Bettongia gaimardi. By Randolph W. Rose and Robert K. Rose

Bettongia Gray, 1837

Bettongia Gray, 1837:584. Type species *Bettongia setosa* Gray, 1837 (not *Hypsiprymnus setosus* Ogilby, 1832) by subsequent designation.

Bettongiops Matschie, 1916:264 footnote. Type species *Hypsiprymnus* lesueur Quoy and Gaimard, 1824 by monotypy.

CONTEXT AND CONTENT. Order Marsupialia, Superfamily Macropodoidea, Family Potoroidae, Subfamily Potoroinae, Genus *Bettongia*, with four extant species in the genus (Groves, 1993). The family Potoroidae is derived from the now extinct giant rat-kangaroos (Propleopinae) from the middle Miocene. These giants weighed up to 100 kg and probably were carnivorous (Archer and Flannery, 1985).

The genus *Bettongia* is one of four genera in the subfamily which includes the extinct *Caloprymnus* and the extant monotypic *Aepyprymnus* and *Potorous* (three species). The potoroos differ from bettongs in their preference for more humid regions, whereas *Aepyprymnus*, although favoring similar habitat, has a greater mass than the bettongs.

The status of the most recently described species, *Bettongia tropica*, a form described as a new species from Queensland on the basis of skull morphology (Wakefield, 1967), still is controversial (Sharman et al., 1980), but at present four species are recognized. Key to the species of *Bettongia:*

1 Tail without crest .... *B. lesueur*
  Tail with crest 2
2 Premolar outwardly flexed .... *B. penicillata*
  Premolar not outwardly flexed 3
3 Length of auditory bulla <10.4 mm, length of M4 >3.1 mm
  .... *B gaimardi*
  Length of auditory bulla >10.5 mm, length of M4 <3.1 mm
  .... *B. tropica*

Bettongia gaimardi (Desmarest, 1822)

Tasmanian bettong

Kangurus gaimardi Desmarest, 1822:542. Type locality "Port Jackson N. S. W." (=New South Wales), Australia.

Hypsiprymnus whitei Quoy and Gaimard, 1824:62. Type locality same as *Kangurus gaimardi* Desmarest, 1822, though stated to be "from Blue Mts., N.S.W."

Kangurus lepturus Quoy and Gaimard, 1824:64, see above (renaming of *Hypsiprymnus white* Quoy and Gaimard).

Bettongia setosa Gray, 1837:584. [junior secondary homonym to *Hypsiprymnus setosus* Ogilby, 1838, now in the genus *Potorous*]. Type locality "Tasmania."

Hypsiprymnus formosus Ogilby, 1838:62. Type locality unknown (=New South Wales, Australia).

Hypsiprymnus cuniculus Ogilby, 1838:63. Type locality "Hunter's River, N.S.W." Australia, but see below.

Hypsiprymnus phillippi Ogilby, 1838:62. Type locality unknown (=New South Wales, Australia).

Hypsiprymnus hunteri Owen, 1841:408. Type locality unknown (= New South Wales, Australia).

Potorous minimus Boitard, 1842:295. [as of "Desm," in synonomy, so *nom. nud.*]

Bettongia whitei Gray, 1841:403. (emendation for *B. white* Quoy and Gaimard 1824.)

CONTEXT AND CONTENT. Context as noted above. Features of skull morphology were used to synonymize the Tasmanian species, *Bettongia cuniculus*, with the Australian mainland form, *B. gaimardi* (Wakefield, 1967); thus two subspecies now are rec-

ognized. The Tasmanian subspecies (*B. g. cuniculus*) is larger (basal length of the skull is 10% longer—Seebeck and Rose, 1988) and has proportionately less well-developed bullae and tail crest than the mainland form (*B. g. gaimardi*—Wakefield, 1967). The mainland subspecies, now likely extinct (Poole, 1979), is known from museum specimens from coastal areas in extreme southern Queensland, southward across New South Wales and Victoria, Australia, and westward to just across the border into South Australia.

Bettongia gaimardi gaimardi (Desmarest, 1822) from Port Jackson (New South Wales) in the Paris Museum No 79a. See above.

Bettongia gaimardi cuniculus (Ogilby, 1838), described as a specimen from Hunter's River, New South Wales, but Waterhouse (1846) believed an error of locality had been made and that this specimen was actually from Tasmania. See above.

DIAGNOSIS. *Bettongia gaimardi*, the only bettong in Tasmania, Australia resembles a slender, delicate kangaroo, with relatively long hind feet and a moderately long and slightly prehensile tail (Fig. 1). The tail is slightly longer than the length of head and body, although both measure 320–330 mm. The rhinarium is much more coarsely granular than in either *B. penicillata* or *B. lesueur* (Finlayson, 1959). The manus is much stouter than in *B. penicillata*, and the claws are straighter and wider at the base and taper more to a point (in a superior view) than in *B. penicillata*. The stout tail is similar to that of *B. lesueur* and relatively larger than that of *B. penicillata*. The texture of the pelage is crisper than in *B. lesueur* and much softer than in adults of *B. penicillata*; the pelage is longer than in either. In comparison with *B. lesueur* and *B. penicillata*, the pelage of *B. gaimardi* is conspicuously pale; its lighter examples are decidedly paler and colder in tone than either of the other two species. Its darker variants approach them in color but have the further distinction of a much longer pelage, a ruff on the nape, and near-white forefeet and hind feet (Finlayson, 1959).

The cranium of *B. gaimardi* is the largest of the genus, the range of its chief dimensions overlapping the maxima for *B. lesueur* and *B. penicillata* (e.g., the mean basal length of the skull of *B. gaimardi* is 70.6 mm compared with 60.2 and 66.5 for *B. lesueur* and *B. penicillata, respectively*). The mean displacement volume of the cranium is 66 ml, whereas it is 64 ml for *B. penicillata* and 53–64 ml in three populations of *B. lesueur* (Finlayson, 1959).

Adult Tasmanian bettongs average 1.6–1.8 kg. In Tasmania,

Fig. 1. Tasmanian bettong, *Bettongia gaimardi*. Note: forelimbs are short relative to hindlimbs.
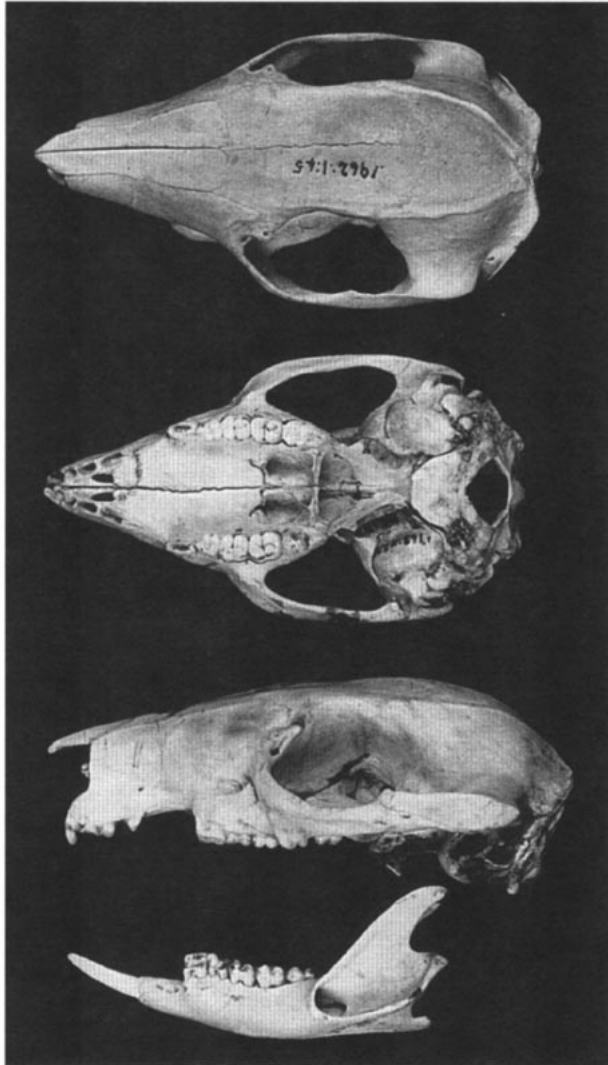
FIG. 2. Dorsal, ventral, and lateral views of the cranium, and lateral view of the mandible of *Bettongia gaimardi*. Composite of three individuals from the Queen Victoria Museum, Launceston, Australia. Greatest length of cranium is 91.0 mm.

it is most similar to the long-nosed potoroo, *Potorous tridactylus*, from which it differs by its much larger size and lighter color. Compared to *P. tridactylus*, the bettong has a shorter nose and a much longer and invariably white-tipped, non-tapering tail with a minor crest. The bettong tends to live in drier country than the potoroo.

Bettongia gaimardi is the largest species of the genus. It differs from *B. penicillata*, which has a brush-tail, and *B. lesueur*, which is a burrowing form, mainly in differences in the skull morphology and in the shape and insertion of the p4 (Wakefield, 1967).

GENERAL CHARACTERS. Tasmanian bettongs are small and compact, with short rounded ears and short muscular forearms with short spatulate claws on small forefeet. The fur resembles that of the rabbit, *Oryctolagus cuniculus*, hence the subspecific name *cuniculus*. The belly fur is nearly white. The long, non-tapered tail becomes almost black distally before ending in a white tip. The crown of the skull has a very short crest (Wakefield, 1967).

Hind limbs are heavily muscled in *B. gaimardi* with long tibiae and fibulae and elongated feet. Digits II and III are weakly developed and joined in syndactyly. Tasmanian bettongs groom and comb their fur by turning these digits at right angles to the foot and using a sweeping motion. Digit IV is the major toe.

The skull is relatively short and broad, characterized by large posterior palatal foramina, inflated auditory bullae and premolars with more than six vertical ridges (Fig. 2). The nasals are short and broad. I1 is stronger and more robust than I2 and I3, and a narrow
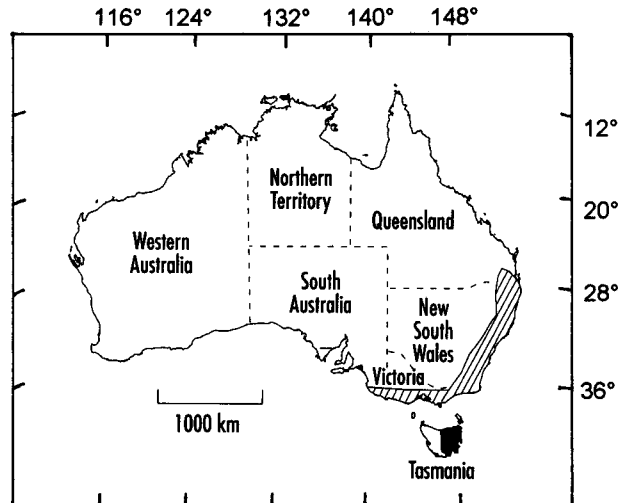

FIG. 3. Distribution of *Bettongia gaimardi*, including past distribution on mainland Australia (striped shading).

diastema separates the incisors from the weak and peg-like canine. PM3 is long, narrow, and serrate, and ornamented with seven to eight fine vertical ridges. The molars are quadrituberculate and bunodont and are smaller posteriorly. Molar rows are straight or gently curved but anteriorly divergent. The lower incisor, i3, is long and falcate, pm3 is similar to PM3, and the lower molars are similar to, but smaller than, the upper molars (Seebeck and Rose, 1988). The relatively short and deep mandible has long and pointed angular processes and broad ascending rami. The vertebral column consists of 7cervical, 13 thoracic, 6 lumbar, 2 sacral, and 22 caudal vertebrae, a total of 50; there are 13 pairs of ribs (Green, 1973).

Locomotion is either by a slow or fast gait, the former being a quadrupedal crawl during which the tail drags on the ground. The fast bipedal gait, which is characteristic of most macropodoids, derives its main propulsion from the downward extension of the hind limbs; the tail is slightly upturned and counterpoises the body. The forelimbs are held close to the body and only touch the ground when the running animal stops or changes direction.

Average measurements (in mm) of male and female *Bettongia gaimardi* from Tasmania are (n = 17): total length, 650; length of tail, 319; length of hind foot, 116.5; length of dried ear, 21.4; greatest length of skull, 79.25/94, (mean, 90.2); depth of rostrum, 16/17.5; cranial breadth, 19.75/22; zygomatic breadth, 44.75/47; length of maxillary tooth row, 22.75/25; and length of molariform teeth in mandibular tooth row, 22.88/25 (R. H. Green, in litt.).

Females carry a single young in a forward-opening abdominal pouch which has four teats. There is little sexual dimorphism, but males are slightly longer and slimmer than females (Rose, 1985). Adults range in body mass from 1.2 to 2.3 kg and average ca. 1.6–1.8 kg (Rose, 1982, 1989a).

The fur of pouch young is darker than that of the adult, but this distinction disappears by the time young leave the pouch. There are five digits on the forefeet but only four on the hind feet, including two in syndactyly. The palate has large vacuities and the dorsally flattened skull has large inflated tympanic bullae (Wakefield, 1967). No baculum is present.

DISTRIBUTION. *Bettongia gaimardi*, now restricted to Tasmania, formerly was distributed in coastal areas from southeastern Queensland to southeastern South Australia (Wakefield, 1967; Fig. 3). Although absent in western Tasmania, the Tasmanian bettong is common in the drier eastern half of the state (Rounsevell et al., 1991). There is no record of *B. gaimardi* ever occupying any island in Bass Strait (Hope, 1972).

FOSSIL RECORD. *Bettongia* fossils of early Pleistocene age are known from the Fisherman's Cliff local fauna in southwestern New South Wales. Fossils of *B. gaimardi* from the late Pleistocene (>50,000 years ago) are known from the Victoria Cave local fauna of southeastern South Australia (Archer and Hand, 1984). Subfossil remains of *B. gaimardi* also indicate a wider distribution in the past in South Australia (Smith, 1971). In Tasmania,

fossils are recorded from a large sandstone shelter in the central plateau (440 m elevation) that is dated from 30,840 ± 480 to 2,500 years ago (Cosgrove et al., 1990).

FORM AND FUNCTION. The dental formula, similar to that of other potoroids, is i 1–3/1, c 1/0, p 2–3/2–3, m 1–4(5)/1–4(5), total 34 for most mature adult Tasmanian bettongs. The actual number of teeth varies with age. The lower incisors erupt while the young are in the pouch. P2 and the deciduous P3 are erupting at the time that the young emerge from their mother's pouch. The sequential eruption pattern of premolars and molars is useful in aging bettongs. M1 first appears at 4.5 months of age, M2 at 6.5 months of age, and M3 at 11 months. The fourth molar does not completely erupt until the fourth year, and some animals over 5 years of age may develop a fifth molar (Rose, 1985, 1989a).

The dentition is typical of the Diprotodontia in which the lower incisors are reduced to a single pair of forward-projecting teeth. All teeth have roots, and hence animals can be aged by the degree of tooth wear as well as by the pattern of tooth eruption (Rose, 1989a).

The metabolic rate in resting, nonlactating females averages 229 kJ kg$^{-0.75}$ day^{-1} (0.42 ml O$_2$ gm^{-1} hr^{-1}), but this value increases by 24% to 287 kJ when a large young is present in the pouch (Rose, 1987a). Other species of *Bettongia* have similar maintenance levels of metabolism, between 238 and 279 kJ kg$^{-0.75}$ day^{-1} (Wallis and Farrell, 1992). Values in the wild, as opposed to those from the laboratory for similar-sized marsupials, are about twice as large (Nagy, 1987). Levels of CO$_2$ production vary linearly in females from 0.7 to 1.0 CO$_2$ gm^{-1} hr^{-1}, the energy expenditure increasing with the amount of fungus in the diet (Johnson, 1994a). Noradrenaline has been shown to cause an increase in oxygen consumption of the perfused hind limb of the bettong (Jiming et al., 1995) as it does in the related potoroo, *P. tridactylus* and some other wallabies but in no other marsupial group (Rose, 1987a).

The body temperature of *Bettongia gaimardi* varies over a 24-h period. It is lowest (36.2°C) at midday when the animal is asleep and highest (37.5°C) near midnight when the animal is active (Rose, 1985). In females, the basal body temperature varies during the estrous cycle. Male bettongs housed outside have a circadian rhythm in body temperature, but all bettongs are good homeotherms at ambient temperatures of 5–35°C (Rose et al., 1990). *B. gaimardi* adjusts the thickness of the nest (insulation) depending on temperature, apparently to reduce heat loss in the colder months and to increase it in the warmer months (Rose, 1985).

Some potoroids can survive without free water to drink; whether the Tasmanian bettong can is unknown, but its distribution in the driest areas suggests it derives sufficient water from its food (hypogeous fungi) and from metabolic water (Seebeck and Rose, 1988). Excess heat can be eliminated by sweat glands located at the base of the tail, the lower parts of the hind limbs, and inside the pouch (Seebeck and Rose, 1988).

The Tasmanian bettong has a set of anal glands, the secretions of which reach the surface via a 'digital process' that protrudes from the dorsal surface of the anus, where white droplets of liquid, presumably used for marking, sometimes are evident. The accessory reproductive glands of male Tasmanian bettongs include a carrot-shaped prostate gland and three pairs of Cowper's glands (Owen, 1868).

There are four mammary glands, similar in structure and function to those of other marsupials. The actively sucked gland increases dramatically in size in late lactation, with milk production reaching a peak near the time of pouch vacation (Smolenski and Rose, 1988).

The milk changes in composition throughout lactation (Rose, 1987a). Early in lactation it is high in carbohydrates (10 g/100 ml) and low in lipids (1–2 g/100 ml). Protein content increases during the lactation period, and milk solids become more concentrated, reaching 50% levels at weaning (Rose, 1978). When the pouch young emerges, milk composition changes dramatically, with carbohydrates falling sharply to 3 g/100 ml, lipid values increasing to 14 g/100 ml, and protein rising further to 10–13 g/100 ml. Thus, the energy content of milk increases throughout the lactation period (Rose, 1987a).

The uterus of a nonpregnant female measures 7 by 5 mm, whereas the uterus of a near-term pregnant female increases to 25 by 19 mm. Diameters of uterine glands associated with these re-

productive stages are 53.6 ± 1.4 mm and 107.1 ± 3.8 mm, respectively (Rose, 1992).

The Tasmanian bettong has a typical potoroid stomach, with the largest compartment being a sacciform forestomach with longitudinal taeniae. A narrow tubiform fore(mid)stomach expands into a globose gastric pouch (hindstomach) and funnel-shaped pylorus. Although the gastric groove typical of foregut fermenters is absent, the large area of the foregut suggests its value either as a storage area or as a fermentation chamber (Hume, 1978). Because the diet of hypogeous fungi is deficient in several essential amino acids, foregut fermentation may supply these by microbial action (Frappell and Rose, 1986; Kinnear et al., 1979).

The colon has a U-shaped loop, the anterior (oral) segment of which undergoes considerable and progressive dilation as far as the ileocolic junction. Here the relatively short, sausage-shaped cecum continues in line with the colon, retaining the increased diameter until near its apex, whereas the terminal third diminishes slightly in cross section (Hill and Rewell, 1955).

ONTOGENY AND REPRODUCTION. Sexual maturity in males is accompanied by a brief surge in testosterone levels, which subsequently vary directly with the mass and volume of the testes. At maturity the mean testes weight is 5.74 g (Rose et al., 1997). Rose and Bradley (1991) show how both albumin-bound testosterone and sex-hormone-binding globulin vary throughout the year.

The estrous cycle is 22.6 days in *B. gaimardi*, slightly longer than its 21.6 day gestation; in these parameters it is similar to the other members of this genus (Rose, 1978). On day 3 after estrus, the basal body temperature of the adult female is significantly elevated, a condition that remains until at least 10 days after estrus. This period corresponds with high levels of serum progesterone (Rose and Jones, 1996).

In bettongs and relatives, gestation occupies the luteal phase and the subsequent follicular phase of the subsequent estrous cycle. The luteal phase lasts 14–15 days (Rose, 1992) and the follicular phase 6–7 days. Thus, the estrous cycle containing a gestation is slightly but significantly shorter than cycles without gestation (Rose, 1987a). At the end of the luteal phase of the estrous cycle, lymph extrudes into the glandular lumina; this may be a source of nutrition for an embryo, if present.

Although there are four teats, normally only one young is produced (Rose, 1978). The exit of pouch young is accompanied, often the same night, by a new birth and subsequent postpartum estrus and mating (Rose, 1986a). The resultant blastocyst remains quiescent in the uterus while a young resides in the pouch (Rose 1987b). If lactation follows, the corpus albicans associated with pregnancy declines in the same way as in a nonpregnant female, but the new corpus luteum formed at postpartum ovulation is held in a state of quiescence that may persist for most of the period of pouch occupancy (Rose, 1992). If the pouch young is removed, the next young is born 18 days later (Rose, 1978).

The pattern of early embryonic development is similar to that of other potoroids and macropodid marsupials (Rose, 1989c, 1989d, 1992). The quiescent blastocyst, which measures 250 μm including membranes (Kerr, 1934), develops from a unilaminar (at day 3) to a bilaminar blastocyst measuring 1.1 mm by day 5 (Rose, 1992). At day 7, the embryo is at the primitive-streak stage of development and measures 2.5 mm. Early and well-formed fetuses at days 11 and 14, measuring 7.5 and 11 mm, respectively, develop by day 17 into near-term fetuses measuring 14 mm (Rose, 1992). Birth occurs at day 18 after the previous young leaves the pouch. Both pituitary and adrenal glands are active before birth, suggesting their role in parturition (Gemmell and Rose, 1989). The hormones of birth (prostaglandin F2alpha and oxytocin) cause both birth behavior and pouch contraction (Rose and McFadyen, 1997).

The developing young is ectothermic at birth and passively homeothermic in the pouch, and it gradually becomes actively homeothermic. Despite having the highest growth rate (4.56 × 10^{-2} ln g/day) during pouch life of any macropodoid marsupial (Rose, 1989c, 1989d), the shift to homeothermy is gradual. At 8–9 weeks, immature Tasmanian bettongs are unable to increase their metabolic rate above basal levels in response to cold stress. From 10 weeks until they leave the pouch at 15 weeks (longer if not replaced by a new young and the mother does not ovulate; Rose, 1987a), young are able to increase their metabolic rate and maintain their body temperature substantially above ambient. During this time, substantial fur is present (reducing thermal conductance). Young

begin excursions outside the pouch soon thereafter (Rose 1989b). Increased sporocarp (fungal) production is associated with increased energy expenditure by the mother and accelerated growth of pouch young (Johnson, 1994a). Young bettongs can be said to be homeothermic about week 12.

The pouch young develop at different rates, with the 300-mg neonate increasing its body mass to 1 g at 7 days, 2 g at 14 days, and 4 g at 21 days (Rose, 1989a). Young Tasmanian bettongs grow at an exponential rate (weight in g = 1.33 $e^{0.38A}$, where A is age in weeks—Rose, 1985) and by 12 weeks the body mass is nearly 250 g. Subsequently, *B. gaimardi* gains about 100 g per week, and achieves nearly full adult size at 1,400 g. Development parallels the progression of changes in body mass. Although sex can be determined by the end of the first week, many other features develop more slowly. Young are mute until 6 weeks of age, cannot right themselves until more than 8 weeks of age, and the eyes do not open until 12 weeks (Rose, 1989a).

The mystacial and supraorbital vibrissae develop first, followed by the geanal, submental, ulnar, carpal, and interramal vibrissae (Lyne, 1959; Rose, 1985). Tasmanian bettongs generally have more vibrissae than the now-extinct mainland subspecies (Lyne, 1959).

Young are born any month of the year; hence, there is no seasonal regression of gonads in either sex. Females mature in 8–11 months and, because breeding is year-round in Tasmania, they breed soon thereafter (Rose, 1978). Because the pouch is vacant for only short periods, the generations overlap, and the minimum interval between litters is about 106 days, it is possible for females to produce ca. 3–3.5 young per year. Eight young are the most that can be produced by one female in her lifetime under natural conditions (Rose, 1987b), although individual females have produced up to 15 young in captivity during five years of breeding. Maximum life span seems to be six years (Rose, 1985).

ECOLOGY. *Bettongia gaimardi* is a specialist mycophagist whose population density is positively correlated with the abundance of mycorrhizal fungi (Taylor, 1993a). Restricted to dry sclerophyll forest types, Tasmanian bettongs are found only in areas with open understory and are absent from patches of dense undergrowth. Because mycorrhizal fungi develop and sporulate well in soils of low fertility, areas with infertile soils support the highest densities of *B. gaimardi* (Taylor, 1993a). Examination of digging activity in relation to vegetation pattern revealed that digging is positively associated with density (but not size) of *Eucalyptus* and *Acacia* stems but is unrelated to type or density of understory vegetation in suitable habitat (Johnson, 1994b). The Tasmanian bettong's most likely competitor in these habitats is the long-nosed potoroo (*Potorous tridactylus*), which tends to have a similar diet but lives in the wetter patches of the habitat (Rose, 1985).

Sporocarps (fruiting bodies) of hypogeous fungi make up the bulk of the diet, but other plant material (epigeous fungi, leaf, stem, seed, fruit, gum, roots, and tubers) and invertebrates also are consumed (Johnson, 1994a; Rose, 1982, 1985; Taylor, 1992). Except for fungi, these foods are easily digestible. Thus, the large sacciform forestomach probably is used in the breakdown (by fermentation) of fungal carbohydrates (Dawson, 1989). Fungi constitute the majority of the diet in most months and sometimes comprise more than 80% of the diet (Johnson, 1994c; Taylor, 1992); body condition of both sexes tends to increase with increased representation of fungi in the diet. Lastly, rates of energy turnover in females and growth rates of their pouch young are positively related to sporocarp production (Johnson, 1994a). Not surprisingly, the habitat variable most closely correlated with abundance of *B. gaimardi* is the incidence of mycorrhizal infection of plant roots (Taylor, 1993a).

The occurrence of fungus in the diet is correlated with sporocarp production; when production is high, the bettongs are almost exclusively mycophagous, whereas at lower levels of fungal production they add more fruits, leaves, tubers, and occasionally the gum of *Acacia* trees to their diets (Johnson, 1994a). Fungus is more important in winter than in spring and summer (Johnson, 1994a; Taylor, 1992). Fire, a dominant feature of *Eucalyptus* forests, increases sporocarp production and thus increases mycophagy in Tasmanian bettongs (Johnson, 1995). Experimental fires neither increase mortality nor decrease body condition of *B. gaimardi*, and population numbers increase as a result of immigration into recently burned areas.

Relative densities at 15 sites range from 0.4 to 21.1 animals per 100 trap-nights in central Tasmania. Population density was estimated to be 19 bettongs/km^2 at one of these sites with 17 animals per 100 trap-nights (Taylor, 1993b).

Nests tend to be clumped in one area of a home range, which is 35–55 ha for females, slightly larger for males. These very large home ranges for mammals of such modest size are consistent with active and wide-ranging animals that sometimes move up to 600 m in 30 minutes (Taylor, 1993a). Tasmanian bettongs occasionally may fall prey to wedge-tailed eagles and feral cats, but the now-extinct thylacine (*Thylacinus cynocephalus*) was, perhaps, a more likely predator in the past. There is no evidence that the extant Tasmanian devil (*Sarcophilus laniarius*) or eastern quoll (*Dasyurus viverrinus*) ever prey upon bettongs.

The high fecundity of the potoroids gives them a higher potential rate of increase than most marsupials have (Lee and Cockburn, 1985). In nature, the sex ratio approximates 1:1 (Rose, 1985).

Ectoparasites of *B. gaimardi* include *Ceratophyllus, Echidnophaga, Pygiopsylla,* and *Stephanocircus* (Siphonaptera); *Australaelaps, Haemaphysalis,* and *Ixodes* (Acarina); and *Heterodoxus* (Phthiraptera) (Collins, 1973; Roberts, 1970).

BEHAVIOR. One of the most unusual behavioral features of the Tasmanian bettong is its habit of carrying nesting material in its slightly prehensile tail. To do this a bettong sits on its haunches with its tail forward between its hind legs. In this position, it uses the forefeet to toss nesting material loosely on top of the tail. When sufficient nesting material has accumulated, the tail is curled around it, and the Tasmanian bettong bounds off to the nest site (up to 1 km) with its load.

Bettongia gaimardi is particularly adept at locating and excavating underground fungi, which it locates both with its well-developed sense of smell (Seebeck and Rose, 1988) and its ability to distinguish the complex odors emanating from the fungi (Donaldson and Stoddart, 1994). Once removed from the ground, the fungi are manipulated with the forelimbs during feeding.

The domed grassy nest of the Tasmanian bettong is similar to that of bandicoots. Nests—constructed of dried grasses and shredded bark, often the "stringy bark" of *Eucalyptus obliqua*—usually are placed in a shallow depression in the ground and hidden by a fallen log, clumps of sedges, bracken, or shrub thickets (Rose, 1986b). A male and female may cohabit near the time of estrus, and mother and young may live in the same nest for a considerable period (Rose, 1985). Individuals use 5–10 nests, often visiting one nest for 3–6 days before moving to another (Taylor, 1993a).

Primarily nocturnal, the Tasmanian bettong rarely is active during the day except when flushed from its nest. Individuals leave their nests soon after dark for what is, usually a single long (8–10 h) activity period; activity sometimes is interrupted by inclement weather. *B. gaimardi* is active about 95% of short summer nights but only 66% of long winter nights, resulting in significant seasonal differences (Taylor, 1993a).

The mother plays an important role in determining the duration of pouch life. During the last two weeks of pouch life (at 13–15 weeks of age), the young Tasmanian bettong spends an increasing amount of time outside the pouch. On the final night before the young vacates the pouch permanently, a precise sequence of events occurs (Rose, 1986a). A dramatic tightening of the pouch sphincter prevents the re-entry of the young once it has left the pouch—or is "at foot." Then, usually that same night, both birth and a postpartum estrus occur—the former resulting in a new young in the pouch, the latter initiating the formation of yet another embryo "in waiting" (Rose, 1986a). After this, the young at foot initiates most encounters with its mother, nursing but gradually reducing the interaction as its need for milk diminishes. The relative time spent together is shorter than that observed for more social macropods (Virtue, 1987). During this period of "interim" pouch life, the mother, if disturbed, will call her young back to the pouch with a "tsk-tsk" sound (Rose, 1985).

Although it walks on four feet while probing and feeding, the Tasmanian bettong normally bounds in kangaroo fashion. At night, it is less timid than many native mammals and can be observed with a spotlight—a behavior that makes it particularly vulnerable (Rose and Johnson, 1995).

In captivity, males check females daily for signs of estrus by sniffing the urogenital sinus, but females tolerate males only at estrus. At other times, females are aggressive towards males and sometimes will lie on their sides and kick and hiss at the male

(Virtue, 1987). During copulation, which can occur during day or night, the male mounts from behind and clasps the female's thorax with his forelimbs. She responds by raising her hindquarters. After intromission the male uses pelvic thrusts. Intromission lasts from 8 s to 8 min and can occur many times on the one night of estrus (Rose, 1985; Virtue, 1987). In captivity, males are aggressive toward each other and will set up a hierarchy (Rose, 1982, 1985).

GENETICS. The diploid number of chromosomes is 2n = 22, and the sex chromosomes are of XX/XY type (Rose, 1989*b*; Sharman, 1961). These include seven pairs (two large, two medium-sized and three small) of acrocentric chromosomes, one pair of metacentrics, and two pairs of submetacentrics.

CONSERVATION STATUS. The absence of foxes has likely contributed to the continued survival of *B. gaimardi* in Tasmania, but foxes probably contributed to their demise on the mainland (Rose and Johnson, 1995). The Tasmanian bettong has the most secure status of all members of this genus (Rose, 1986*b*; Rose and Johnson, 1995). However, the status of the Tasmanian bettong is that of vulnerable (Rose, 1986*b*) because almost all bettong habitat occurs on privately owned land susceptible to forestry and to agricultural development; only 5% of its potential habitat lies within National Parks.

REMARKS. *Bettongia* is derived from an aboriginal name for "small wallaby," whereas *gaimardi* is a Latinized form of the name of J. P. Gaimard, a French naturalist on the exploration vessel l'Uranie, which visited Port Jackson in 1819 (Strahan, 1981). Other common names include eastern bettong and rat-kangaroo. We thank H. Wapstra for the photograph, J. Leeming and J. Rainbird of the Queen Victoria Museum in Launceston for the skull photographs and standard measurements, respectively, and S. Pigot, Tasmania Parks and Wildlife Service, for the distribution map.

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