

Cercartetus nanus (Diprotodontia: Burramyidae)

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Abstract: *Cercartetus nanus* (Desmarest, 1817) is a burramyid commonly called the eastern pygmy-possum. It is 1 of 4 species in the genus *Cercartetus*, which together with *Burramys parvus* form the marsupial family Burramyidae. This species is endemic to southeastern Australia and occupies a range of vegetation types, but *Banksia* woodland is probably preferred habitat. This species is notable for its longevity, ability to hibernate, and its likely role as an important pollinator of a range of large-flowered plants. This species is of conservation concern in several Australian states, where it is threatened by habitat loss, inappropriate fire regimes, and introduced predators. DOI: 10.1644/815.1.

Key words: Australia, Burramyidae, eastern pygmy-possum, hibernation, marsupial, pollination

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Cercartetus nanus (Desmarest, 1817) Eastern Pygmy-possum

Phalangista nana Desmarest, 1817:477. Type locality “L’île Maria, située sur la côte est de la terre de Van Diémen” (= Maria Island), Tasmania.

Phalangista gliriformis Bell, 1829:127, table XIII. Type locality “New Holland” (= Australia).

Dromicia nana: Gray, 1841:401. Name combination.

Dromicia gliriformis Gray, 1843:85. Type locality “New Holland” (= Australia).

Phalangista (Dromicia) nana Waterhouse, 1846:309. Type locality “Van Diemen’s Land” (= Tasmania).

Dromicia unicolor Krefft, 1863:49. Type locality “near St. Leonard’s, North Shore, Sydney,” New South Wales.

Dromicia britta Wood Jones, 1925:97. Type locality “Millicent,” South Australia.

Cercartetus nanus Iredale and Troughton, 1934:22. Type locality “Île Maria, Tasmania.”

CONTEXT AND CONTENT. Order Diprotodontia, suborder Phalangeriformes, superfamily Phalangoidea, family Burramyidae (Kirsch 1968). The family Burramyidae consists of 2 genera: *Burramys* and *Cercartetus*. Members of *Cercartetus* are *C. caudatus*, *C. concinnus*, *C. lepidus*, and *C. nanus* (Strahan 1995). Two subspecies are currently recognized:

C. n. nanus Desmarest, 1817:477. See above.

C. n. unicolor Krefft, 1863:49. See above.

NOMENCLATORIAL NOTES. The authority is often cited as Desmarest (1818), but de Beaufort (1966) proposed it as



Fig. 1.—Adult male *Cercartetus nanus* from Royal National Park, New South Wales. Used with permission of the photographers N. Remillieux-Leschelle and J. M. Harris.

Geoffroy Saint-Hilaire and Desmarest 1817, which was followed by Harris (2006a) and Ward and Turner (2008). The 1st description of this species by Desmarest (1817) lists Geoffroy Saint-Hilaire as responsible for the name. Therefore, the year 1817 rather than 1818 is correct (see also Harris 2006b). However, whether inclusion of Geoffroy Saint-Hilaire in the authorship satisfies the current *International Code of Zoological Nomenclature* (International Commission on Zoological Nomenclature 2000) is uncertain. Because it is not known that Geoffroy Saint-Hilaire “is alone responsible” (article 50.1.1), there may not be grounds for including both him and Desmarest in the authorship. Application to the International Commission on Zoological Nomenclature to elevate or suppress Geoffroy Saint-Hilaire may be warranted. In the absence of further information on the circumstances of the 1st naming of this species, the authorship is Desmarest (1817).

DIAGNOSIS

Cercartetus nanus (Fig. 1) is distinguished from other pygmy-possums by its size, coloration, tail length, and dentition. Generally about the size of a small mouse, they are distinguished from murids by presence of an opposable, clawless hallux, syndactylous digits on the hind feet, and diprotodont lower incisors. They also have a long, slender, prehensile tail that can be used to suspend themselves while climbing.

GENERAL CHARACTERS

Cercartetus nanus has a conical head with short muzzle (Fig. 2); long whiskers; large, dark, forward-directing eyes; and large, thin, almost naked ears that can be expanded or furled depending on activity and ambient temperature (Fig. 1). The tail is cylindrical in shape, except for the base, which is incrassated. Total engorgement of the tail is often seen in captive *C. nanus*, but the incrassation is much less apparent in wild-caught animals (Turner 1985). The fur is thick at the tail base and becomes gradually sparser toward the tip. The general color of the dorsal pelage is dull gray, with the ventral parts almost white (see also Le Souef and Burrell 1918; Wakefield 1963). The coat is composed of fine soft hairs that are circular in cross section (guard hairs maximum diameter = 25 μm ; maximum length = 10 mm—Brunner and Triggs 2002). Each eye is encircled by a dark ring. Long whiskers extend from either side of the snout. No dimorphism in size between the sexes is apparent. Ranges for standard external measurements (lengths in mm) from 8 male and 5 female specimens in the Australian Museum are: head and body (males 71–94; females 69–85); tail (males 87–110; females 84–104); hind foot (males 11–15; females 11–13—Flannery 1994). Based on craniometric data, *C. nanus* from western and central Victoria tends to be smaller than

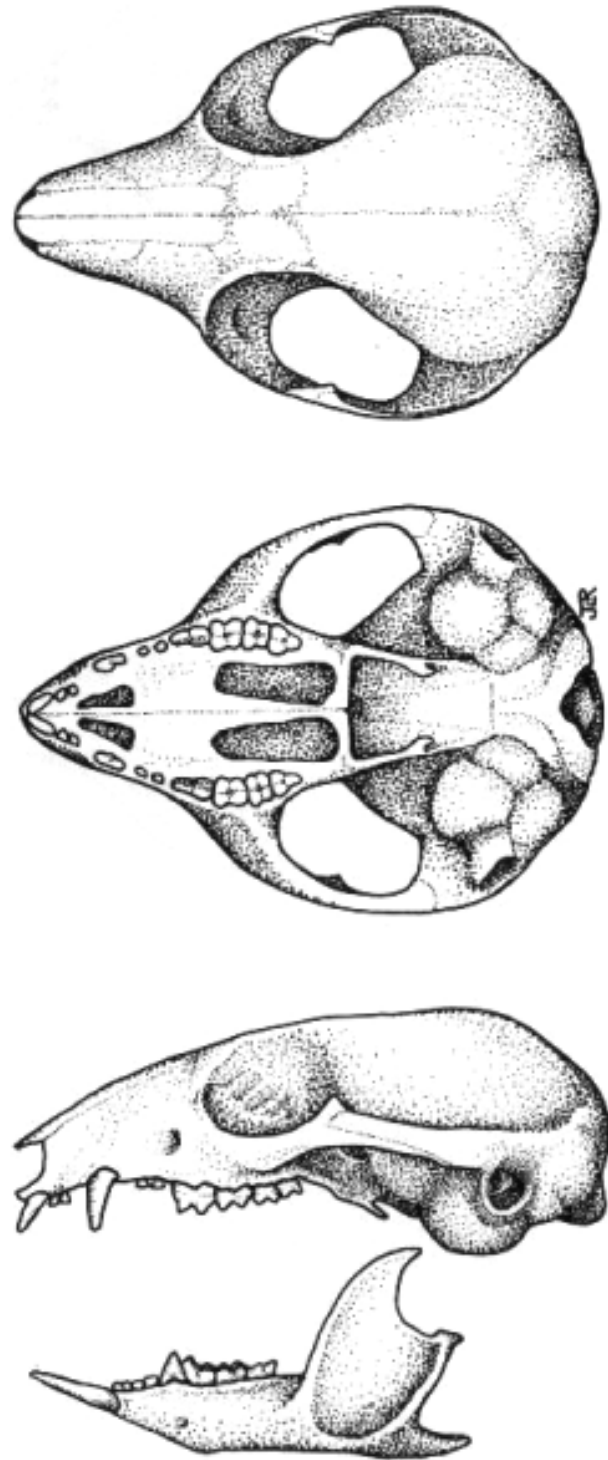


Fig. 2.—Dorsal, ventral and lateral views of cranium, and lateral view of mandible of an adult *Cercartetus nanus*, from Magnet, Tasmania (Queen Victoria Museum and Art Gallery no. 1982/1/148). Collected by O. L. Adams on 9 February 1904. Greatest length of skull is 26.6 mm. Used with permission of the illustrator Judy Rainbird.

those from eastern Victoria and New South Wales (Wakefield 1970). Body masses of adults range from 17.5 to 42.5 g. Lactating females carrying pouch young are significantly heavier than other adults (Bladon et al. 2002; Ward 1990). It is well established that overfeeding of captive animals can result in obesity (Bartholomew and Hudson 1962; Westman and Geiser 2004). However, even when not overfed, captive *C. nanus* may display a general body fattening before winter (Andrews 2003; Perrers 1965; Tyndale-Biscoe 1973). Few data are available to identify whether this is also the case with free-ranging *C. nanus*, although Turner (1985) reported that some individuals with subcutaneous fat deposits trapped in autumn were quite lean when recaptured after winter.

DISTRIBUTION

Cercartetus nanus has a wide but patchy distribution in Tasmania (Harris et al. 2008) and along the eastern seaboard of mainland Australia (Fig. 3) from southeastern Queensland (Harris et al. 2007b), through New South Wales (Bowen and Goldingay 2000), Australian Capital Territory (Dickman and Happold 1988) and Victoria (Harris and Goldingay 2005b), and into southeastern South Australia (van Weenen and Harris 2006). The elevational range is from sea level to about 1,800 m (Green and Osborne 1994).

FOSSIL RECORD

Cercartetus nanus has been recorded from 57 fossil and subfossil deposits (Harris 2006a, 2008; Harris and Garvey 2006; Harris and Goldingay 2005c). The oldest fossil bones of *C. nanus* are from Cathedral Cave in the Naracoorte Caves National Park World Heritage Site where dates as old as 528,000 years \pm 41,000 *SD* have been established. Comparison of prehistoric and modern distribution records for *C. nanus* indicates a slight eastward contraction at the range periphery in Queensland (Harris et al. 2007b).

FORM AND FUNCTION

Form.—Dental formula is $i\ 3/1, c\ 1/0, p\ 3/4, m\ 3/3$, total 36 (Fig. 2; Green and Rainbird 1983). *C. nanus* has a diagnostic P4 that is large, singly pointed, and double-rooted (Menkhorst and Knight 2001). Other features of the dental morphology and basicranial anatomy of *C. nanus* are described elsewhere (Aplin 1987; Archer 1984; Long et al. 2002; Murray et al. 1987; Triggs 1996; Turner and McKay 1989; Wakefield 1963). Statistical data for tooth measurements of *C. nanus* also are available (Turnbull and Schram 1973).

The female's pouch is well developed and typical of diprotodont marsupials (type 5—Russell 1982). It opens anteriorly and usually contains 4 teats (Fig. 4) but 6 teats have been recorded (4 functional and 2 rudimentary—Ward

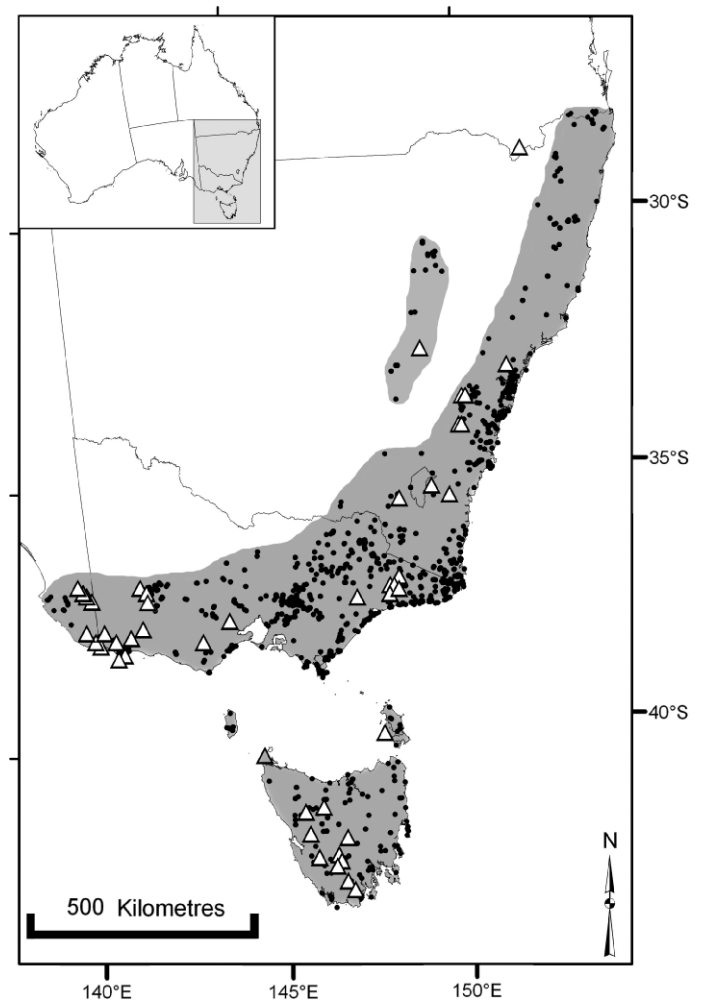


Fig. 3.—Geographic distribution of modern and fossil (Δ) records of *Cercartetus nanus*.

1990, 1998). Up to 15 corpora lutea were counted upon dissection of ovaries (\bar{X} = 7.8—Athey 1993, not seen, cited in Ward 1998). Male *C. nanus* have a bifid penis and paired testes. The testes and epididymides are situated in a prepenile scrotum (Turner and McKay 1989) that is nonpendulous (Anonymous 1966) and the tunica vaginalis is deeply pigmented (Tyndale-Biscoe and Renfree 1987). Measurements of scrotal width are available from museum specimens (8.5–10.0 mm; n = 2—Woolley and Vanderveen 2002). The rete testis has been described as similar to that of other species of *Cercartetus* and there are reportedly 18 tubuli recti (Woolley and Vanderveen 2002). Spermatozoan structure has been described for several species of *Cercartetus* but not *C. nanus*. They probably closely resemble other burramyids in terms of sperm head shape, internal proportions, and the presence of a midpiece fiber network (see Harding 1987).

Function.—This species has the ability to hibernate (i.e., undergo prolonged bouts of torpor lasting for several days



Fig. 4.—Pouch of an adult female *Cercartetus nanus* from Barren Grounds Nature Reserve, New South Wales, showing 4 teats. Used with permission of the photographer T. M. du Bois.

or weeks) and it has been argued that the species is a true or deep hibernator (Geiser 1985, 1993; Geiser and Körtner 2004; Lyman 1982). The 1st detailed report of torpor in *C. nanus* was by Hickman and Hickman (1960), based on daily observations of 2 captive females. A subsequent study under laboratory conditions reported that dormancy was independent of season, time of day, and ambient temperature (Bartholomew and Hudson 1962). Body temperature remained 2–3°C above ambient temperature in steady-state conditions, with normally active animals having a body temperature in the range of 32–38°C ($\bar{X} = 34.9^\circ\text{C}$). The body temperature of sleeping animals was 27–32°C at ambient temperatures of 22–24°C (Bartholomew and Hudson 1962). Lowering the ambient temperature increased bout length (at an ambient temperature of 5°C the mean bout duration was 17.0 days \pm 2.5 SE; maximum length recorded was 35 days, which is one of the longest torpor bouts recorded for any mammal); also the body temperature of torpid animals fell to a minimum of 1.3°C \pm 0.4°C SE (Geiser 1993). Oxygen consumption (a measure of metabolic rate) of torpid individuals was 0.018 ml g⁻¹ h⁻¹ \pm 0.003 SE, which is less than 2% of the basal metabolic rate (1.14 ml g⁻¹ h⁻¹). Further studies established a thermal neutral zone of 28.7–32.9°C and that metabolic rate in torpid *C. nanus* was determined both by temperature effects and metabolic inhibition (Song et al. 1997; see also Boyer and Barnes 1999).

Hibernating *C. nanus* expresses reductions in the following suite of behavioral and physiological responses: surface area to volume ratio, responses to external stimuli, heart rate, body temperature, oxygen consumption, metabolic rate, and breathing rate (including periods of apnea—Turner and McKay 1989). Functionally, torpor allows *C. nanus* to reduce overall energy expenditure and increase fasting endurance during poor weather, lower temperatures, and during periods of food shortage (Song et al. 2000; Turner and McKay 1989; Wakefield 1970). The most recent

laboratory study on this species reported a record 367-day hibernation and use of just one-fortieth of the energy it uses while awake (Geiser 2007).

ONTOGENY AND REPRODUCTION

Ontogeny.—Gestation is at least 30 days, pouch life is 33–37 days, weaning occurs at 60–65 days, and adult body mass is attained at about 150 days (Turner 1985; Ward 1990; Westman and Geiser 2004). Females have 4–6 teats (see above), and there are multiple records of 5 pouch young or teats and 2 records of 6 enlarged teats and lactating mammary glands (Bladon et al. 2002; Deerson et al. 1975; Turner 1985; Wakefield 1970; Ward 1990, 1998; Westman and Geiser 2004). Most offspring leave the mother at 9–11 g (>2.5 months old), but some may continue to nest with the mother up to 21 g (Bladon et al. 2002).

Onset of sexual maturity is rapid with individuals able to breed in the wild as early as 3 months of age, depending on food availability and season of birth (Turner and McKay 1989). Most females become sexually mature at 16 g, although a female was recorded with young at 8.5 g, and another was nonparous at 23 g (Bladon et al. 2002). Females that bred in captivity were 1–7 years old (Andrews 2003; Westman and Geiser 2004). Because *C. nanus* attains reproductive maturity quickly and is small, allometric considerations predict a short life span (Cockburn et al. 1990). However, this and other species of pygmy-possum have unusual longevity, and it has been hypothesized that the extensive hibernation exhibited by burramyids may in some way facilitate increased life span (Cockburn et al. 1990; Springer and Kirsch 1989). In captivity, there are records of *C. nanus* living for 7.5 years (Perrers 1965). In the wild, females have lived for at least 3 years and males for at least 5 years (Cockburn et al. 1990; Ward 1990).

Reproduction.—The species is polyestrous and polytocous, producing a modal litter of 4 pouch young usually twice but sometimes 3 times per year, depending on food availability (Bladon et al. 2002; Ward 1990). In captivity, recorded litter sizes range from 1 to 4 with an average of 2.6 ($n = 31$ —Andrews 2003). Captive births have been from September to March, with most in November. In Victoria, births occur mainly from November to March, but in areas where the dominant plant species, *Banksia*, flowered in winter, breeding occurred throughout the year (Turner 1985; Ward 1990). In northern New South Wales, births are recorded from December to June (Bladon et al. 2002). For Tasmania, births are known from August to October (Green 1973).

Cercartetus nanus may exhibit embryonic diapause (Renfree 1993; Sharman 1963; Ward 1990, 1998), based on anecdotal observations of diapause in *C. concinnus* (see Bowley 1939; Casanova 1958; Hartman 1940). However, in *C. concinnus* continued growth of blastocysts during

lactation suggests that diapause does not occur (Clark 1967) or that it is characterized by a slowing growth of blastocysts rather than a total cessation (Tyndale-Biscoe 1973). More recently, Turner and Ward (1995) considered, based on an unpublished thesis by Athey (1993, not seen, cited in Ward 1998), that female *C. nanus* do not have embryonic diapause but may return to estrus late in lactation and often give birth to the next litter immediately after the previous litter is weaned.

ECOLOGY

Population characteristics.—Population densities vary from 2.5 to 20 individuals/ha (Bladon et al. 2002; Laidlaw and Wilson 1996; Turner 1985). Short-term home-range areas are small with males generally utilizing larger areas than females. Ward (1990) reported home ranges of males as 0.24–1.68 ha (\bar{X} = 0.68 ha) and of females as 0.18–0.61 ha (\bar{X} = 0.35 ha). Other home-range estimates are of similar magnitudes (Bladon et al. 2002; Harris et al. 2007a; Laidlaw and Wilson 1996; Tulloch and Dickman 2006). Home ranges may overlap considerably, both within and between the sexes (Bladon et al. 2002). Female *C. nanus* are thought to occupy better habitat than males in terms of potential nest sites and food quality and quantity (Turner 1985).

Space use.—Across its range, *C. nanus* is a midstory specialist inhabiting shrubby components of a variety of habitats including rain forest, sclerophyll forest, shrubland, heathland, and woodland (Bowen and Goldingay 2000; Harris et al. 2007b, 2008; Harris and Goldingay 2005b; Turner 1985; van Weenen and Harris 2006). Despite this breadth of habitat, this species is patchily distributed and generally in low abundance. Additionally, the species is infrequently observed or trapped in wildlife surveys and is generally regarded as difficult to detect. Use of nest boxes and livetrapping within trees probably represent the most efficient census methods employed for this species in tall or densely wooded habitats (Bladon et al. 2002; Harris and Goldingay 2005a; Turner 1985; Ward 1990). However, pitfall trapping would be expected to be more successful in heathlands and open woodlands (Harris and Goldingay 2005b; Tulloch and Dickman 2006; van Weenen and Harris 2006).

A variety of cavities are used as shelters but tree hollows and stumps appear to be used principally. Other recorded shelter sites include holes in the ground, and in thickets of vegetation such as *Xanthorrhoea* skirts (Bladon et al. 2002; Harris et al. 2007a; Laidlaw and Wilson 1996; Tulloch and Dickman 2006; Ward 1990). *C. nanus* also has been discovered using bird nests for shelter, for example, those of New Holland honeyeater (*Phylidonyris novaehollandiae*—Chaffer 1930; Fig. 5) and yellow-throated scrubwren (*Sericornis citreogularis*—Schulz 2000). Nest-building may be restricted to mothers with young (Ward 1990). Spherical bark nests < 6 cm in diameter have been described (Turner



Fig. 5.—Radiotracked adult *Cercartetus nanus* using a bird nest as a diurnal shelter in Royal National Park, New South Wales. The nest was originally constructed by the New Holland honeyeater (*Phylidonyris novaehollandiae*) in a *Banksia ericifolia* thicket about 1.8 m above the ground. Photograph by J. M. Harris.

1985). Nesting material also may consist of fresh green foliage (Bladon et al. 2002; Ward 1990). Nest sites are changed frequently and do not appear to be used exclusively by any single animal or group of animals (Bladon et al. 2002; Ward 1990). Females with large young generally use more substantial cavities, such as hollows, and these are where nesting material is added (S. Ward, pers. comm.).

Diet.—*Cercartetus nanus* is omnivorous but its diet is thought to chiefly consist of nectar and pollen (Tulloch 2004; Turner 1984). Fine papillae on the tongue assist greatly with the uptake of these plant products (Turner and McKay 1989). Although it has eaten small skinks in captivity (e.g., metallic skink [*Niveoscincus metallicus*]—Hickman and Hickman 1960), vertebrate remains have not been found in the feces of wild-caught animals (Dickman and Happold 1988; Huang et al. 1986; Turner 1985; van Tets and Whelan 1997). Multiple studies suggest that it also feeds extensively on seeds, fruit, and invertebrates, and that it switches between foods depending on their availability (Huang et al. 1986; Perrers 1965; Tulloch 2004; Turner 1985). Invertebrates consumed in captivity include green mantis (*Orthodera ministralis*), dampwood termite (*Porotermes adamsoni*), southern or wood scorpion (*Cercophonium squama*), and huntsman spider (*Delena cancerides*—Hickman and Hickman 1960).

Pollen is an important source of nitrogen for individuals of *C. nanus*. Field studies reported high densities of empty pollen grains in fecal samples from *C. nanus* (63.7–78.6% [Turner 1984], 89.7% [Huang et al. 1986], and 65% [van Tets and Whelan 1997]), and a laboratory study demonstrated very low maintenance nitrogen requirements on a pollen-based diet (46 mg N kg^{-0.75} d⁻¹—van Tets and Hulbert

1999). At Barren Grounds Nature Reserve, New South Wales, van Tets (1998) estimated the number of inflorescences needed by *C. nanus* from measurement of the average mass of *Banksia* pollen produced per plant, coupled with data on inflorescences and plant density. He estimated that harvesting of pollen from 7 or 8 average *Banksia* plants a night would provide *C. nanus* with a substantial proportion of its nitrogen requirements. However, even at this single site there appears to be substantial seasonal variation such that insect protein is likely to be of greater importance than pollen at certain times of the year (see also van Tets and Whelan 1997).

Diseases and parasites.—There are 11 parasites recorded for *C. nanus*: the fleas *Acanthopsylla rothschildi*, *A. scintilla*, *Choristopsylla thomasi*, and *Ch. ochi*; the mites *Guntheria newmani*, *G. shieldsi*, *Ornithonyssus bacoti* (normally a parasite of captive rats), and *Stomatodex cercarteti* (type described from *C. nanus*); the nematodes *Tetrabothriostromylus mackerrasae* and *Paraastrostrongylus gymnobelideus*; and the common marsupial tick *Ixodes tasmani*. There is also a record of a free-living platyhelminth, *Geoplana*, although this was possibly an accidental infection (Harris and Vilcins 2007).

Interspecific interactions.—There is evidence that the flowering patterns of some species of *Banksia* (i.e., food availability) are linked to the timing of the species' reproductive ecology. For example, at Wilsons Promontory National Park breeding activity of *C. nanus* was associated with flowering of *B. integrifolia*; at Nar Nar Goon North, east of Melbourne, with *B. spinulosa* (Turner 1985; Ward 1990); and at Fernbrook, near Dorrigo in northern New South Wales, with *B. integrifolia* (Bladon et al. 2002). There is also evidence that *C. nanus* is an important pollinator of several species of *Banksia* (Carthew 1993, 1994; Cunningham 1991; Evans and Bunce 2000; Fig. 6) and possibly also a range of other large-flowered myrtaceous and proteaceous plants including waratah (*Telopea speciosissima*—Goldingay and Carthew 1997; Goldingay et al. 1991). The flowering patterns and persistence of *Banksia* communities (as well as many other forests types, e.g., *Eucalyptus* forest) also are linked to the frequency, intensity, and seasonal occurrence of fire. In turn, widespread fires are thought to impact on populations of *C. nanus*, although research on this aspect of their ecology is still in its infancy (Sutherland et al. 2004; Tulloch and Dickman 2006, 2007).

Cercartetus nanus may be prey to any small- or medium-sized predators. Known predation records are by barn owl (*Tyto alba*), masked owl (*T. novaehollandiae*), sooty owl (*T. tenebricosa*), barking owl (*Ninox connivens*), brown antechinus (*Antechinus stuartii*), spotted-tailed quoll (*Dasyurus maculates*), Tasmanian devil (*Sarcophilus harrisii*), dingo and dog (*Canis lupus*), fox (*Vulpes vulpes*), cat (*Felis catus*), Stephen's banded snake (*Hoplocephalus stephensii*), and rough-scaled snake (*Tropidechis carinatus*—see Bladon et al. 2002; Fitzgerald et al. 2004; Harris and Garvey 2006; Harris and Goldingay 2005c; Harris et al. 2007b). These



Fig. 6.—Adult *Cercartetus nanus* from Barren Grounds Nature Reserve, New South Wales. This animal is a nondestructive floral visitor and likely pollinator of a range of plants, including *Banksia ericifolia*, which is depicted in this photograph. Used with permission of the photographers D. Mitchell and J. M. Harris.

records indicate that *C. nanus* is an important prey item for a range of avian, mammalian, and reptilian predators.

BEHAVIOR

When subjected to temperatures of 38°C in the laboratory, individuals of *C. nanus* sprawled on their backs with legs spread and ears fully expanded (Bartholomew and Hudson 1962). They did not lick the pelage or pant, but breathing rate was substantially increased. At low temperatures, animals may shiver (Bartholomew and Hudson 1962; Song et al. 1997). During dormancy, *C. nanus* assumes a typical hibernating posture. It curls into a ball, the eyes closed, the ears folded and bent downward, and the tail coiled in a flat spiral (Bartholomew and Hudson 1962; Hickman and Hickman 1960). Wakefield (1970) described 4 main postural stages during arousal from dormancy: uncurling of the body, regaining balance of the feet, unfurling of the ears, and lifting of the head.

There is limited information on the feeding behavior of *C. nanus*. Most observations are from captive animals, including instances of them catching flying moths with their forepaws (Hickman and Hickman 1960). Using automated photography at flowering inflorescences of *B. spinulosa*, the duration of foraging visits was < 3 min (Carthew 1993). Several inflorescences are visited per plant, and in *B. integrifolia* woodland mean interplant movement was measured at 5.64 m ± 0.75 SE (Evans and Bunce 2000). Extensive self-grooming is undertaken after feeding bouts (Bocking 1939; Hickman and Hickman 1960; Perrers 1965). In the case of feeding at flowers, the subsequent action of grooming is assumed to result in the consumption of substantial amounts of pollen (Turner and McKay 1989).

Animals become active in their nests 4–40 min after sunset and usually leave the nest within 1 h of darkness falling (Bladon et al. 2002). They may be most active in the 1st half of the night (Laidlaw and Wilson 1996) or around midnight (Carthew 1993). Arboreal and highly mobile, the species is able to negotiate the smallest branches of trees and shrubs using the prehensile tail as a “fifth hand” (Turner and McKay 1989). Spool-and-line tracking revealed regular movements through the canopies of low vegetation such as *B. spinulosa* and *B. integrifolia* at a height of 1–2 m (Carthew 1994; Evans and Bunce 2000); in rain forest where taller trees prevail they may move at >12 m above the ground (Bladon et al. 2002); but in burned heathland, where trees are sparse or absent, the species primarily moves on the ground (Tulloch and Dickman 2006). Maximum distance recorded for an overnight movement is 450 m (Bladon et al. 2002) and highest calculated speed of movement is 101 m/h (Laidlaw and Wilson 1996). Males tend to move over greater distances than females each night (Bladon et al. 2002). Young *C. nanus* travel on the backs of their mothers (as illustrated on the cover of *The Victorian Naturalist*, August 1963) and during field observations I have recorded them crossing busy double-lane roads at dusk.

The social organization of populations of *C. nanus* is poorly understood. Based on work in Victoria, *C. nanus* was regarded as promiscuous and normally solitary (71% of wild nest occupancies were of single individuals—Ward 1990). However, a recent study from northern New South Wales has challenged this assumption because 63 (64%) of 98 nest-box observations were of >1 individual (Bladon et al. 2002). These included mothers with young ($n = 30$ observations), male–male groupings ($n = 15$), multiple independent young ($n = 12$), male–female groupings ($n = 4$), and female–female groupings ($n = 2$). The group-nesting associations between males, in particular, were previously unrecognized. There also are recent reports of group nesting of *C. nanus* in captivity (Andrews 2003; Murphy et al. 2003).

Although *C. nanus* is most often docile when removed from fauna survey traps, breeding males sometimes hiss (🔊) and bite (Turner 1985). This behavior may be associated with penile erections and the secretion of yellow, acrid fluid from the anus (Turner and McKay 1989), although this has not been studied in any systematic way. Biggins (1984) indicated that the paracloacal glands of *C. nanus* produce odoriferous secretions and may play a role in communication (see also Salamon 1996). However, there is no further information available on the composition of these secretions or their significance.

GENETICS

The cytogenetics of burramyids has been discussed by McKay (1984). They have XY/XX sex determination and a diploid karyotype of 14 chromosomes. Observations on

chromosomes of *C. nanus* by Martin and Hayman (1967) were deemed invalid by Harris (2007) because of a likely specimen misidentification. Baverstock et al. (1987) reported that rates of albumin evolution are slower in burramyids than in most other phalangeriform taxa. Subsequently, Springer and Kirsch (1989) found a relatively slow average rate of single-copy DNA evolution, the opposite of that expected on the basis of the generation time hypothesis. However, use of burramyids as a counterexample of this hypothesis has been criticized by Cockburn et al. (1990). DNA studies conducted on *Cercartetus* to date suggest that a sister relationship between *C. nanus* and *C. concinnus* is likely, with *C. caudatus* identified as a basal member of this genus (Osborne and Christidis 2002). Extant *Cercartetus* species are estimated to have diverged from each other about 16–27 million years ago (Osborne and Christidis 2002).

CONSERVATION

The species is rated as “least concern, lower risk” on the 2006 IUCN Red List of Threatened Animals (International Union for the Conservation of Nature and Natural Resources 2006). In New South Wales and South Australia, *C. nanus* is listed as vulnerable, and there are data that indicate it may be potentially vulnerable in Victoria (Harris and Goldingay 2005b) and potentially endangered in Queensland (Harris et al. 2007b). In Tasmania, the status of *C. nanus* is poorly known and is in need of further study (Harris et al. 2008). The factors threatening the survival of *C. nanus* include isolated subpopulations with little opportunity for dispersal, which increases the risk of local extinction; forest clearing that results in habitat loss and fragmentation; inappropriate fire regimes that remove nectar-producing understory plants; the loss of nest sites due to past intensive forestry and firewood collection; and predation by foxes and feral cats (New South Wales Scientific Committee 2001).

REMARKS

It has occasionally been presumed that *Cercaertus* (Burmeister 1837) was a misspelling or synonym of *Cercartetus* (e.g., Bartholomew and Hudson 1962; Hickman and Hickman 1960; Simpson 1945). However, *Cercaertus* is a junior synonym of *Trichosurus* and not of *Cercartetus* (Harris 2006a; Wakefield 1963). *Cercartetus* is a reference to the prehensile tail (from the Greek *kerkos*) and *nanus* is derived from the Latin word for dwarf and is a remark on the animal’s very small size. Historically, a large number of vernacular names have been used for this species (Harris 2006a) and there are a few names recorded that were used by the Tasmanian Aboriginals (Plomley 1976).

Iredale and Troughton (1934) accepted 3 subspecies: *C. nanus nanus* for Tasmania, *C. n. britta* for southeastern

South Australia, and *C. n. unicolor* for New South Wales and Victoria. Wakefield (1963) advanced only 1 subspecies on mainland Australia (*C. n. unicolor*) and 1 in Tasmania (*C. n. nanus*). However, cranial specimens examined ($n = 4$) from Tasmania were insufficient to demonstrate difference from or affinity with mainland populations (Wakefield 1970). Despite this, the subspecific dichotomy of Wakefield (1963) has been accepted by numerous authorities (e.g., Flannery 1994; McKay 1988). Osborne and Christidis (2002) conducted a molecular (DNA) study on the assignment of subspecies in *Cercartetus*, although Tasmanian specimens of *C. nanus* were not included, so the status of the 2 subspecies is yet to be resolved.

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