth to second litters despite the absence of mature males. Blastocysts have been found in the uteri of Feathertail Gliders (Hill 1900a; Ward & Renfree 1986) and Western Pygmy-possums (Clark 1967) carrying young in the pouch. Although Clark (1967) concluded that diapause does not occur in Western Pygmy-possums, due to the continued growth of the blastocysts during suckling, Tyndale-Biscoe (1973) suggested that diapause in this genus may be characterised by the slowed growth of blastocysts rather than a total cessation of growth. The nature of embryonic diapause in the Burramyidae seems more closely allied to that occurring in the Tarsipedidae than the Macropodidae (Renfree, Russell & Wooller 1984).

There is virtually no information on the oestrus cycle of burramyids. This is due to the infrequency with which individuals from this family breeds in captivity, the ready ejection of young from the pouches of wild-caught animals brought into captivity and the difficulty of observing the pouches of such small animals without risking dissociation between young and teat (Fleming & Frey 1984). Successive captures of free-living Mountain Pygmy-possums and Eastern Pygmy-possums at monthly intervals has revealed the pattern of reproduction. Females, assessed as pregnant in one month, usually have pouch young in the subsequent month and are lactating without young attached by the third month. Newly independent young then enter the trappable population in greatest numbers four months after pregnancy (Dimpel & Calaby 1972; Mansergh 1984a; Turner 1985; Mansergh & Scotts 1986a). Kerle (1984b) reported a gestation estimate of 14–16 days for Mountain Pygmy-possums which accords with the typical gestation length of other possums and gliders (Tyndale-Biscoe 1984b). In contrast, gestation has been estimated at 51 days in Western Pygmy-possums (Bowley 1939) and less than 30 days in Eastern Pygmy-possums (Turner 1985). Gestation estimates for Feathertail Gliders and *Cercartetus* species may be confounded by the incidence of embryonic diapause. Obligate pouch life lasts around 3 weeks in Mountain Pygmy-possums and young are weaned at about 8–9 weeks of age (Table 27.1). Young Feathertail Gliders stay in the pouch for over twice as long as young Mountain Pygmy-possums and are weaned when about 14 weeks old. Obligate pouch life in *Cercartetus* species is quite variable, estimated to range from 25 days in Western Pygmy-possums (Smith 1980) to 45 days in Long-tailed Pygmy-possums (Atherton & Haffenden 1982). *Cercartetus* species are probably weaned at around 10 weeks of age (Table 27.1).

Table 27.1 Comparison of the rates of development of several burramyids. Maternal body weights (MBW) used were 13.5 g (*Acrobates pygmaeus*), 30 g (*Cercartetus* spp.) and 40 g (*Burramys parvus*). Age is in days. Sources: 1, Atherton & Haffenden (1982); 2, Dimpel & Calaby (1972); 3, Dwyer (1977); 4, Fanning & Watkins (1980); 5, Fleming & Frey (1984); 6, Kerle (1984b); 7, Smith (1980); 8, Turner (1985); 9, Ward (1986).

DEVELOPMENTAL STAGE	*Acrobates pygmaeus*		*Burramys parvus*		*Cercartetus* spp.	
	Age	%MBW	Age	%MBW	Age	%MBW
Left in nest	50-60	11	20-25	16-20	25-45	13
Eyes open	70	22	37-45	32-44	40-60	20
Weaned	95-100	52	55-65	52	65-76	40-50
Adult weight and length	110	100	200	100	100	100
Source	4, 5		1, 3, 7, 8, 9		2, 6	

The reproductive morphology of male burramyids resembles that found in most marsupials and consists of paired testes and epididymides situated in a prepenile scrotum connected by vasa deferentia to the prostatic portion of the urethra. These structures are associated with a large, disseminate, carrot-shaped prostate and two pairs of Cowper's (bulbo-urethral) glands. Most male marsupials, unlike eutherians, lack seminal vesicles, ampullae and coagulating glands. The Mountain Pygmy-possum (and *Caenolestes* species), however, possess a structure resembling the eutherian ampulla. The scrotal skin is densely furred in burramyids and the tunica vaginalis deeply pigmented in *Cercartetus* species, but is unpigmented in the Feathertail Glider and the Mountain Pygmy-possum. *Cercartetus* species and the Mountain Pygmy-possum differ from most marsupials in their possession of a non-pendulous scrotum. Burramyids have a bifid penis and, at least in the Little Pygmy-possum, the left fork is slightly larger than the right. The glans penis in this species is covered with short backward projecting spines. The limited information on the sperm of the Burramyidae suggests that its structure resembles that of other Australian marsupial groups (Smith 1984; Temple-Smith 1984a). There is some evidence that the male reproductive organs of the Feathertail Glider and *Cercartetus* species undergo seasonal recrudescence and regression (Atherton & Haffenden 1982; Fleming & Frey 1984; Temple-Smith 1984a; Turner 1985).

The Burramyidae exhibits a large degree of plasticity in the timing of reproductive events. Populations of *Cercartetus* species and Feathertail Gliders in drier and warmer parts of their range may breed year round, or almost so, whereas others experience more restricted breeding periods (Smith 1980). Although young may be found in the pouch of wild-caught Mountain Pygmy-possums from September to December with a peak in births in November, captive animals may give birth up until April (Kerle 1984b). In the New Guinean Feathertail Possum, young have been found in the pouch in October (Tate 1945) and January (Woolley & Allison 1982).

All burramyids can attain sexual maturity within a year of birth (Fleming & Frey 1984; Kerle 1984b; Mansergh & Scotts 1986a; Smith 1980; Woolley & Allison 1982). The Eastern Pygmy-possum is exceptional in being able to breed at only 3 months of age when still not fully grown (Turner 1985; Ward 1986).

Embryology and Development

The only information on the embryology of the Burramyidae deals with the foetal and perinatal organogenesis of New Guinea Feathertail Possums (Hughes *et al*. 1986). This species exhibits a number of unique features of uterine development, but whether these are shared with other members of the Burramyidae is unknown.

Neonatal burramyids develop more rapidly than any other marsupial and are left in the nest when they are not fully furred and without their eyes open (Table 27.1 and references therein). The limited data available on the early development of burramyids suggest that the Mountain Pygmy-possum matures the most rapidly and Feathertail Gliders the least (Table 27.1). Young *Cercartetus* mature at a rate intermediate between the other two genera. Developmental stages in Feathertail Gliders and *Cercartetus* are reached at a similar percentage of maternal body mass, however, and these two genera attain adult size and weight more quickly than Mountain Pygmy-possums.

NATURAL HISTORY

Life History

The life histories of burramyids are characterised by larger litters, shorter times to weaning and higher weights at weaning (relative to adult weight) than the larger possums and gliders (Smith & Lee 1984). Feathertail Gliders and all species of *Cercartetus* except the Little Pygmy-possum also exhibit an extended breeding season, which may last all year, enabling most females to wean two to three litters a year. These burramyids are also unique amongst marsupials in combining high annual fecundity with relatively long life (Green 1973; Lee & Cockburn 1985; Turner 1985). The length of the breeding season (which influences annual fecundity) may be controlled by climatic and nutritional factors. All burramyids inhabiting temperate localities experience shorter breeding seasons than their tropical relatives. In general, *Cercartetus* species experience a nadir in births in winter (Turner 1985) and Feathertail Gliders do so in autumn (Fleming & Frey 1984). The Mountain Pygmy-possum exhibits the most restricted breeding season of all the burramyids and must be greatly influenced by the length of the snow-free period (Mansergh 1984a; Mansergh & Scotts 1986a). Differences in the timing of nectar and pollen abundance in two nearly adjacent *Banksia* species woodland communities may be responsible for the differential breeding seasons observed in their individual populations of the Eastern Pygmy-possum (Turner 1985).

In all burramyids which produce more than one litter a year, the average number of young suckled to weaning in each reproductive episode is lower than the number of available teats (Turner 1985). This contrasts with those species which breed only once a year and which wean a litter equal in number to the number of teats. The decreased costs associated with suckling a litter containing fewer than the potential maximum number of young presumably allows females the opportunity to breed again, thereby weaning young into the population throughout the year. This life history trait is particularly adaptive for animals inhabiting environments such as heathlands, with notoriously unpredictable foraging conditions and food resources. Spreading reproductive effort over much of the year undoubtedly increases the chance that some offspring will survive.

Possibly, the concentrated foods eaten by burramyids, coupled with their ability to save on metabolic costs by frequently entering torpor, afford these small possums their unusual suite of life history traits.

Ecology

Members of the Burramyidae occupy a wide range of habitats (Smith 1980; Woolley & Allison 1982). *Cercartetus* species may be found in heathland, mallee shrubland, sclerophyll forest and woodland and rainforest. Feathertail Gliders also inhabit sclerophyll forest and woodland whereas New Guinean Feathertail Possums occurs in rainforest. The Mountain Pygmy-possum is the only mammal which is restricted to an alpine-subalpine habitat in Australia.

Recent trapping studies have provided population estimates of between 14 and 20 individuals/ha for the Mountain Pygmy-possum and the Eastern Pygmy-possum (Mansergh 1984b; Turner 1985). In both study areas, burramyids were the most numerous small mammals. Feathertail Gliders also may be locally abundant and aggregations of 40 individuals have been observed feeding at a profusely flowering tree (Russell 1980).

There is some evidence to suggest that female Mountain Pygmy-possums and Eastern Pygmy-possums occupy better habitat than males in terms of potential nest sites and food quality and quantity. Optimal breeding habitat for the Mountain Pygmy-possum is characterised by a basalt scree slope which supports a dense shrublayer of *Podocarpus lawrencei*, *Tasmannia xerophylla* and *Olearia phlogopappa* (Gullan & Norris 1984; Mansergh 1984b). Female Mountain Pygmy-possums remain permanently in such habitats and males move into these areas to breed. The influx of juveniles onto the scree slopes is paralleled by the migration of adult males into surrounding poorer habitat. Males consequently suffer higher mortality than females (Mansergh & Scotts 1986a). In *Banksia* woodland, female Eastern Pygmy-possums occupy areas with larger *Banksia* trees than males (Turner 1985).

Mountain Pygmy-possum and Eastern Pygmy-possum females and both sexes in the Feathertail Glider show considerable site fidelity (Fleming & Frey 1984; Mansergh 1984b; Turner 1985). In general, females of these species are more sedentary. A male Eastern Pygmy-possum has been recorded moving 120 m in one night (Turner 1985). A male Mountain Pygmy-possum was captured 420 m away from its natal area (Mansergh & Scotts 1986a) and a male Feathertail Glider was found 600 m from its first point of capture (Fleming & Frey 1984).

Although data are limited on the diets of burramyids in the wild, most taxa are omnivorous, taking fruits, seeds, nectar, pollen and invertebrates (Stirrat 1981; Kavanagh 1984; Mansergh 1984a; Turner 1984a, 1984b; Smith & Broome 1986). Pollen and nectar-feeding are especially well developed in the Feathertail Glider and *Cercartetus* species occupying dry sclerophyll forest and woodland, respectively (Turner 1984a, 1984b). The Mountain Pygmy-possum relies heavily on fruits and seeds (Kerle 1984a; Stirrat 1981) and food caching behaviour in captive animals suggests that these items may be stored under the snow during winter.

The Feathertail Glider also feeds at the sap sites of larger possums and gliders (Russell 1980; S.M. Davey & J.H. Seebeck personal communication). Soft fruits, such as those of *Leucopogon parvifolius*, are seasonally important in the diet of the Eastern Pygmy-possum (Turner 1985). Nothing is known about the diet of the New Guinean Feathertail Possum, but both of the above items may be prominent (Kay & Hylander 1978; Woolley & Allison 1982).

The preference of the burramyids for concentrated foods results in obesity in captivity. General body fattening of captive Eastern Pygmy-possums prior to the winter months has been considered as an adaptation which allows an increase in the frequency of torpor (Perrers 1965; Tyndale-Biscoe 1973). Wild caught Eastern Pygmy-possums, however, are generally not heavier prior to winter, although some individuals with substantial subcutaneous fat deposits in autumn were quite lean when recaptured after winter (Turner 1985).

Cercartetus species are unusual among burramyids in their ability to store fat at the base of the tail. This fat store presumably plays a role in torpor. Why Feathertail Gliders and Mountain Pygmy-possums, which also frequently enter torpor, do not store fat in this way is not clear. There has been frequent reference to the incrassated tail of *Cercartetus* species (Chaffer 1930; Carlquist 1965; Perrers 1965; Troughton 1966; Dimpel & Calaby 1972; Green 1973; Dixon 1974), mostly based on observations of captive animals which are usually more obese than free-living animals. Although the tail base of some wild-caught Eastern Pygmy-possums was very enlarged it never become engorged with fat as observed in some captive specimens (Turner 1983). The total incrassation of the tail often seen in captive species of *Cercartetus* species may be abnormal and maladaptive, since such fat stores would hinder the locomotion and the use of the prehensile tail of this arboreal possum (Turner 1985).

Although captive Mountain Pygmy-possums only enter torpor in autumn and winter, torpid animals have been found in traps in spring and summer (Dimpel & Calaby 1972; Fleming 1985b; V. Turner unpublished data). Feathertail Gliders are found torpid in nests in all seasons except summer, though torpid individuals are encountered most commonly during winter (Frey & Fleming 1984b). Both captive and free-living Eastern Pygmy-possums enter torpor at all times of the year, but they experience greater periods of dormancy in winter (Hickman & Hickman 1960; V. Turner unpublished data).

Burramyids employ huddling as well as, or instead of, torpor as a means of reducing metabolic costs in cold climates. Groups of Feathertail Gliders may consist of individuals which are all normothermic, all torpid or a mixture of the two thermal states (Frey & Fleming 1984b). While normothermic, huddling Feathertail Gliders experience significantly reduced thermoregulatory costs, this species clearly does not aggregate only as a thermal strategy, since the largest groups are found in summer (Frey & Fleming 1984b).

Non-breeding, captive and free-living burramyids nest alone or in groups of variable composition. Nesting groups of free-living burramyids most commonly consist of mothers and their suckling offspring (Dwyer 1977; Fleming & Frey 1984). Lactating Mountain Pygmy-possums and *Cercartetus* species do not nest with other adults (Dwyer 1977; Kerle 1984a) as do Feathertail Gliders and New Guinea Feathertail Possums do (Woolley & Allison 1982; Fleming & Frey 1984). Twenty-five Feathertail Gliders have been found nesting together (Macdonald 1984) and this represents the largest aggregation of any burramyid. Most free-living groups of nesting burramyids contain between two and five animals (Dwyer 1977; Woolley & Allison 1982; Fleming & Frey 1984).

The nests of Feathertail Gliders and *Cercartetus* species are usually spherical structures, up to 150 mm in diameter, and made of leaves (eucalypt, wattle, fern and grass), bark fibres or a combination of these materials. Nests have been located in hollows in trees and in the canopies of pit pit, *Xanthorrhoea* species, and ferns (Jones 1924; Ryan 1963b; Troughton 1966; Coleman 1970; Dwyer 1977; Woolley & Allison 1982; Green 1983a). Feathertail Gliders readily uses plastic telephone cable junction boxes attached to roadside poles (Fanning 1980; Fleming & Frey 1984). No Mountain Pygmy-possum nests have been located in the wild. In captivity, however, they weave snow grass leaves into a platform which provides a roof over a depression in sawdust (Dixon 1971; Kerle 1984a). These structures have been built under natural features such as a cairn of rocks and a branch. Mountain Pygmy-possums probably nest among boulders, which provide a subnivean space in winter, rather than in the rare hollows of the snow gums, *Eucalyptus pauciflora*, which would be much more exposed (Kerle 1984a).

Burramyids also have been found nesting in huts, stoves, sacks, old clothing, plastic bags, farm machines and even amongst the turf sods in an old fallowed paddock (Wakefield 1963c; Baynes 1971; Dimpel & Calaby 1972; Strahan 1983; Mansergh & Scotts 1986a).

Burramyids do not always construct nests. Hickman & Hickman (1960) found that both Little Pygmy-possums and Eastern Pygmy-possums merely burrow amongst the decaying wood present in stumps and tree cavities. The Eastern Pygmy-possum also has been observed sheltering amongst the dead leaves and bark caught in a fork of a *Leptospermum laevigatum* bush (V. Turner personal observation). Green (1973) comments that *Cercartetus* species only make rough nests loosely put together in a tree or stump or among accumulated debris or stones. The opportunism of the burramyids extends to their occupation of abandoned birds nests and *Pseudocheirus peregrinus* dreys (Chaffer 1930; Fleay 1947; Ryan 1963b; Wakefield 1963c; V. Turner personal observation).

Native carnivores such as owls, snakes and possibly quolls (*Dasyurus* species) prey on burramyids (Wakefield 1960, 1963c; Lundelius 1963; Troughton 1966; Gould 1974; Dwyer 1977; Green & Osborne 1981; Gullan & Norris 1981; Green 1983a). Foxes also have been known to take Mountain Pygmy-possums and *Cercartetus* species, but feral and domestic cats are probably the major predators of the family.

There is virtually no information on the parasites of burramyids. Fleas of the genera *Acanthopsylla* and *Choristopsylla* have been found on burramyids (Dunnet & Mardon 1974). The flea, *Acanthopsylla rothschildi rothschildi*, which is a well-known ectoparasite of *Antechinus* species, has been bred from the nesting material of Mountain Pygmy-possums in captivity (Dimpel & Calaby 1972). Mites have been observed on wild-caught Eastern Pygmy-possums on numerous occasions (V. Turner personal observation).

Behaviour

Like most Australian small mammals, burramyids are essentially nocturnal, although captive and free living Feathertail Gliders and *Cercartetus* species have been observed to be active diurnally, particularly in overcast conditions (Hickman & Hickman 1960; J.H. Seebeck personal communication; V. Turner personal observation). In contrast, captive Mountain Pygmy-possums are almost strictly nocturnal, usually emerging to feed within half an hour of nightfall (Dimpel & Calaby 1972; Kerle 1984a; O'Reilly, Mansergh & Willig 1986). Kerle (1984a) found captive Mountain Pygmy-possums to be active for much of the night, although retiring to the nest box well before dawn. The behaviour of the animals during the dark period was characterised by bursts of activity (running, feeding) alternating with more sedentary periods where the animals groomed, sat or returned to the nest. In contrast, O'Reilly *et al*. (1986) found captive Mountain Pygmy-possums to be more or less continually active during the whole 10-hour dark period. The behaviour of Mountain Pygmy-possums has not been observed in the wild. An investigation of the response of this species to virtually 24 hours of darkness in its winter subnivean environment may prove interesting (Kerle 1984a).

The Mountain Pygmy-possum is the only burramyid whose nest building activity has been observed in detail, but only in captivity. Kerle (1984a) observed the animals to construct nests from snow grass, *Poa australis* and a few shreds of cotton wool. The abundant sclerophyllous leaves and bark were ignored. Chunks of the grass were removed from a nearby sod with the teeth and quickly transferred to the feet and finally to the tail for transport to the nest. Most nest construction occurred during the second half of the dark period.

Perrers (1965) observed a captive Eastern Pygmy-possum to shred newspaper to make a nest. Several studies indicate, however, that if captive burramyids are provided with suitable nests in the form of a wooden or metal box or a hollow log lined with cotton wool, rag or wool, no nest building will take place (Conway 1939; Kerle 1984a; Fleming 1985a).

Groups of nesting burramyids typically form tetrahedron shaped huddles with the animals hunched closely together. In Feathertail Gliders, one or more individuals lie across the top of the group (Fleming 1985a, 1985b). The ultimate thermoregulatory response exhibited by burramyids is torpor. In this state, the body is tightly curled with the head nuzzled into the chest or abdomen. The ears are furled and often cover the closed eyes while the tail may be coiled tightly against the body or wrapped loosely about it. *Cercartetus* species and Mountain Pygmy-possums usually lie on their side whereas Feathertail Gliders always remain on their feet (Breeden & Breeden 1972; Fleming 1985a, 1985b; Hickman & Hickman 1960; Wakefield 1970). Four main postural stages may be observed during arousal from torpor: uncurling of the body, regaining balance on the feet (except in the Feathertail Glider), unfurling of the ears and lifting of the head (Wakefield 1970).

Torpid *Cercartetus* species will retract the gums from the teeth if disturbed and also may hiss (Hickman & Hickman 1960; Atherton & Haffenden 1982; V. Turner, personal observation). Feathertail Gliders do not vocalise when torpid (Fleming 1985a). Hissing is the most common noise made by burramyids and handling usually elicits this response (Fanning & Watkins 1980; M. Fleming personal communication; V. Turner personal observation). Feathertail Gliders also make ticking and popping sounds when exploring their environment (Fanning & Watkins 1980). These vocalisations may play a role in the cohesion of a group of foraging animals. The Mountain Pygmy-possum produces a guttural noise when startled or stressed (Dixon 1971) and screams when threatened (Kerle 1984a).

Although the Eastern Pygmy-possum is most often docile when removed from traps, males captured in late summer to early autumn, in the middle of the breeding season, behave very aggressively. Hissing and biting also was associated sometimes with penile erections and the secretion of yellow, acrid fluid from the cloaca (V. Turner unpublished data).

Eight different categories of specialised glandular areas on the bodies in the Feathertail Glider, the Mountain Pygmy-possum and *Cercartetus* species produce odorous secretions (Biggins 1984). Little is known about the function of these secretions in any marsupials, but they are assumed to play a role in social cohesion and mating.

The most common interaction observed between captive Mountain Pygmy-possums involves face to face sniffing (Kerle 1984a). Males of this species also regularly sniff the cloaca of females over the period leading up to oestrus. This behaviour usually culminates with male mounting female, presumably at oestrus (Kerle 1984a, 1984b). Pregnant and lactating Mountain Pygmy-possums actively defend the nestbox from all animals except their own suckling offspring (Kerle 1984a).

A Mountain Pygmy-possum female grooms young in the pouch by squatting on her haunches, holding her pouch open with her forefeet and licking their backs (Dimpel & Calaby 1972). The female continues to groom the young for a short while after they first leave the nest (Kerle 1984a). Young Mountain Pygmy-possums have never been observed travelling on the backs of their mothers (Dimpel & Calaby 1972; Kerle 1984a) unlike those of the Eastern Pygmy-possum (as illustrated on the cover of the Victorian Naturalist, August 1983). Atherton & Haffenden (1983) reported that a female Long-tailed Pygmy-possum will defend her young by standing over them with the forelegs extended

while making a hissing noise. Female burramyids, however, have been known to reject young from the pouch and to eat them as a response to stress in captivity (Dimpel & Calaby 1972; Fanning & Watkins 1980; Atherton & Haffenden 1982; Woolley & Allison 1982).

Burramyids, like many other possums, indulge in extensive self-grooming, mainly using the claws. The fur is cleaned with the aid of saliva, transferred from mouth to fur by the forearms and claws. In species which feed at flowers, this action is particularly important in transferring pollen, an important protein source, from the fur to the mouth.

Except for breeding females, burramyids usually show a large degree of social tolerance (Kerle 1984a; Fleming & Frey 1984; Mansergh & Scotts 1986a). The most aggressive behaviour reported involved pairs of Mountain Pygmy-possums apparently fighting over food. The ‘fighting’ scenario began with a chase around the cage followed by the animals confronting each other by standing on their back feet with their ventral surfaces in contact. The interaction ended with the animals rolling apart and running off in opposite directions (Kerle 1984a).

Economic Significance

Feathertail Gliders and *Cercartetus* species may play an important role in the pollination, and consequently survival, of many species of native plants. Some members of the Myrtaceae such as species of *Eucalyptus, Callistemon and Syzygium* and the Proteaceae such as *Banksia* species, exhibit particular adaptations to flower-visiting mammals (Turner 1982, 1985). The importance of the pollination effected by these animals in the overall population biology of the plants they visit is unknown. The effects of forestry logging and clearing practices and those of the apiculture industry, which introduces and widely disseminates the voracious, nectar- and pollen-feeding honey bee, on the population biology of these plants and the burramyids which feed from them has not been investigated, but at least in some areas is likely to be quite damaging.

The Feathertail Glider and the Eastern Pygmy-possum are the most widespread burramyids and populations are likely to be preserved in national parks along the eastern coast of Australia. Corridors of suitable habitat must remain between national parks as avenues for dispersing juveniles and for the maintenance of genetic flow between populations. Although these species occur in a wide range of habitat types, the highest densities have been found in communities which provide good supplies of nectar and pollen throughout the year, adequate understorey cover and suitable nesting sites (Fleming & Frey 1984; Turner 1985). Old, mature, mixed eucalypt forest with a well-developed *Banksia* species shrub layer and *Banksia* species woodlands are just two examples of excellent habitat for temperate species of burramyids. Although the Burramyidae are not dependent on hollows for nest sites, they are rarely encountered in treeless habitats. That land management practices do not degrade forests to the point where the above criteria cannot be met is important to the survival of these small possums.

Although small numbers of Western Pygmy-possums have been recorded over much of south-western Australia (Atherton & Haffenden 1983; Calaby 1983; Green 1983a; Russell 1983; Smith 1983; Turner 1983), a sizeable population of this species is unknown. Habitat destruction and predation by feral animals pose constant threats (Smith 1980). Long-tailed Pygmy-possums, Little Pygmy-possums and Mountain Pygmy-possums are restricted to relatively small pockets of suitable habitat (Atherton & Haffenden 1983; Calaby 1983; Green 1983a). Populations of these two species of *Cercartetus* need to be located and all burramyids need protection in a national park system (Mansergh 1984b).

The conservation of the Mountain Pygmy-possum has received particular attention because of its alpine-subalpine habitat and status as a recently rediscovered 'living fossil' (Ride 1970). It is regarded as a vulnerable and possibly endangered species as its habitat is severely threatened by the expanding downhill skiing industry. Because of the extreme habitat separation of male and female *Burramys*, measures must be taken to ensure that barriers (roads, ski tows) which prevent males from returning, in the breeding season, to the areas primarily occupied by females, are not thoughtlessly erected (Mansergh & Scotts 1986a). A corridor-culvert as proposed by Mansergh & Scotts (1986b) has been constructed under the Alpine Road at Mt Higginbotham to encourage the movement of males to and from the scree slopes and thus prevent further disruption of the biology of this population.

BIOGEOGRAPHY AND PHYLOGENY

Distribution

The Feathertail Glider is distributed widely in the forest and woodland habitats of eastern Australia from Cape York to southern South Australia, but is absent from Tasmania.

The Mountain Pygmy-possum has the most restricted distribution, occurring only above 1300 m in the immediate vicinity of Mount Hotham, Victoria and Mount Kosciusko, New South Wales (Mansergh 1984b; Caughley 1986). These two populations are disjunct; the low altitude of the Mitta Mitta River valley constitutes a barrier.

The distribution of the genus *Cercartetus* is broadly disjunct. One species (the Long-tailed Pygmy-possum) occurs in rainforest in north Queensland and in Papua New Guinea and the remaining three species are distributed across southern Australia. The Little Pygmy-possum and the Eastern Pygmy-possum occur on the mainland and in Tasmania, whereas eastern and western populations of the Western Pygmy-possum are separated by the Nullarbor Plain.

New Guinea Feathertail Possum is endemic to New Guinea.

Affinities with other Groups

As discussed in Chapter 26, the affinities of Mountain Pygmy-possums and *Cercartetus* appear to lie more closely with the Phalangeridae than with any other group. The relationships of Feathertail Gliders and New Guinea Feathertail Possums are less certain, but may lie closer to the Petauridae (Archer 1984b; Baverstock 1984).

Affinities within the Burramyidae

Mountain Pygmy-possums and *Cercartetus* form a monophyletic group, as do Feathertail Gliders and New Guinea Feathertail Possums. These two groups, however, do not show sufficient shared characters to indicate a common ancestry (Archer 1984b). Besides a number of small differences in the dentition, there are major differences in the structure of the bones surrounding the middle ear involving the morphology of the ectotympanic, alisphenoid and periotic bones. That the Burramyidae is polyphyletic appears to be supported by serological data (Baverstock 1984).

Fossil Record

The relatively limited fossil record of burramyids is reviewed by Archer (1984b). Burramyid remains are present in the fossil record from Oligocene to Pleistocene, but most of the Tertiary specimens are fragmentary and undescribed. The relatively more abundant Pleistocene record contains extant genera and species.

COLLECTION AND MAINTENANCE IN CAPTIVITY

Methods of Capture

Feathertail Gliders and *Cercartetus* species have rarely been captured by survey teams trapping for small mammals using cage or box type traps (Norris & Mansergh 1981; Norris *et al*. 1983). Turner (1985) had considerable success, however, in capturing Eastern Pygmy-possums in coastal *Banksia* species communities using small (330 mm x 100 mm x 100 mm) collapsible aluminium Elliott traps baited with candied *Banksia ornata* honey. Cockburn, Fleming & Wainer (1979) were successful in capturing Western Pygmy-possums and Little Pygmy-possums in pitfall traps and survey teams recently have improved their rates of capture of Eastern Pygmy-possums by using similar methods (S.R. Henry personal communication). *Cercartetus* species do not readily colonise artifical nest boxes (Fleming & Frey 1984; Menkhorst 1984) and individuals from this genus are encountered infrequently using spotlight techniques (Russell 1980; Davey 1984; Kavanagh 1984).

The Feathertail Glider is difficult to trap with present techniques and this hinders the collection of data on population sizes. Fortunately, the species frequently nests in artifical nest boxes (Menkhorst 1984) and Telecom junction boxes (Fanning 1980; Fleming & Frey 1984) which facilitates the collection of information on many other aspects of its natural history (Fleming & Frey 1984; Frey & Fleming 1984b; Menkhorst 1984; Turner 1984b). Despite its tiny size, Feathertail Gliders are frequently detected by spotlighting and important information has been obtained on habitat utilisation and feeding behaviour (Davey 1984; Kavanagh 1984; R.L. Goldingay unpublished data).

Mountain Pygmy-possums are readily captured in summer, especially at full moon, in small Elliott traps baited with walnut pieces (Mansergh 1984b; Caughley 1986). Mountain Pygmy-possums and Eastern Pygmy-possums become virtually untrappable during winter, a phenomenon explained by the probable increase in the incidence and duration of torpor caused by inhospitable foraging conditions (Turner 1985; Mansergh & Scotts 1986a).

Maintenance in Captivity

Burramyids are easy to keep in captivity. They require relatively little space and food (Hickman & Hickman 1960; Atherton & Haffenden 1982; Woolley & Allison 1982; Fleming 1985a, 1985b; Kerle 1984a). *Cercartetus* possums kept in captivity thrive on many different diets, which may include wild food as well as many exotic fruits, seeds and processed food such as biscuit, cake and jam (Jones 1924; Chaffer 1930; Bocking 1939; Conway 1939; Hickman & Hickman 1960; Perrers 1965; Green 1973; Gould 1974; Atherton & Haffenden 1982). Although captive *Cercartetus* animals readily eat invertebrates and lizards, they can survive on a totally vegetarian diet. The longest-lived captive burramyid was a Eastern Pygmy-possum which lived 7.5 years in captivity without eating animal protein or products (Perrers 1965). As *Cercartetus* possums tend to become obsese in captivity (Bartholomew & Hudson 1962), they should never be fed with sweetened foods. A mixture of oats, nuts, seeds and dried fruits is recommended as an ideal and easily obtained food for captive possums of this

genus. Water should be freely available and the diet supplemented with wildflowers (particularly *Banksia* species) and insects when available. Further, the food should be placed in the cage in such a way that the animal needs to work to obtain it.

Feathertail Gliders have been maintained in captivity on a mixture of diluted honey, high protein baby cereal and milk protein supplement. Its diet was supplemented with lambs brains and baby food. Water was provided *ad libitum* (Fleming 1985a). Feathertail Gliders did not become obese on this diet.

Captive New Guinea Feathertail Possums have survived on a diet similar to the one of Feathertail Gliders, but with supplements of raw fruits, such as banana and paw paw and a large variety of invertebrates (Collins 1973; Woolley & Allison 1982).

Mountain Pygmy-possums in captivity thrive on a vegetarian diet which includes nuts, seeds and raw fruit (Kerle 1984a). Captive animals also take cheese, fly pupae and meat mixtures (Thomas 1982). Dietary supplements such as Penta-vite, calcium hydroxide or dicalcium phosphate are important in order to prevent a rickets-like disease (Dimpel & Calaby 1972; Thomas 1982).

Mountain Pygmy-possums (Kerle 1984b), Long-tailed Pygmy-possums (Atherton & Haffenden 1982) and Western Pygmy-possums (Smith 1980) are the only burramyids known to breed in captivity.

Hepatomas were found in two male Western Pygmy-possums which died in captivity (Hopkins, Dickson & Gaynor 1984). Whether this is a common cause of death in the Burramyidae is unknown.

CLASSIFICATION

As presently understood, the family Burramyidae consists of four genera:

Acrobates, with a single species *A. pygmaeus* (Feathertail Glider);

Burramys, with a single species *B. parvus* (Mountain Pygmy-possum)

Cercartetus, with four species: *C. caudatus* (Long-tailed Pygmy-possum), *C. concinnus* (Western Pygmy-possum), *C. lepidus* (Little Pygmy-possum) and *C. nanus* (Eastern Pygmy-possum)

Distoechurus, extralimital and contains the single species *D. pennatus* (New Guinea Feathertail Possum).

Descriptions

Feathertail Glider: patagium present, tail hairs distichous.

Mountain Pygmy-possum: patagium absent, tail lightly furred and never incrassated, third premolar greatly enlarged.

Cercartetus: patagium absent, tail lightly furred and often incrassated, third premolar not enlarged.

New Guinea Feathertail Possum: patagium absent, tail hairs distichous.

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