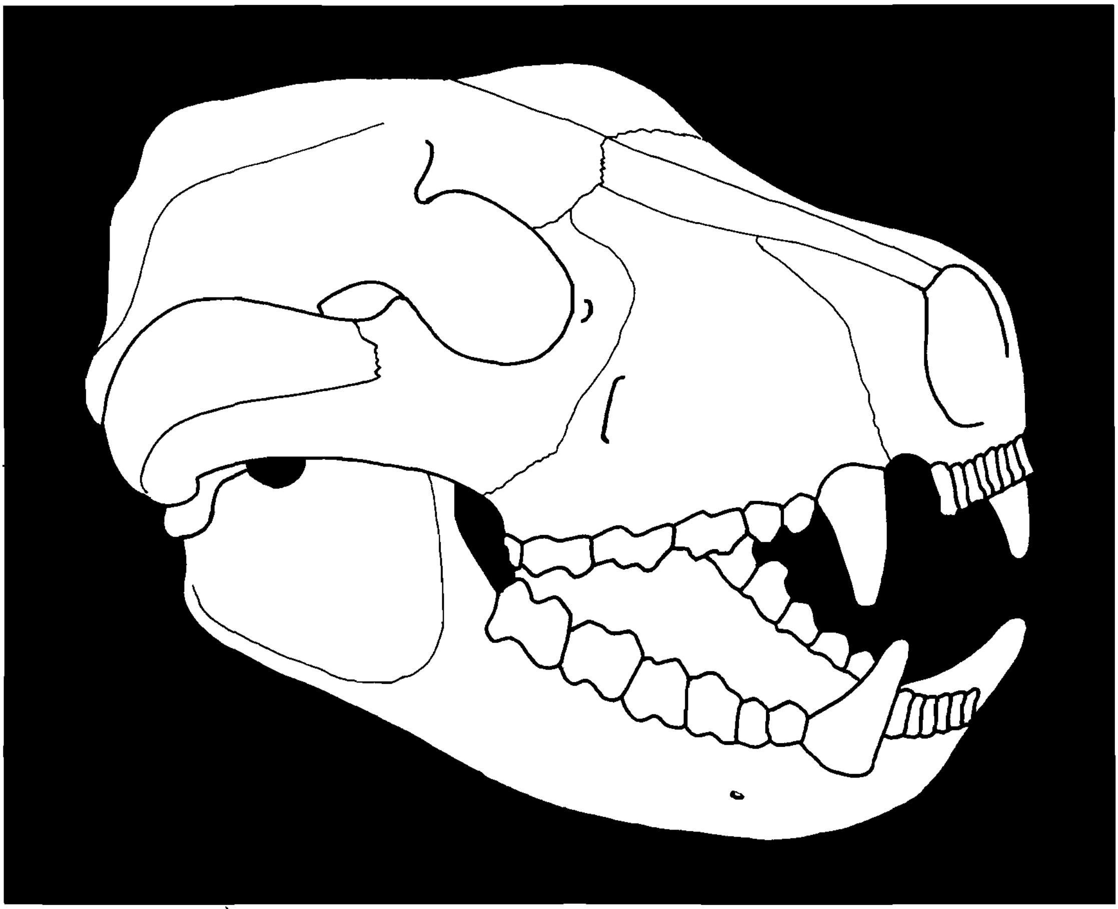
SKULLS of the MAMMALS in TASMANIA



R. H. GREEN
with illustrations by
J. L. RAINBIRD

An Illustrated Key to the

Skulls of the Mammals in Tasmania

by

R. H. GREEN

with illustrations by
J. L. RAINBIRD

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INTRODUCTION

The skulls of mammals are often brought to museums for indentification. The enquirers may be familiar with the live animal but they are often quite confused when confronted with the task of identifying a skull or, worse, only part of a skull.

Skulls may be found in the bush with, or apart from, the rest of the skeleton. They are sometimes dry and easily handled, sometimes in an unpleasant state of partial decay, or even fragmented and wrapped amongst fur and other matter in mammal droppings or in the regurgitated food pellets of a bird of prey.

Skulls are often easily identified to species level, and reveal a great deal of information about the animal from which they originated.

The finding of a skull suggests the occurrence of that species in the aréa and where there is one there should be more, unless it was carried there from its natural habitat, perhaps by a predator which may have fed upon the carcass. Skulls and fragments of skulls found in droppings and regurgitated pellets also indicate the predators of those species, and thus help us to learn more about predator-prey relationships.

Skulls are of the utmost importance to taxonomists in endeavouring to trace the evolution of animals, as their general form and the dentition reveal relationships between families, genera and species. They also reveal a great deal about the feeding habits of animals, whether they are carnivorous, insectivorous, herbivorous or omnivorous, and are therefore useful in learning something of the ecology of animals. Close examination of a skull can indicate the approximate age of the animal at the time it died because skull size, development of the bone and the degree of tooth eruption and wear all help in determining age. In some mammals, the pattern of deposition of dentine within the pulp canal or of cementum on the outside of the root, is used to determine age, in the same way as the annual rings in a tree are used to determine its age.

Thus the study of skulls is important as well as interesting to both the professional zoologist and the amateur naturalist, and knowledge gained can be useful for the control and conservation of animal populations.

The animal's head is its most vital appendage, containing the brain which is the control centre for the central nervous system. In it also are centred the essential senses of sight, smell, hearing and taste. For most animals the head, with its specialised mouth and teeth, is the principal tool in securing food. Whether this be soft vegetable matter, insects, flesh or bone, all must pass between the jaws in the initial preparation for digestion. The tongue and teeth are also used in grooming and cleaning itself and its young.

Skulls are often used as models by artists who see the beauty of nature in their graceful forms, the wonders of evolution in their complexity and the extremes between the passive herbivores and predatory carnivores in the various dental arrangements.

This publication has been prepared as a simple, illustrated key for the identification of skulls of native and introduced mammals in Tasmania in the hope that it will encourage the interest of students in the process of evolution, the relationship of species and the beauty of nature's specialisation as revealed in the study of skulls.

A dichotomous key is given in Appendix I.

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The skull used to illustrate the New Zealand Fur-seal was kindly loaned by the National Museum of Victoria.

TYPES OF TEETH

There are four types of adult teeth regularly referred to when discussing the dental complement of mammals — incisors, canines, premolars and molars. These are shown in Figures 2 and 3 where skulls of a carnivore and a herbivore are illustrated.

Most eutherian or placental mammals are born with some of their front teeth either erupted above the gums or almost so. These first teeth are known as milk (or deciduous) teeth. These usually remain in place during the period of suckling but are later replaced by permanent teeth more suitable for the animal's adult diet.

In the marsupials, the teeth erupt some considerable time after the young are born, because birth occurs at an early stage of development. Marsupials have only one deciduous milk tooth, the rear most of the premolars.

Incisor teeth, near the front of the mouth, are simple, single rooted and adapted for seizing and cutting according to the animal's mode of feeding.

Canine teeth, on either side of the mouth, may vary from tiny rudimentary teeth as found in some herbivores to the sabre-like or conical, powerful, interlocking teeth of carnivores. They enable the predatory mammal to secure a firm hold on its struggling prey and assist in killing by their stabbing action. There is never more than a single pair in each jaw.

Premolar teeth are the cheek teeth in front of the molars. They usually have more than one root and in some species, especially in the herbivores, the prominent premolars are almost indistinguishable from the molars. In carnivores, they are often blade-like with a shearing action for chopping up the prey.

Molar teeth are the rear cheek teeth which have no milk teeth preceding them. They usually have several roots and a complex pattern of cusps and ridges to serve as grinders for the mastication of food.

Post Canine teeth are the premolars and molars (cheek teeth). The term is usually used when numbering the teeth of seals in which both kinds look alike.

Dental Formula is based upon these kinds of teeth and for brevity, only the first letter of each is used, preceding the number of those teeth usually present in skulls of adults. The number given is for the teeth on one side only, that above the line being for the upper jaw (premaxilla and maxilla) and that below for the lower jaw (mandible or dentary). This is followed by the sum of all teeth, but occasionally individuals are found with more or less than the normal complement.

THE ILLUSTRATIONS

The illustrations are designed to show the main characteristics used to identify the skulls of the mammals in Tasmania. All but the New Zealand Fur-seal have been drawn from specimens in the collections of the Queen Victoria Museum and the registered numbers and sex of the skulls are listed in Appendix II. The dental formula (see page 6) quoted beneath each illustration is typical for the species but deviations from normal sometimes occur. Some inconsistencies may occasionally be found when examining skulls of juvenile animals. Such discrepancies are most apparent in skull size and in the incomplete eruption of teeth, especially the posterior molars.

The skull of a Caucasian man is also illustrated for general comparative interest (page 93).

The use of common names is confusing as several are sometimes applied to one species. In support of standardisation, the taxonomy and arrangements here followed are those of Strahan (1980) Recommended Common Names of Australian Mammals, *Australian Mammal Society Bulletin* Vol. 6 (2), 13-23.

An asterisk (*) indicates that the species has been introduced and now occurs in Tasmania in a feral or domesticated state.

The brief text preceding each family discusses some of the characteristics of the skulls and teeth and the way in which they relate to the habits and food of the species.

The skulls of most marsupials can be separated from those of eutherian mammals by reference to the shape of the frontal bones, those of marsupials generally being expanded posteriorally; also the palate of marsupials often has prominent openings between the molar rows.

As a general rule, the strongly inflected angle of the mandible in marsupials (Figure 1 ↗) can be used to distinguish them from the eutherian mammals.

Arrows (↗ and ↗) indicate some of the features referred to in the text and key.

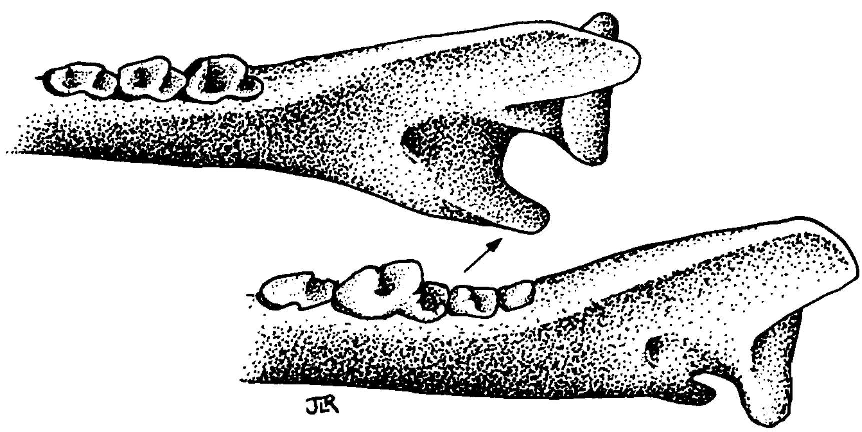


Figure 1 The inside of the right lower jaw (mandible) of a marsupial (Thylacine, above) illustrating the inflected angle (↗) and of a eutherian (Dog, below) in which it is lacking.

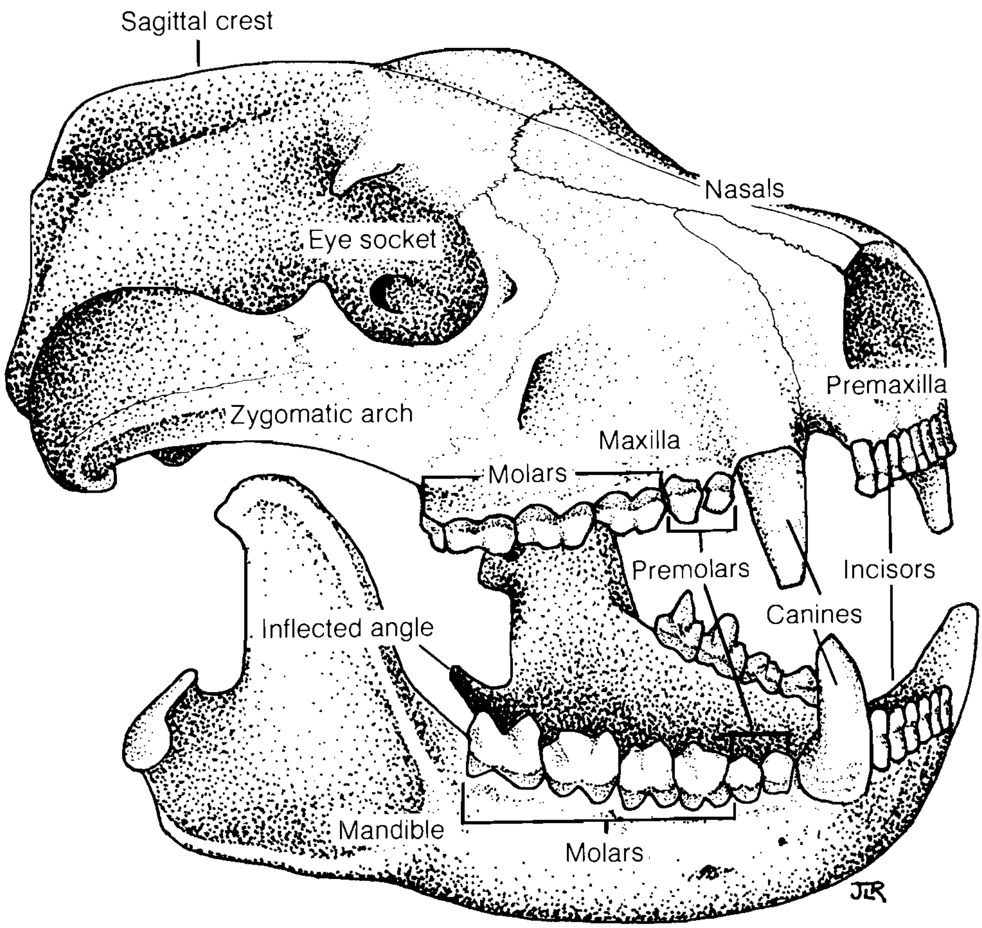


Figure 2 Skull of a carnivore (Tasmanian Devil) indicating features mentioned in the text and an example of the POLYPROTODONTIA: Marsupials with numerous small sub-equal incisors and large canines. The molars have sharp cusps. The dental formula is I $\frac{4}{3}$, C $\frac{1}{1}$, P $\frac{2}{2}$, M $\frac{4}{4}$, = 42.

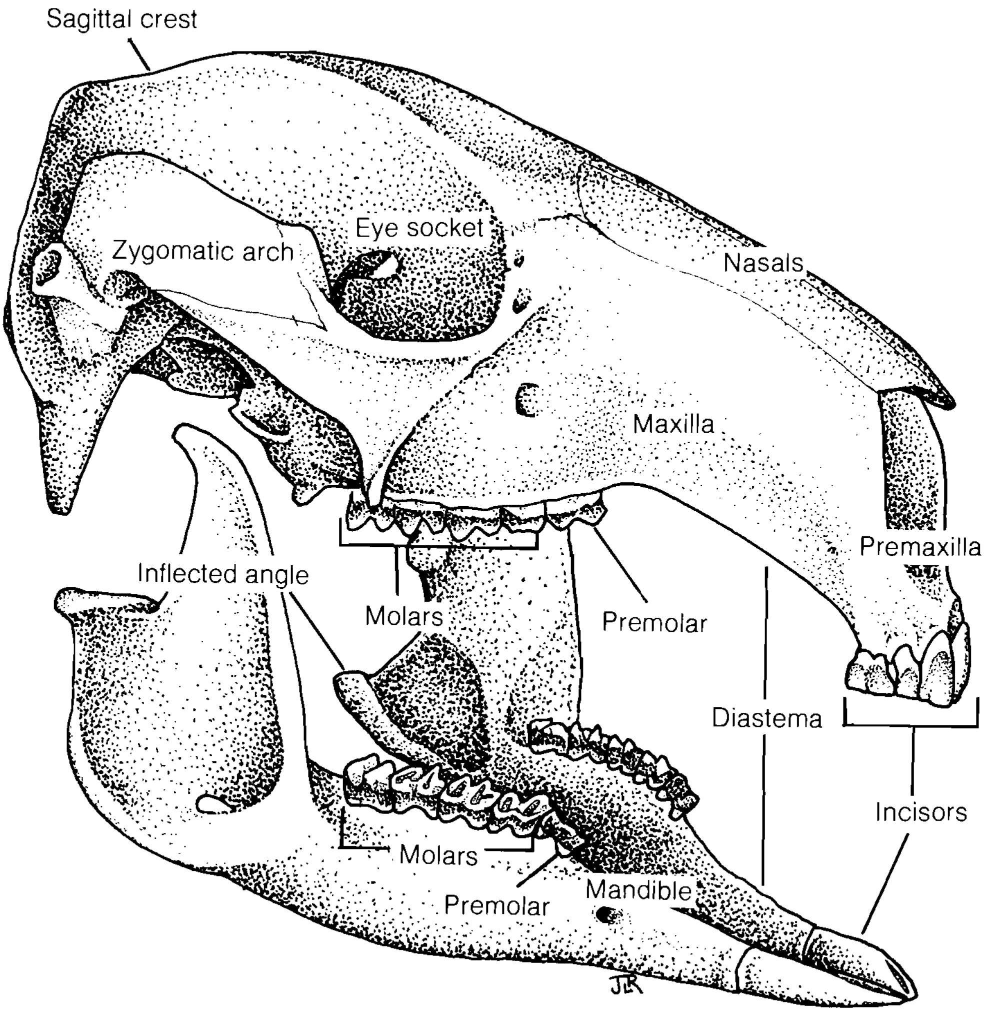


Figure 3 Skull of a herbivore (Red-necked Wallaby) indicating features mentioned in the text and an example of the DIPROTODONTIA: marsupials in which the lower incisors are reduced to a single central pair (rarely with an inferior second pair) of forward projecting teeth. The molars are blunt with transverse ridges.

The dental formula is I $\frac{3}{1}$, C $\frac{0}{0}$, P $\frac{1}{1}$, M $\frac{4}{4}$, = 28.

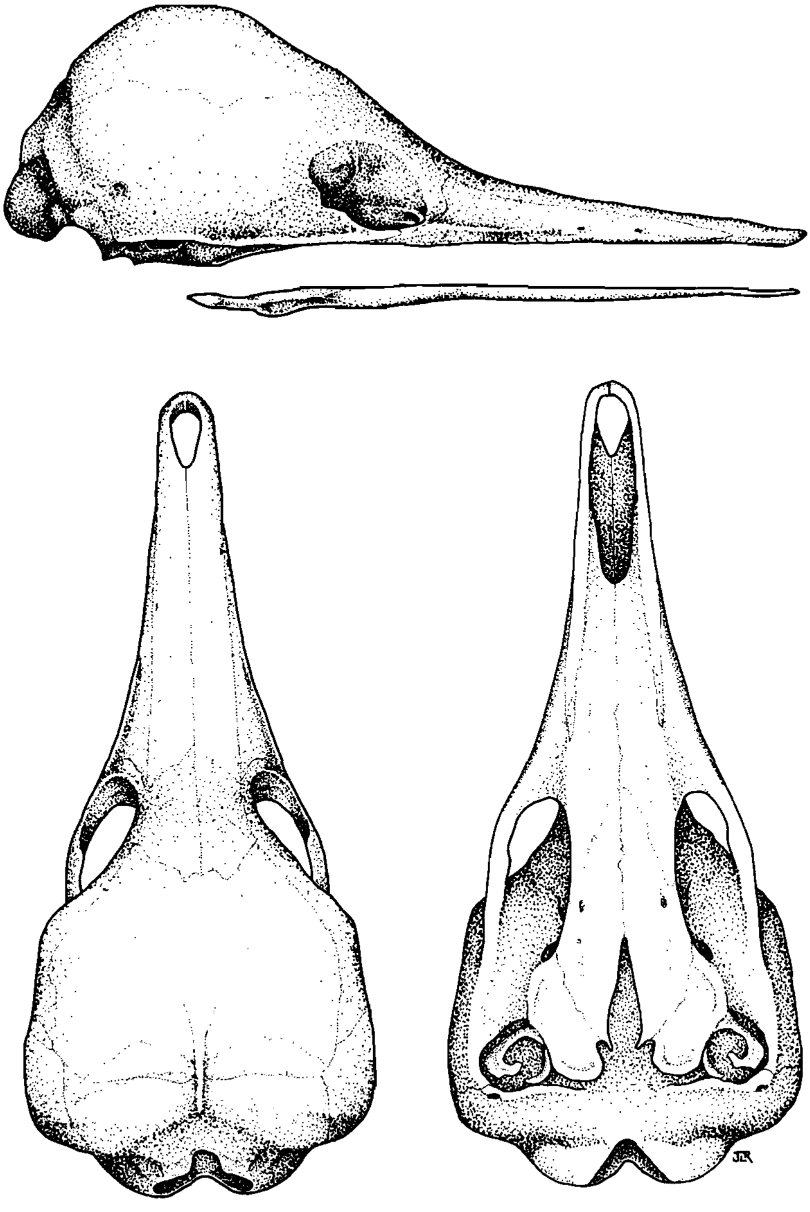
Order MONOTREMATA
Family TACHYGLOSSIDAE

Short-beaked Echidna *Tachyglossus aculeatus*

The diet of the echidna consists principally of small ants but termites and earthworms are sometimes eaten. They gather their food items by digging with powerful front feet and collecting the prey with their long, sticky tongue. The greatly elongated snout is used as a tool to probe into ants' nests and holes in search of food.

The echidna is toothless. The efficiency of the tongue in securing items is such that incisors and canines, as occur in other insectivorous mammals, are unnecessary. Within the mouth the food is reduced to small fragments by the grinding action of a set of hard spines on the dorsal surface of the base of the tongue against sets of transversely arranged spines on the palate. The lower jaw is extremely weak and rudimentary. It fits neatly into the concaved ventral surface of the maxilla and is thus protected by it when the echidna is vigorously probing. In fact the echidna cannot open its jaws. The subterminal mouth is only large enough to admit the retracting tongue with its prey.

The brain case is relatively huge compared to the rest of the skull.

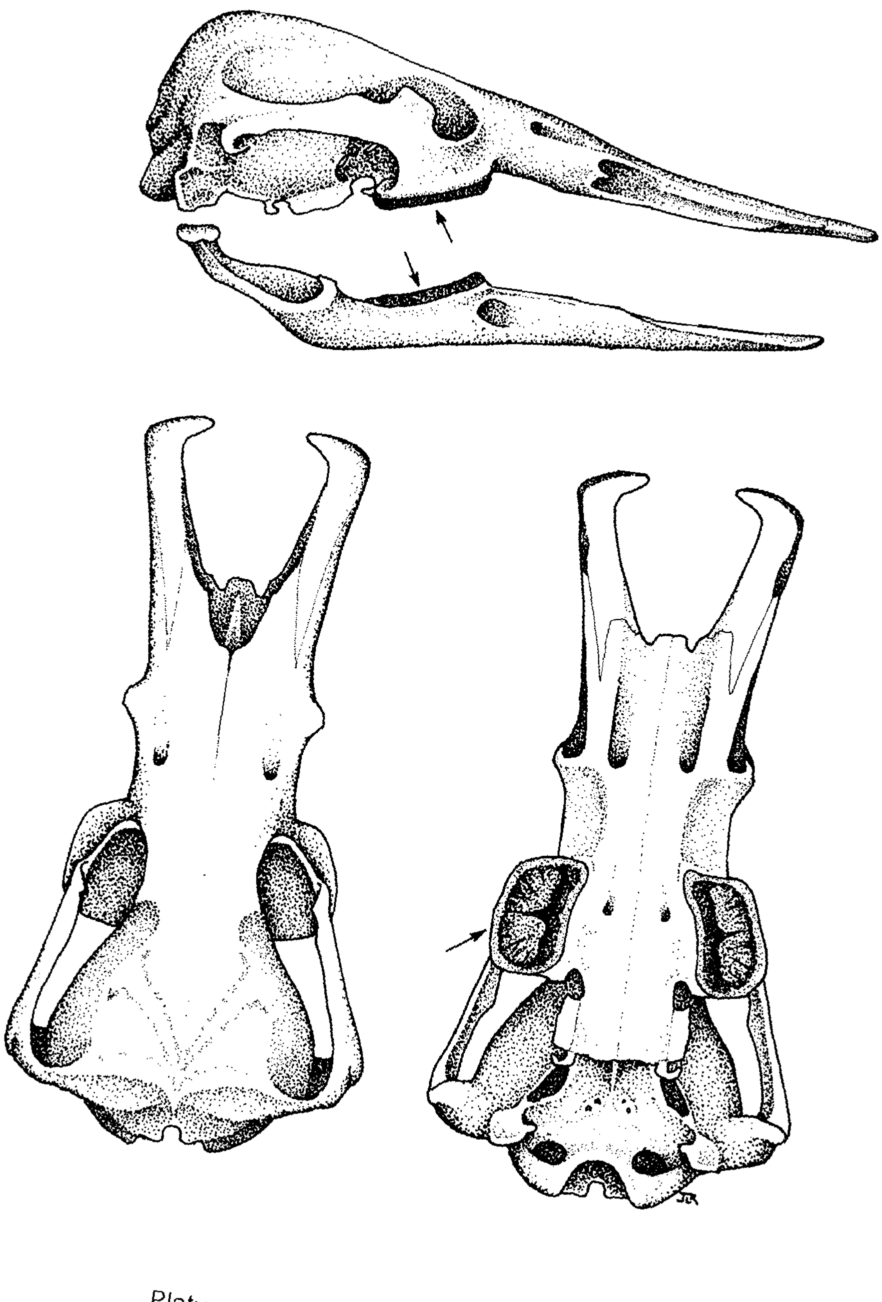


Short-beaked Echidna
Tachyglossus aculeatus   nat. size
No teeth

Order MONOTREMATA
Family ORNITHORHYNCHIDAE

Platypus *Ornithorhynchus anatinus*

The single member of this family is widely distributed in Tasmania, living an aquatic life along the shores of lakes and streams. The anteriorally expanded and flattened snout reflects its mode of feeding. Sometimes called a "Duck-bill", it gathers food beneath the water, in the manner of dabbling ducks, by filtering small aquatic animals from amongst stones, debris and silt. Such items are held in the mouth until the platypus surfaces to breathe and only then are masticated and swallowed. Teeth are present in juveniles but they are lost at an early age and replaced by horny molar plates (/) which serve to grind the food.



Platypus
Ornithorhynchus anatinus nat. size
Horny molar plates (↗)

Order MARSUPIALIA
Family DASYURIDAE

Tiger Quoll (Tiger Cat) *Dasyurus maculatus*

Eastern Quoll (Native Cat) *Dasyurus viverrinus*

Tasmanian Devil *Sarcophilus harrisii*

Swamp Antechinus *Antechinus minimus*

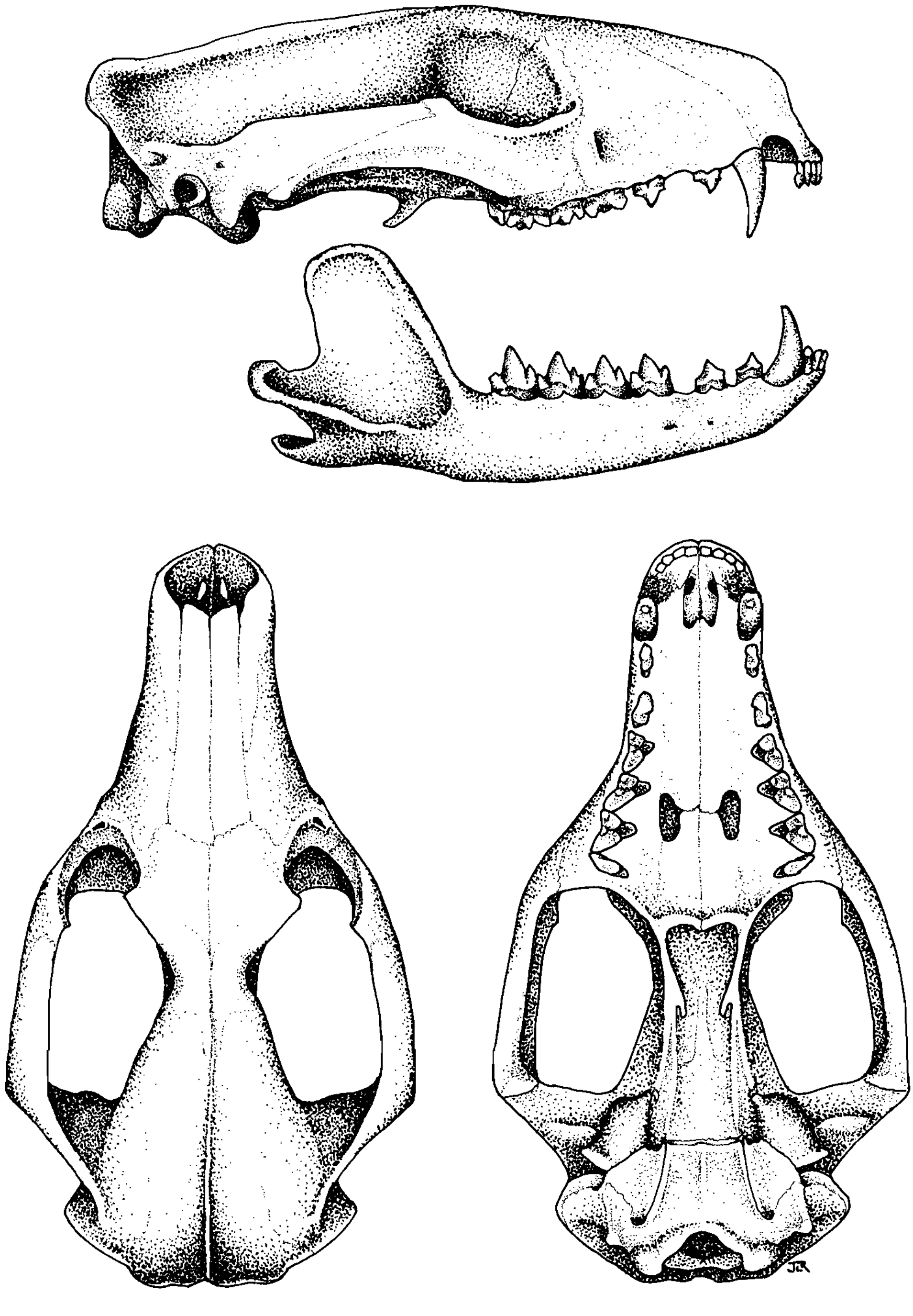
Dusky Antechinus *Antechinus swainsonii*

White-footed Dunnart *Sminthopsis leucopus*

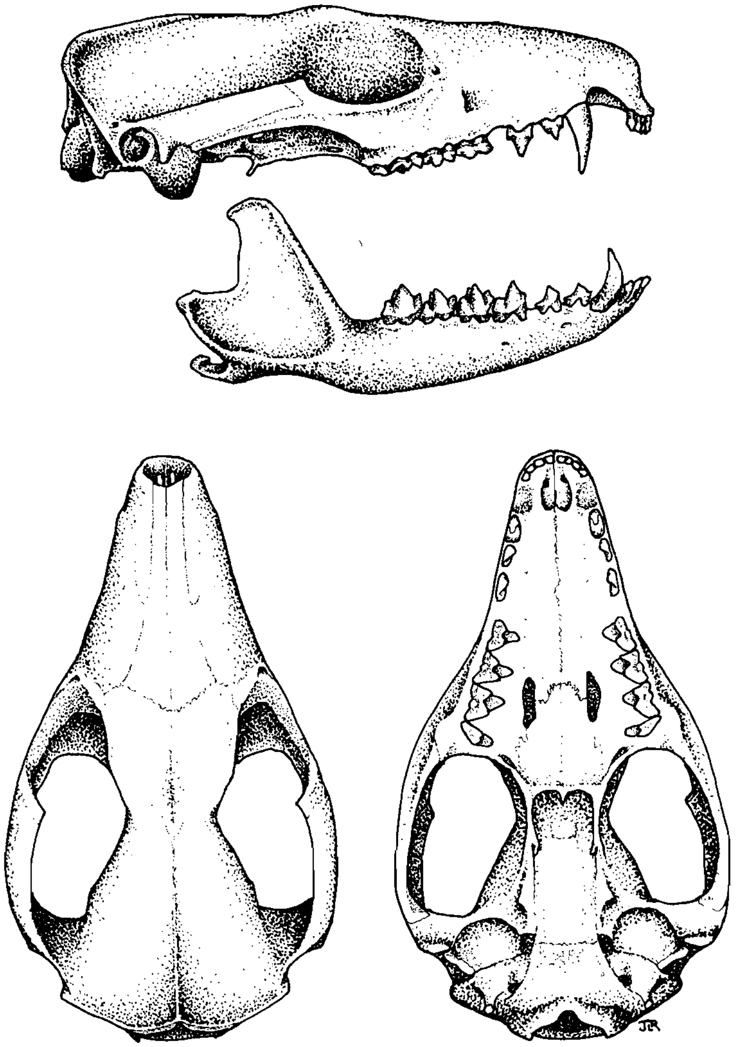
This large family of carnivorous and insectivorous marsupials is included in the suborder POLYPROTODONTIA, its members having more than one pair of lower incisors. The first three are the larger carnivorous species which possess prominent, long, sabre-like canines, the lower pair closing into socket-like depressions in front of the upper pair. This interlocking action improves the animal's efficiency in holding and killing its prey. The prominent sagittal crest provides for strong muscle attachments and thus a more powerful bite.

The other three are smaller insectivorous species. They have somewhat similar interlocking canines but because of their diminutive size, this is often overlooked. Their sharply pointed snout allows them to probe into crevices and holes to secure insects. Like the larger dasyurids, they too have sharply cusped cheek teeth for chopping up their food but the lack of a sagittal crest indicates a less powerful bite consistent with the small size of their prey.

The Dusky Antechinus may be separated from the remaining two small dasyurids by reference to the palatal openings, the anterior pair (↗) being longer than their distance from the posterior pair.



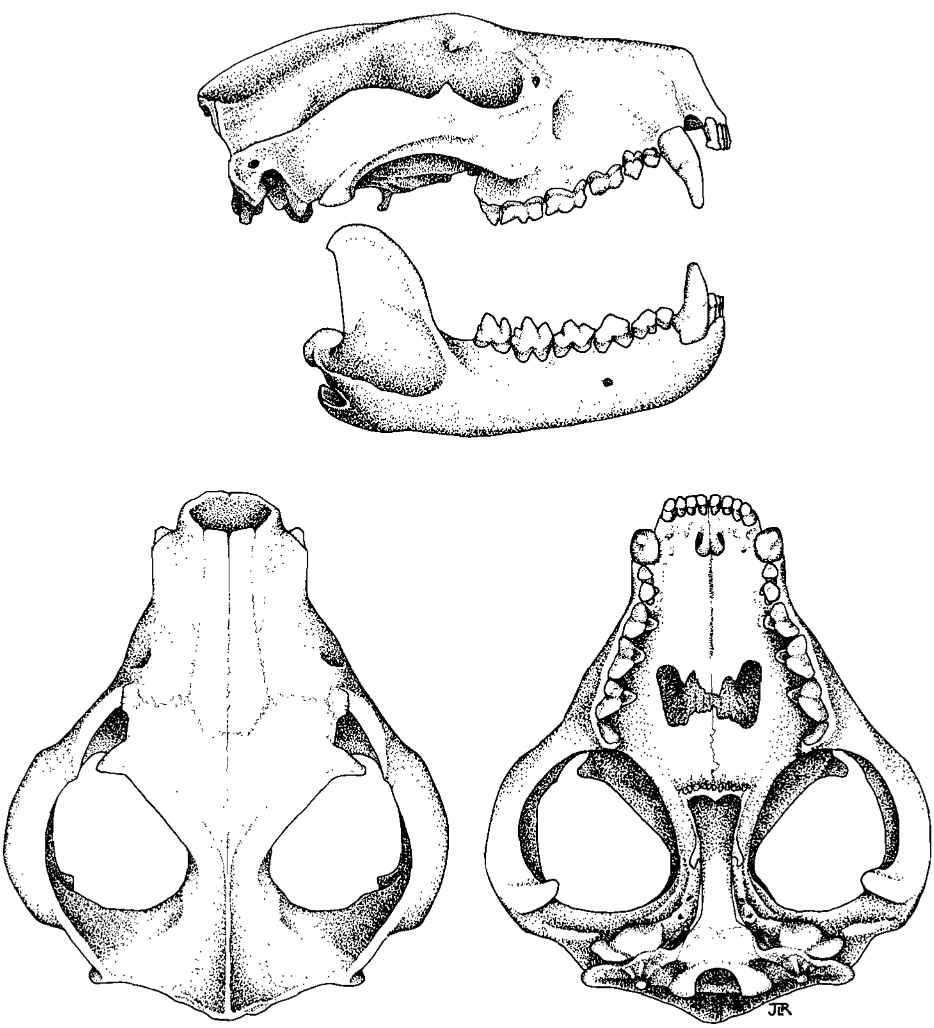
Tiger Quoll (Tiger Cat)
Dasyurus maculatus nat. size
$I\frac{4}{3}$, $C\frac{1}{1}$, $P\frac{2}{2}$, $M\frac{4}{4}$, = 42.



Eastern Quoll (Native Cat)

Dasyurus viverrinus nat. size

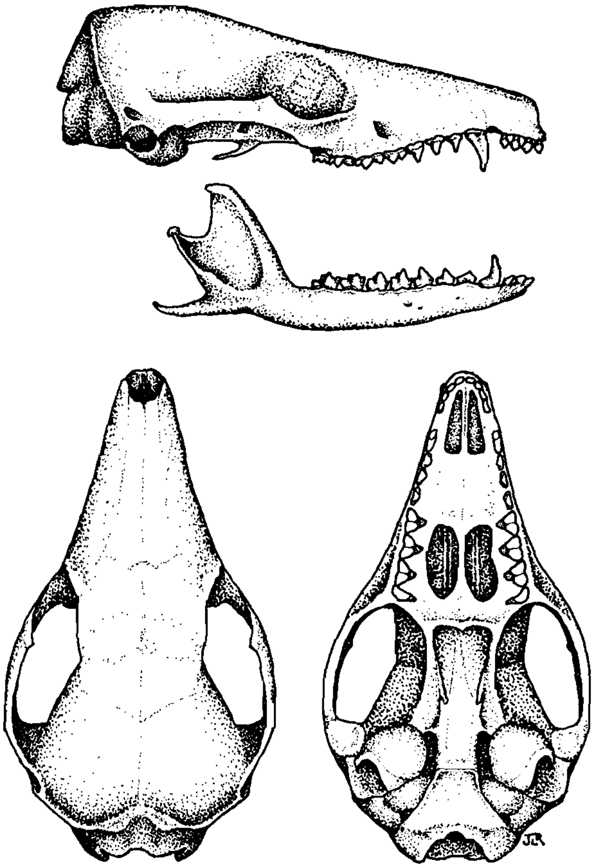
I^{4}_{3}, C^{1}_{1}, P^{2}_{2}, M^{4}_{4}, = 42.



Tasmanian Devil

Sarcophilus harrisii x 0·5

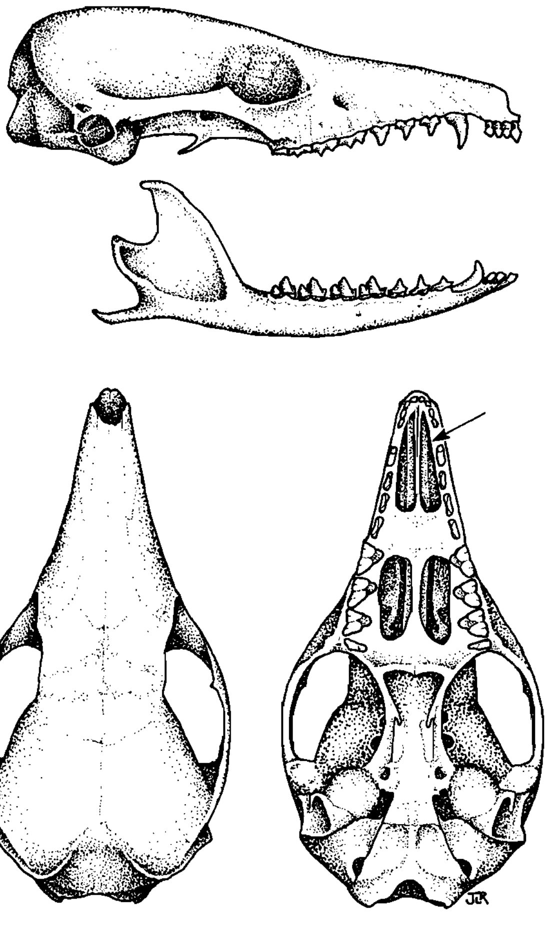
$I\frac{4}{3}$, $C\frac{1}{1}$, $P\frac{2}{2}$, $M\frac{4}{4}$, = 42.



Swamp Antechinus

Antechinus minimus x 2

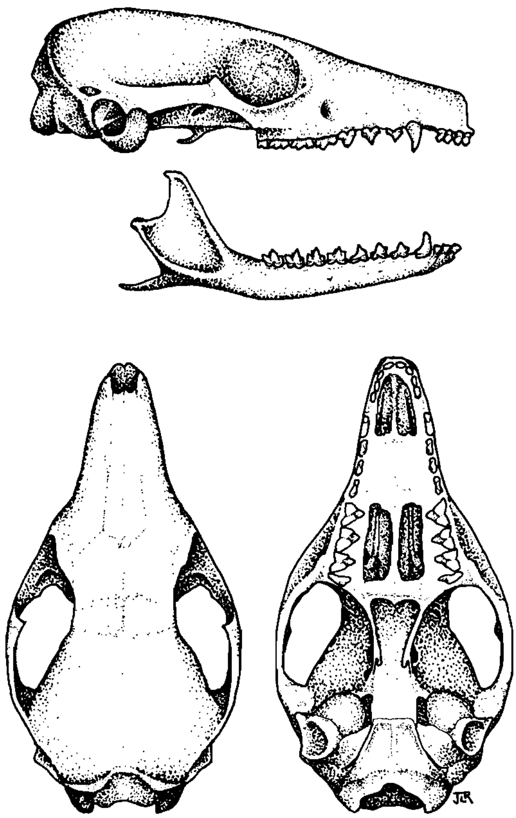
I^{4}_{3}, C^{1}_{1}, P^{3}_{3}, M^{4}_{4}, = 46.



Dusky Antechinus

Antechinus swainsonii x 2

I^{4}_{3}, C^{1}_{1}, P^{3}_{3}, M^{4}_{4}. = 46.



White-footed Dunnart

Sminthopsis leucopus x 2

$I\frac{4}{3}$, $C\frac{1}{1}$, $P\frac{3}{3}$, $M\frac{4}{4}$, = 46.

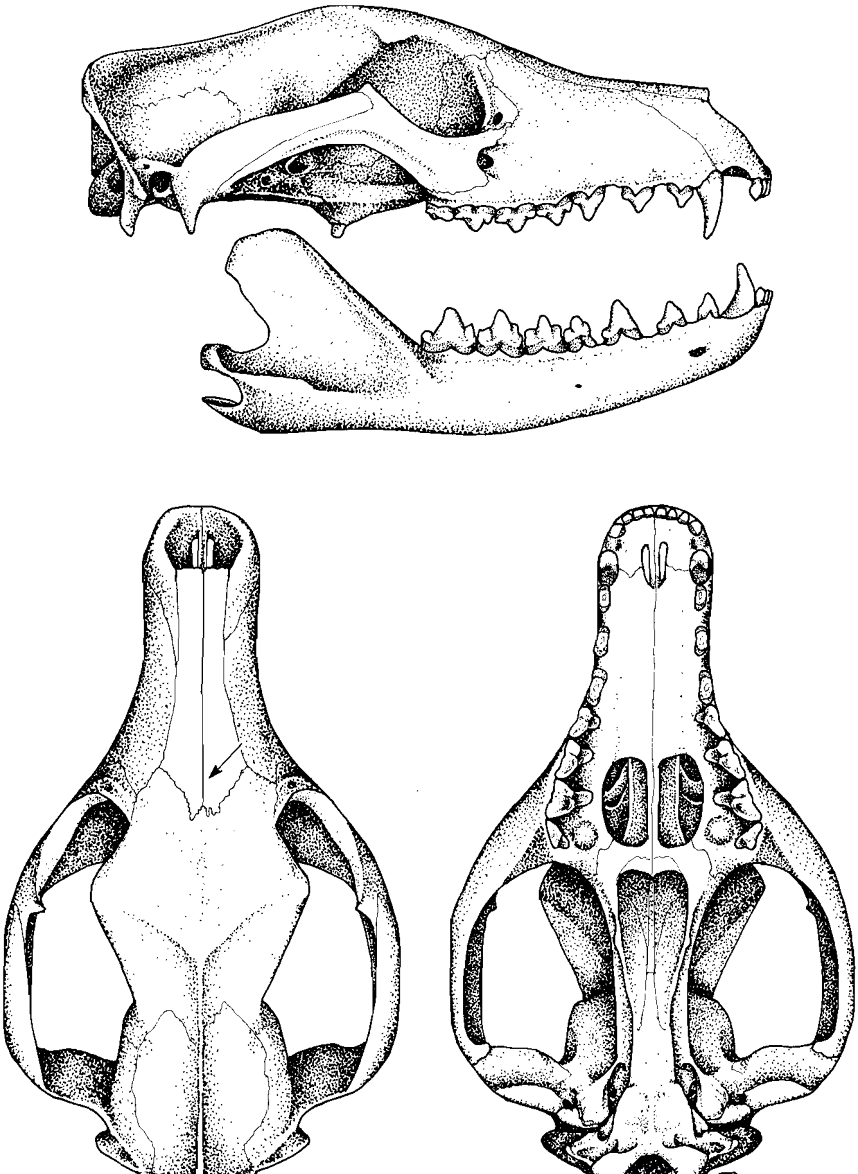
NOTES

Order MARSUPIALIA
Family THYLACINIDAE

Thylacine *Thylacinus cynocephalus*

The Thylacine is the largest member of the suborder POLYPROTODONTIA and provides an excellent example of convergent evolution. Similarities of hunting and feeding methods to that of the dog are well illustrated by the superficial likeness of the skulls of these two carnivores. They have evolved with a somewhat similar skull shape, large jaws and canines which equip them for catching, holding and killing large mammals such as wallabies.

A detailed comparison of the skulls of the Thylacine and dog reveal that they differ in many small but important features which help to illustrate the Thylacine's relationship to the other carnivorous marsupials and clearly distinguish it from the dog. These include a relatively smaller brain cavity, a greater number of incisors and molars and the absence of lateral cusps on the incisors. The arrangement of molar cusps and relative size of cheek teeth also differs and the nasal bones are broad posteriorly (↗) whereas in the dog they are broad anteriorly. The mandible of the Thylacine also has an inflected border of the angle (see also page 7).



Thylacine (Tasmanian Tiger)

Thylacinus cynocephalus x 0·5

$I\frac{4}{3}$, $C\frac{1}{1}$, $P\frac{3}{3}$, $M\frac{4}{4}$, = 46.

Order MARSUPIALIA
Family PERAMELIDAE

Southern Brown Bandicoot *Isoodon obesulus*

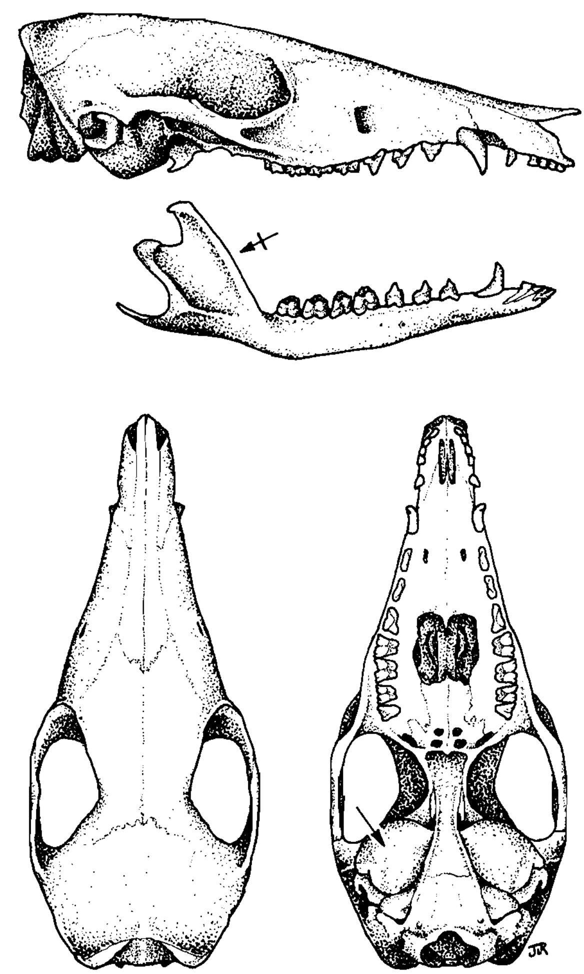
Eastern Barred Bandicoot *Perameles gunnii*

Bandicoots belong to the marsupial suborder POLYPROTODONTIA and have strongly developed insectivorous habits which are reflected in their dentition.

The greatly elongated snouts of bandicoots, with forward-projecting lower incisors, are well suited to the animal's manner of hunting and capturing its food. Though a little vegetable matter may be occasionally eaten, the main diet consists of invertebrate animals secured by digging small holes in the soil and probing beneath grass and other ground cover.

The two species may be easily separated by reference to the relative size of the ear bones or bullae (↗) which are much larger in the Brown Bandicoot. The ascending part of the lower jaw (↗) is broader in the Brown Bandicoot than in the other species.

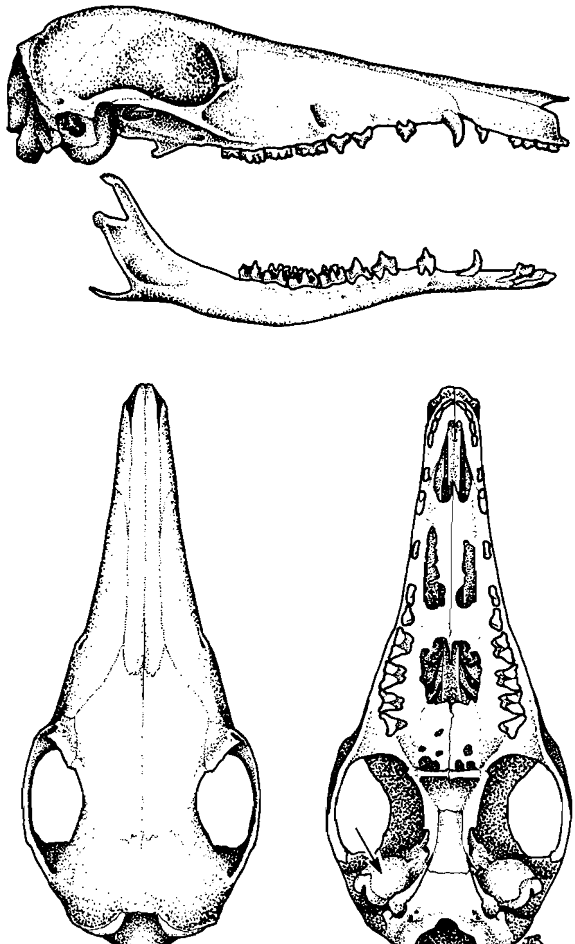
The skulls of males and females may be separated by comparing the relative size of the canines, those of males being slightly larger.



Southern Brown Bandicoot

Isoodon obesulus nat. size

I^{5}_{3}, C^{1}_{1}, P^{3}_{3}, M^{4}_{4}, = 48.



Eastern Barred Bandicoot

Perameles gunnii nat. size

$I\frac{5}{3}$, $C\frac{1}{1}$, $P\frac{3}{3}$, $M\frac{4}{4}$, = 48.

NOTES

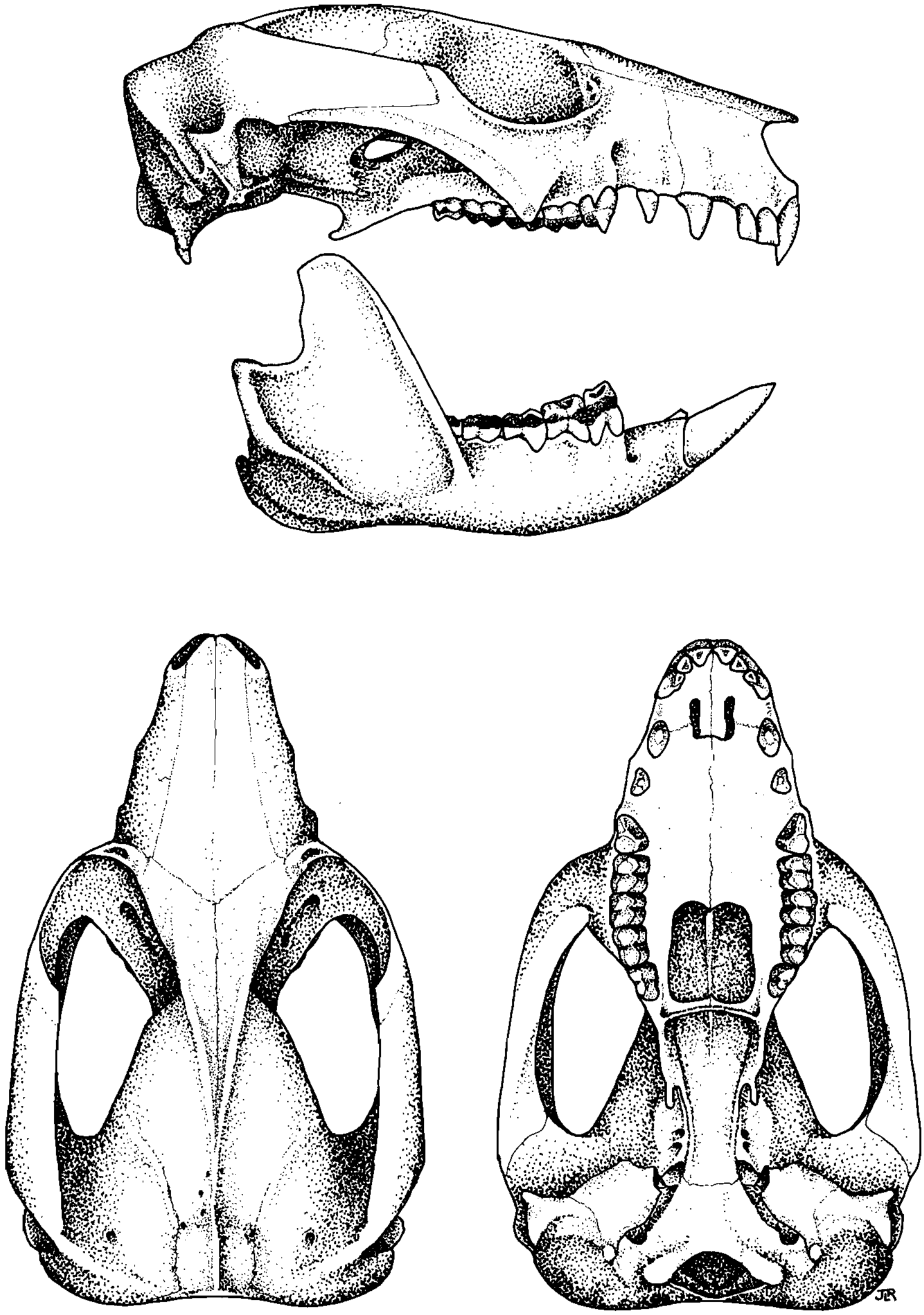
Order MARSUPIALIA
Family PHALANGERIDAE

Common Brushtail Possum *Trichosurus vulpecula*

The Brushtail Possum feeds mostly by browsing but it has carnivorous tendencies and occasionally eats meat and insects.

It belongs to the suborder DIPROTODONTIA, having a large pair of forward-projecting lower incisors. These teeth are not so blade-like or as anteriorally directed as those of the macropodids and very small second incisors may sometimes be present.

In the upper jaw, the strong canines and first premolars are indicative of its carnivorous inclinations. The sagittal crest, which is most prominent in older individuals, provides for strong muscle attachment and a powerful bite.



Common Brushtail Possum

Trichosurus vulpecula nat. size

$I^{3}_{2}, \ C^{1}_{0}, \ P^{2}_{1}, \ M^{4}_{4}, = 34.$

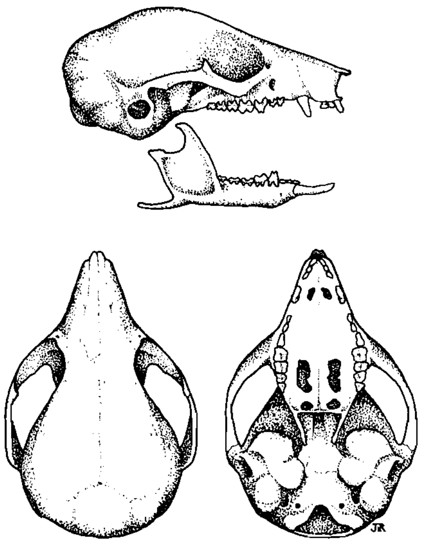
Order MARSUPIALIA
Family BURRAMYIDAE

Little Pygmy-possum *Cercartetus lepidus*

Eastern Pygmy-possum *Cercartetus nanus*

This family contains the smallest members of the suborder DIPROTODONTIA. The pygmy-possums are believed to feed principally on insects but occasionally they take nectar and selected vegetable items. The slightly forward projection of the upper incisors is an advantage in extracting insects from crevices and the prominent upper canines also indicate predatory habits.

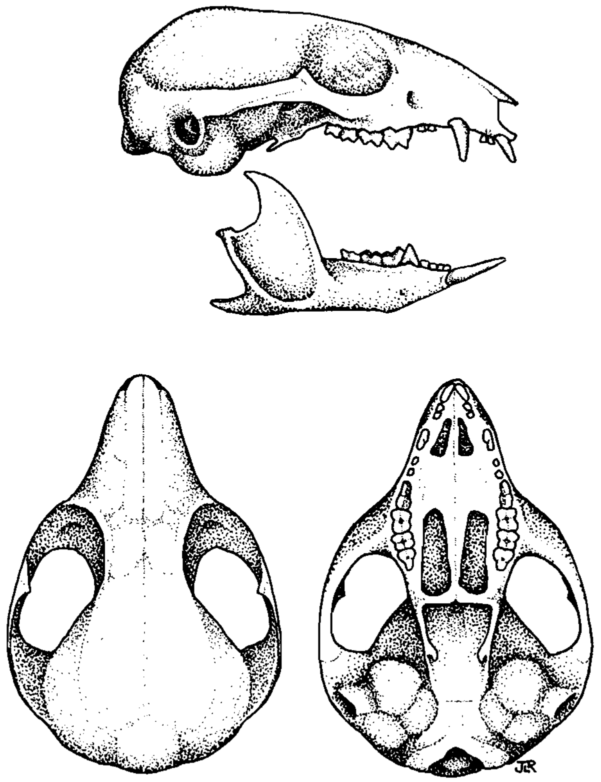
The two species may be separated by the presence of fourth upper and lower molars in the Little Pygmy-possum. The zygomatic arch in the Eastern Pygmy-possum extends almost to the back of the skull, producing a rounded dorsal profile somewhat similar to that of the Sugar Glider.



Little Pygmy-possum

Cercartetus lepidus x 2

$I\frac{3}{1}$, $C\frac{1}{0}$, $P\frac{3}{4}$, $M\frac{4}{4}$, = 40.



Eastern Pygmy-possum

Cercartetus nanus x 2

$I^{3}_{1},\ C^{1}_{0},\ P^{3}_{4},\ M^{3}_{3}, = 36.$

NOTES

Order MARSUPIALIA
Family PETAURIDAE

Sugar Glider *Petaurus breviceps*

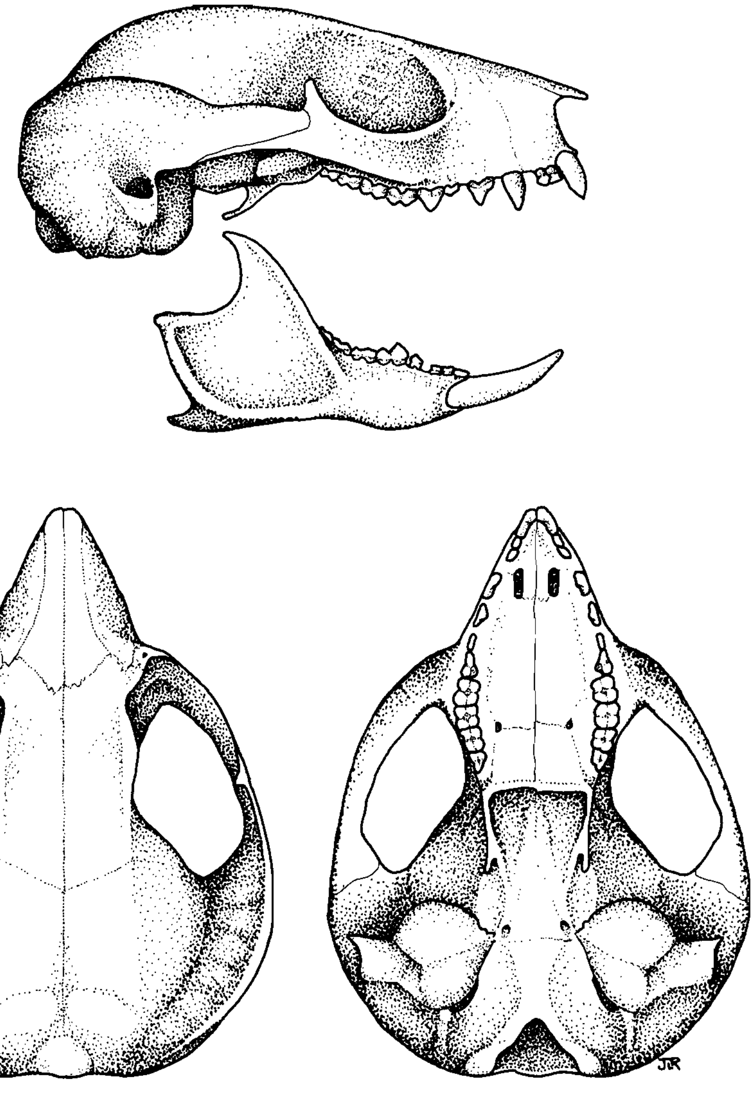
Common Ringtail Possum *Pseudocheirus peregrinus*

These marsupials have a single pair of forward-projecting lower incisors. They are members of the suborder DIPROTODONTIA.

In the Sugar Glider, the unbroken tooth row in the lower jaw and the presence of upper canines and premolars indicate insectivorous feeding habits. However, it is known also to occasionally kill and eat small birds.

The rounded dorsal aspect of the skull of the Sugar Glider somewhat resembles that of the Eastern Pygmy-possum, with the zygomatic arch extended to merge smoothly with the rear of the cranium.

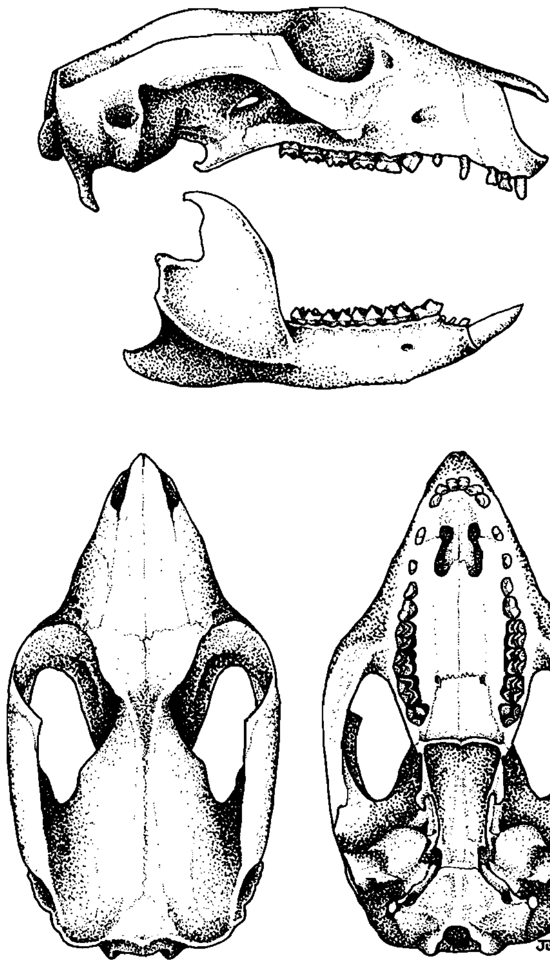
The skull of the Common Ringtail Possum is of a rather rectangular appearance and the zygomatic arch is strong with a high lateral profile. The molars are relatively large and have complicated sharp cusps for reducing its vegetable food to very fine particles. Up to three vestigial lower incisors may be present, but they are so small that they are easily lost or overlooked.



Sugar Glider

Petaurus breviceps x 2

$I^{3}_{1},\ C^{1}_{0},\ P^{3}_{4},\ M^{4}_{4},\ = 40.$



Common Ringtail Possum

Pseudocheirus peregrinus nat. size

$I\frac{3}{2\text{-}4}, C\frac{1}{0}, P\frac{3}{1}, M\frac{4}{4}, = 36\text{-}40.$

NOTES

Order MARSUPIALIA
Family MACROPODIDAE

Tasmanian Bettong *Bettongia gaimardi*

Long-nosed Potoroo *Potorous tridactylus*

Red-bellied Pademelon *Thylogale billardierii*

Red-necked Wallaby *Macropus rufogriseus*

Eastern Grey Kangaroo *Macropus giganteus*

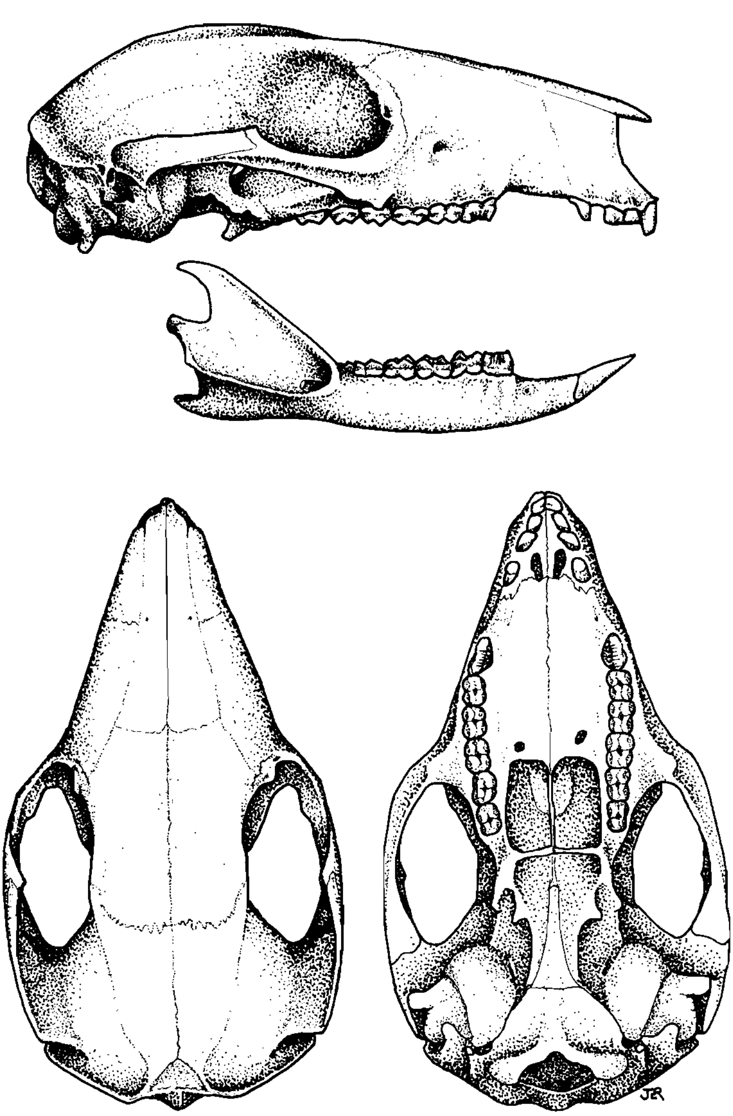
This family includes omnivorous and truly herbivorous marsupials with incisor teeth specialised for nipping off vegetation. The lower incisors are directed anteriorally, almost in a straight line with the jaws. The edges of these teeth are sharp and blade-like and fit neatly against the three pairs of upper incisors to form a shearing or cutting action. Macropods, having but a single functional pair of lower incisors, are included in the suborder DIPROTODONTIA. Posterior to the incisors is a toothless space known as the diastema (see page 9), believed to allow the animal's tongue to manipulate the cropped vegetation and transport it to the back of the mouth to be masticated by the sharp-cusped molar or cheek teeth.

Posterior molars are slow to develop, especially in the larger macropodids. As the animal ages and the skull lengthens, so space is made for additional rear molars to erupt. This gradual lengthening or forward migration of the molar row results in premolars and anterior molars being lost before the last molar eruption is complete. Thus the length of the diastema remains constant.

The two smaller omnivorous macropodids (bettong and potoroo) have short upper canines believed by some authorities to be indicative of ancestral or distant carnivorous relationships. Aged bettongs have five upper and five lower molars.

The bettong and potoroo may be separated by reference to the position of the canine. In the bettong it is about one tooth space from the third incisor, in the potoroo it is further removed.

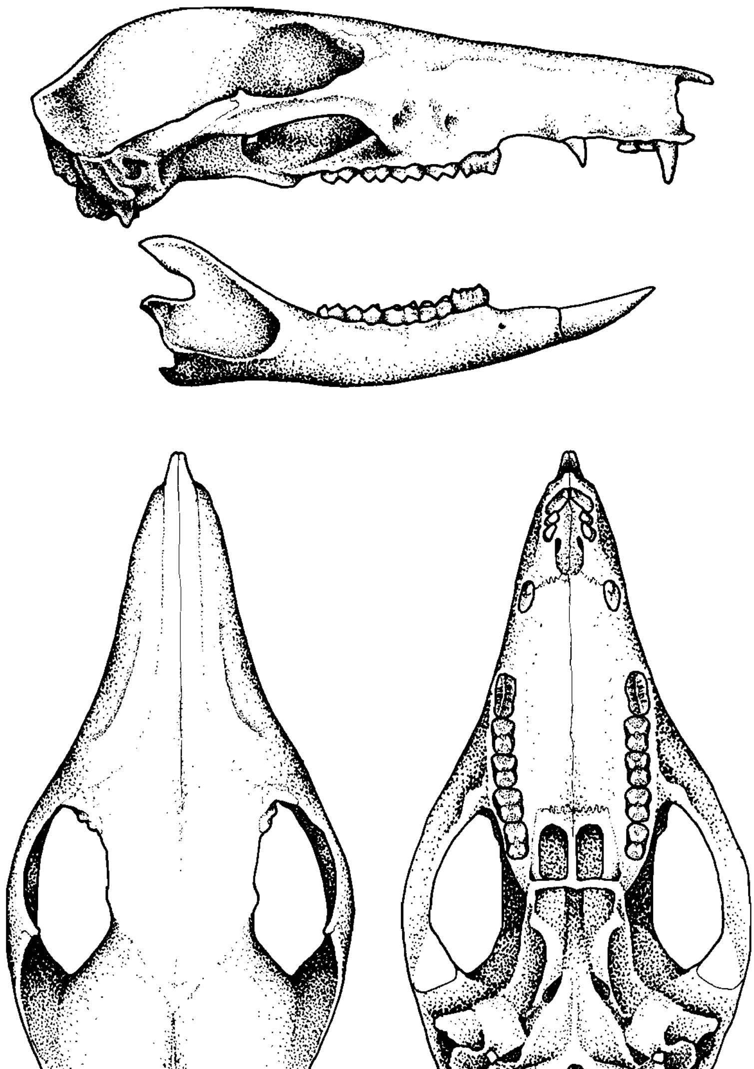
In the pademelon, minute anteriorly directed needle-like canines may be present on the side of the maxilla. The three larger macropods can usually be separated on size but age must then be considered, by reference to the stage of molar eruption.



Tasmanian Bettong

Bettongia gaimardi nat. size

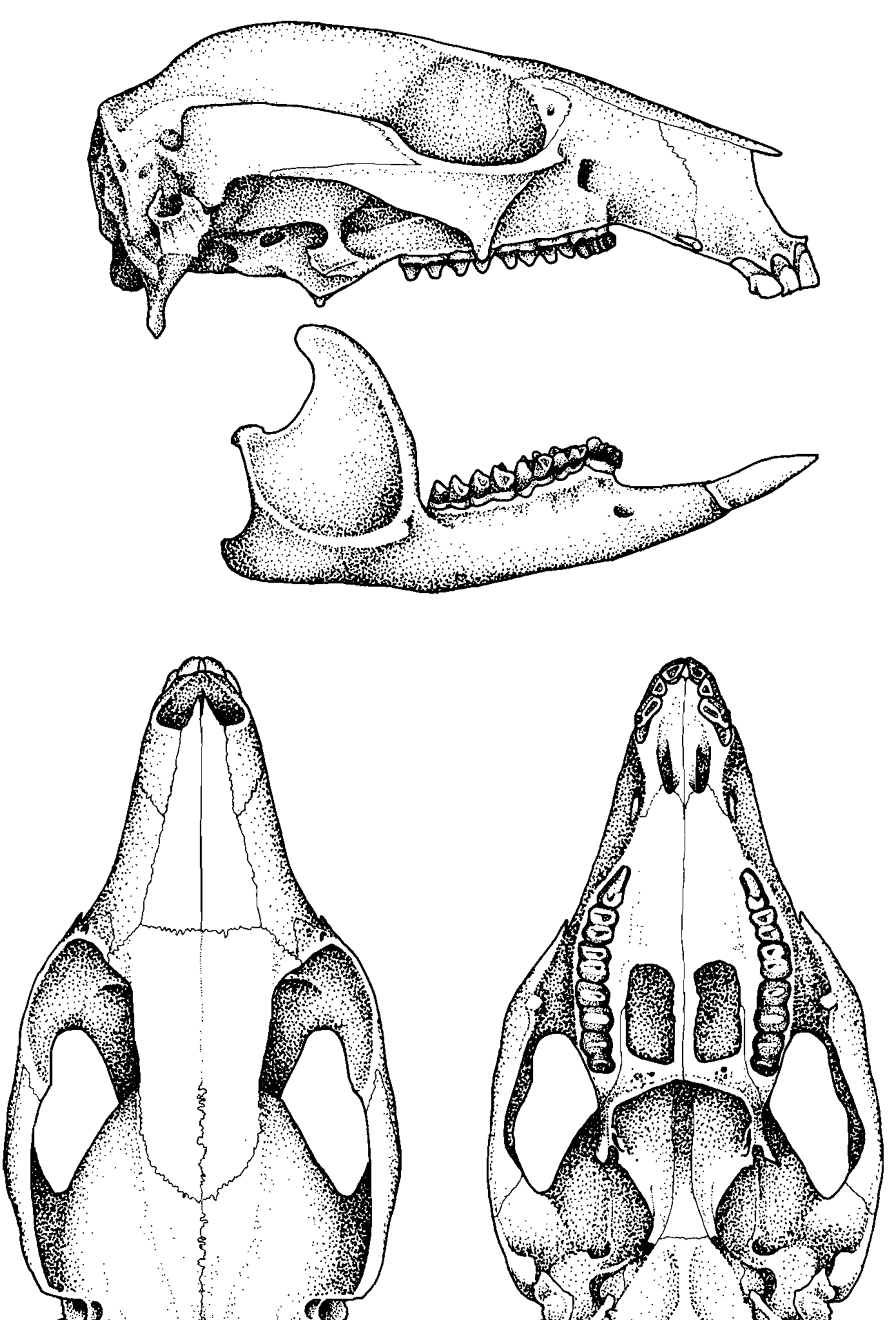
$I\frac{3}{1}$, $C\frac{1}{0}$, $P\frac{1}{1}$, $M\frac{5}{5}$, = 34.



Long-nosed Potoroo

Potorous tridactylus nat. size

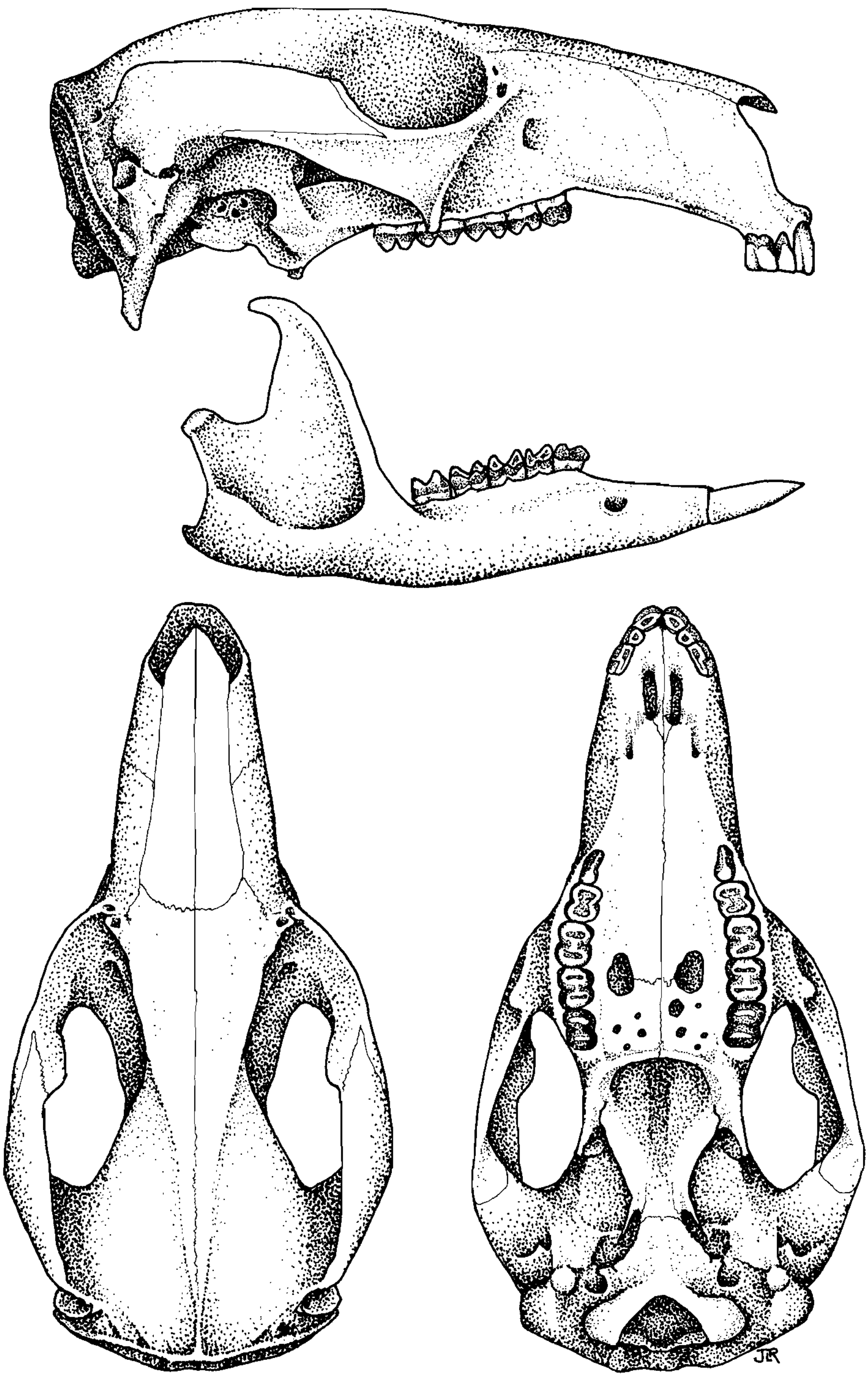
I^{3}_{1}, C^{1}_{0}, P^{1}_{1}, M^{4}_{4}, = 30.



Red-bellied Pademelon

Thylogale billardierii nat. size

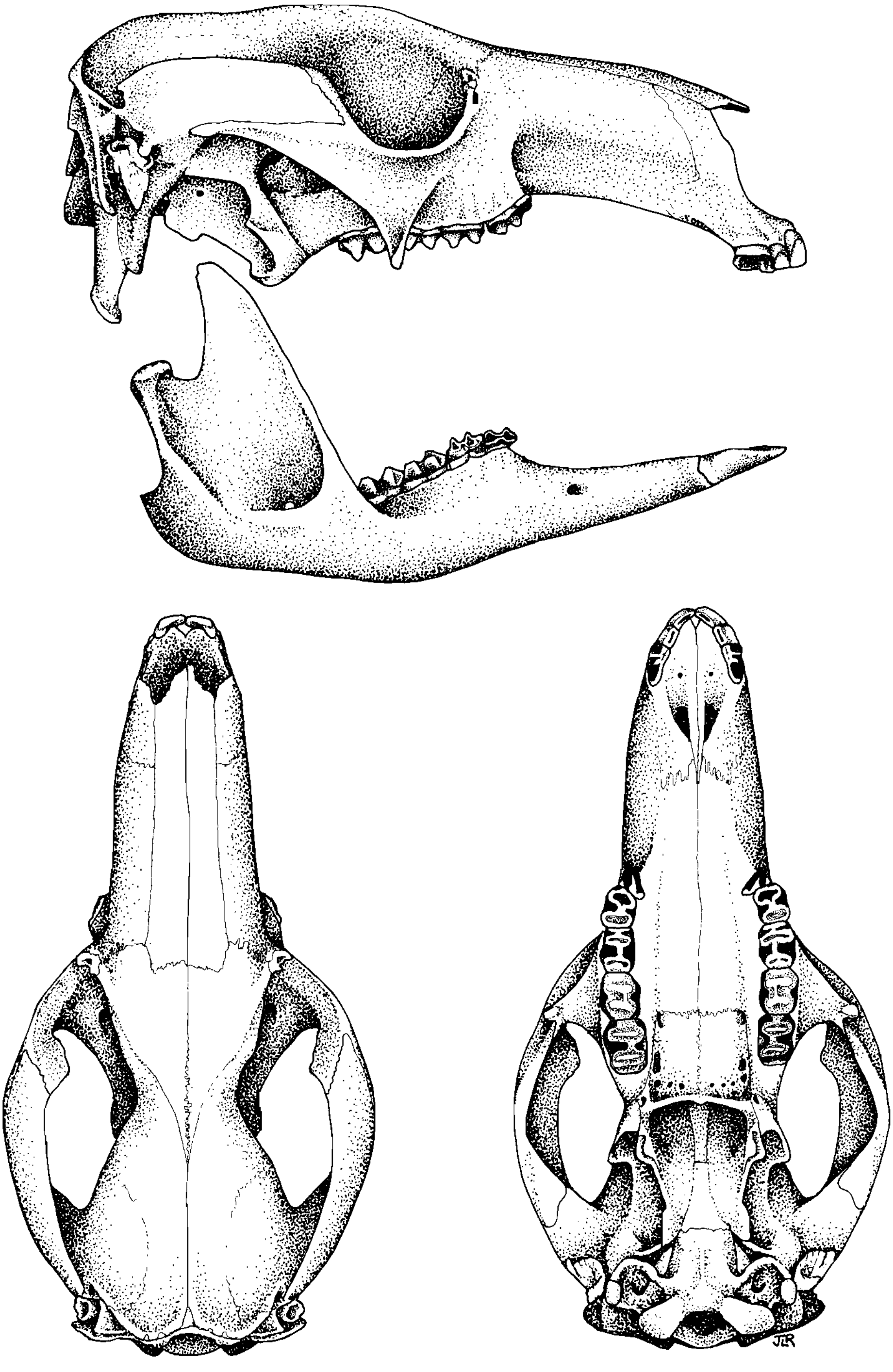
I^{3}_{1}, C^{1}_{0}, P^{1}_{1}, M^{4}_{4}, = 30.



Red-necked Wallaby (Brush Kangaroo, Bennett's Wallaby)

Macropus rufogriseus x 0·75

I^{3}_{1}, C^{0}_{0}, P^{1}_{1}, M^{4}_{4}, = 28.



Eastern Grey Kangaroo (Forester)
Macropus giganteus x 0·5
I^{3}_{1}, C^{0}_{0}, P^{1}_{1}, M^{4}_{4}, = 28.

Order MARSUPIALIA
Family VOMBATIDAE

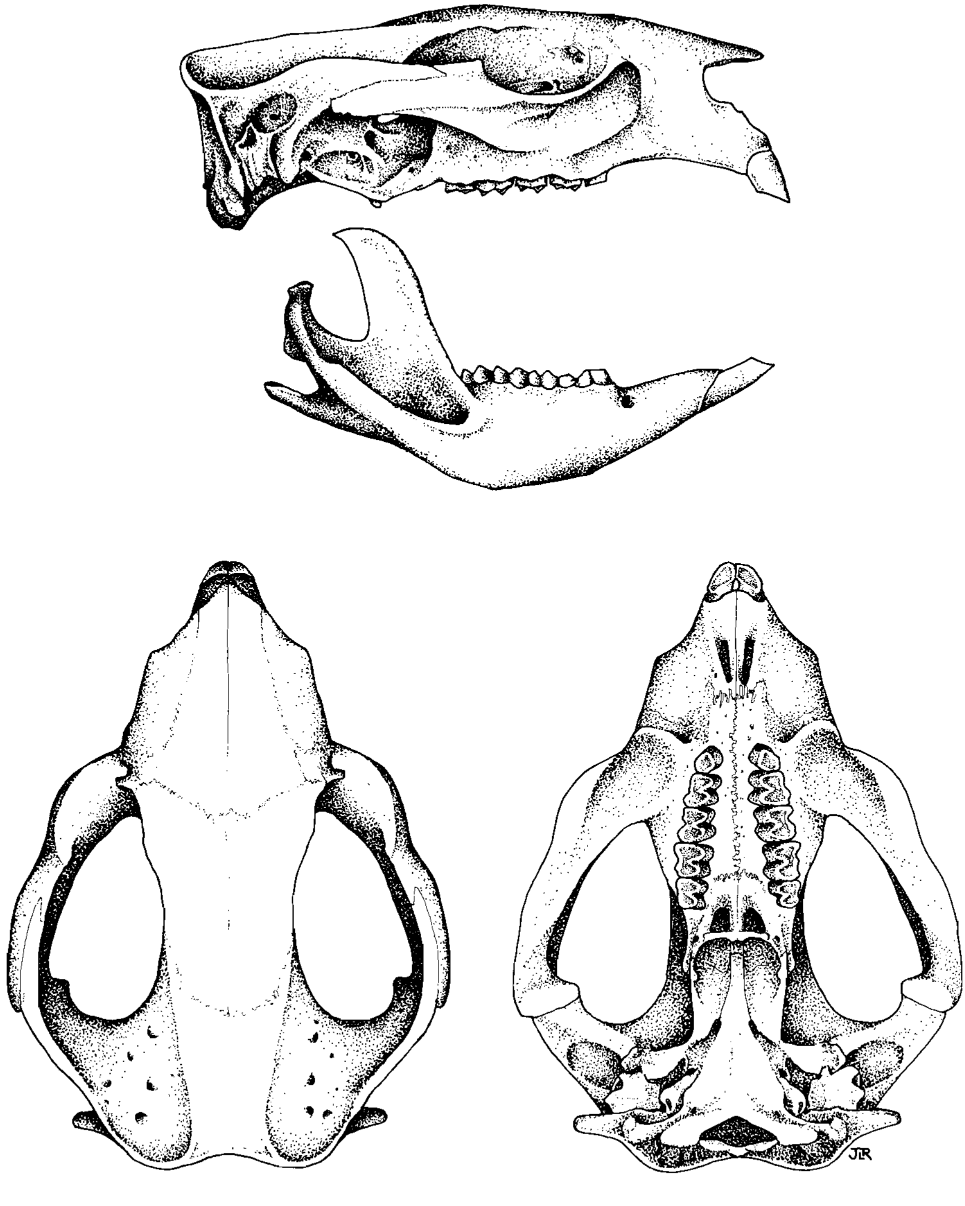
Common Wombat *Vombatus ursinus*

The wombat is almost exclusively a grazing marsupial and this is easily recognised in its dental arrangement. It is a member of the sub-order DIPROTODONTIA but is easily separated from other members of the group by having only one pair of upper incisors.

The large toothless space or diastema is typical of the herbivores and resembles that found in the larger macropodids.

The wombat is the only Tasmanian marsupial with teeth in which the roots retain open pulp cavities and which continue to grow throughout the animal's life. This generally ensures that the wombat has good, healthy teeth because the tips are being continually sharpened and worn to a servicable length by the grinding action between the opposing surfaces.

Open-rooted dentition also occurs in rodents and lagomorphs and the superficial similarity is another example of convergent evolution in marsupial and eutherian mammals.



Common Wombat

Vombatus ursinus x 0·5

I^{1}_{1}, C^{0}_{0}, P^{1}_{1}, M^{4}_{4}, = 24.

Order CHIROPTERA
Family VESPERTILIONIDAE

Gould's Wattled Bat *Chalinolobus gouldii*

Chocolate Wattled Bat *Chalinolobus morio*

King River Eptesicus *Eptesicus regulus*

Large Forest Eptesicus *Eptesicus sagittula*

Little Forest Eptesicus *Eptesicus vulturnus*

Lesser Long-eared Bat *Nyctophilus geoffroyi*

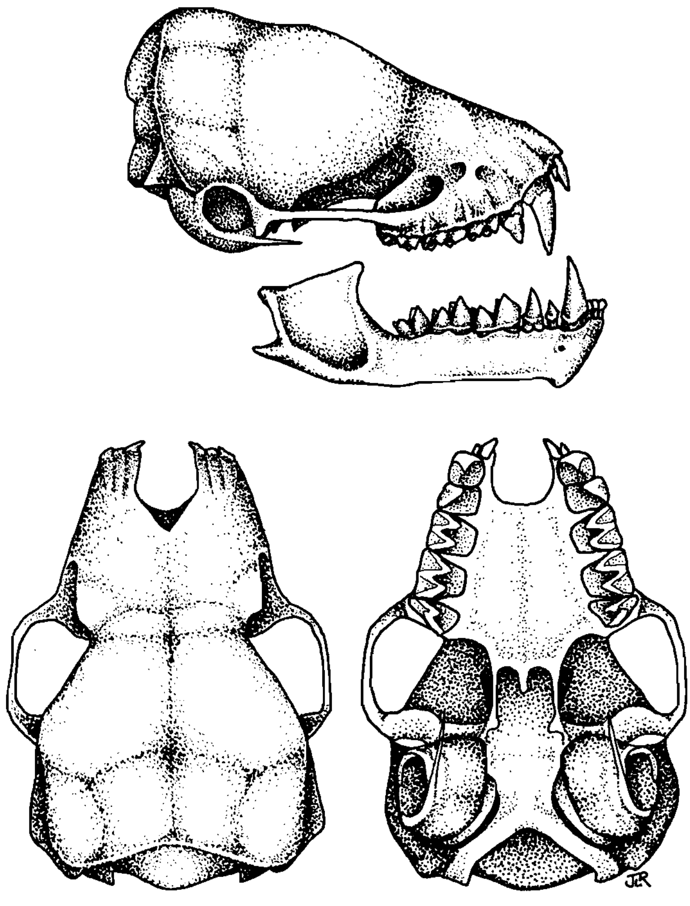
Gould's Long-eared Bat *Nyctophilus gouldi*

Great Pipistrelle *Pipistrellus tasmaniensis*

Members of this family of bats are all insectivorous. They have short snouts and are equipped with a relatively large mouth and teeth suited to capturing insects in flight.

Newly-born young are equipped with deciduous milk teeth quite unlike the adult teeth. The milk teeth are mostly near the front of the mouth and have numerous inwardly directed cusps, like tiny hooks. These are of advantage to the suckling young as they enable a strong grip on the nipples and also help them to hold onto the ventral fur of the mother, especially when she is active and when carrying them in flight. The milk teeth are shed and replaced by adult teeth when the young are weaned to take flight and commence catching insects for themselves.

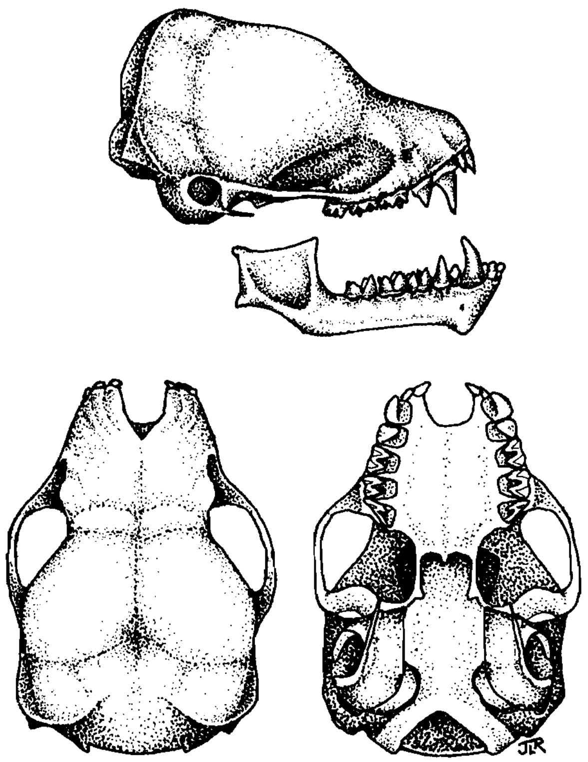
The minuteness of specific detail in the skulls of these small eutherian mammals makes separation of species difficult for the layman but reference to the illustrations and consideration of size and shape will at least help in identification.



Gould's Wattled Bat

Chalinolobus gouldii x 4

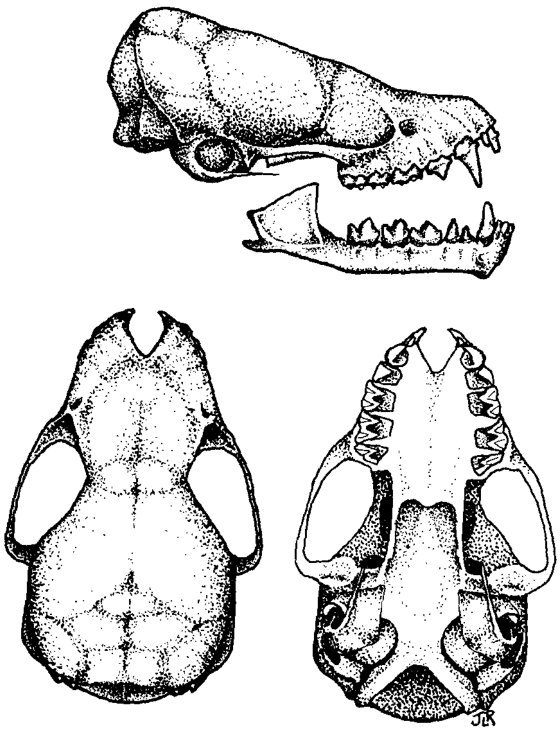
I^{2}_{3}, C^{1}_{1}, P^{1}_{2}, M^{3}_{3}, = 32.



Chocolate Wattled Bat

Chalinolobus morio x 4

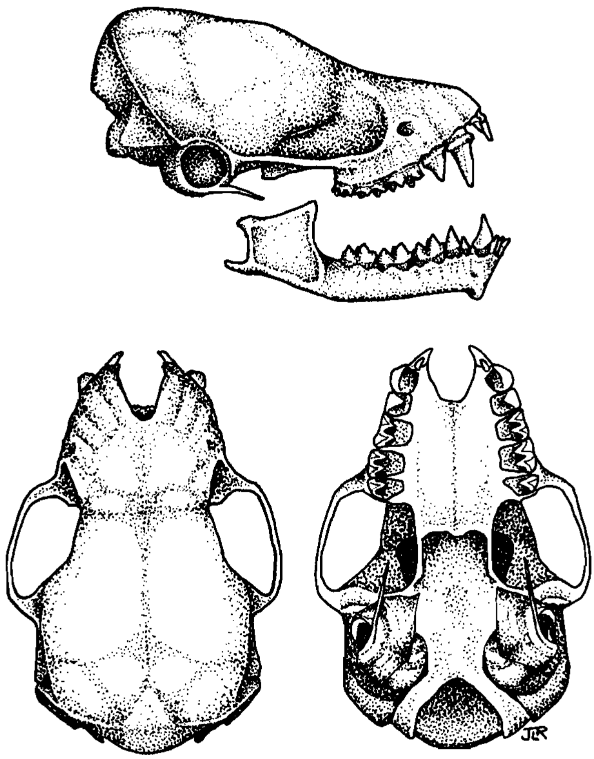
I^{2}_{3}, C^{1}_{1}, P^{1}_{2}, M^{3}_{3}, = 32.



King River Eptesicus

Eptesicus regulus x 4

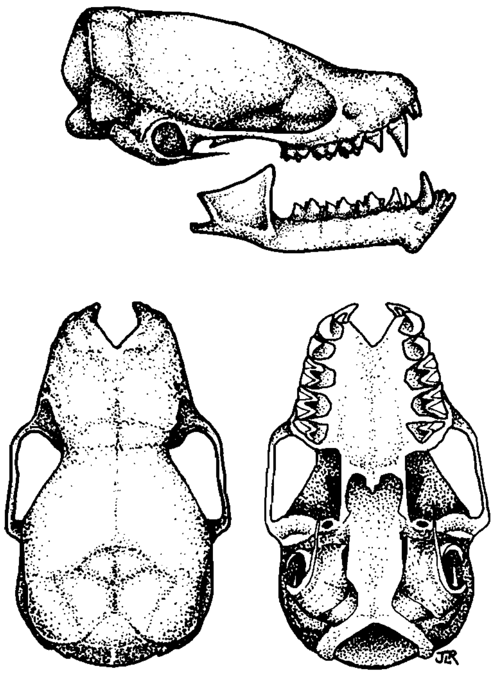
$I\frac{2}{3}$, $C\frac{1}{1}$, $P\frac{1}{2}$, $M\frac{3}{3}$, = 32.



Large Forest Eptesicus

Eptesicus sagittula x 4

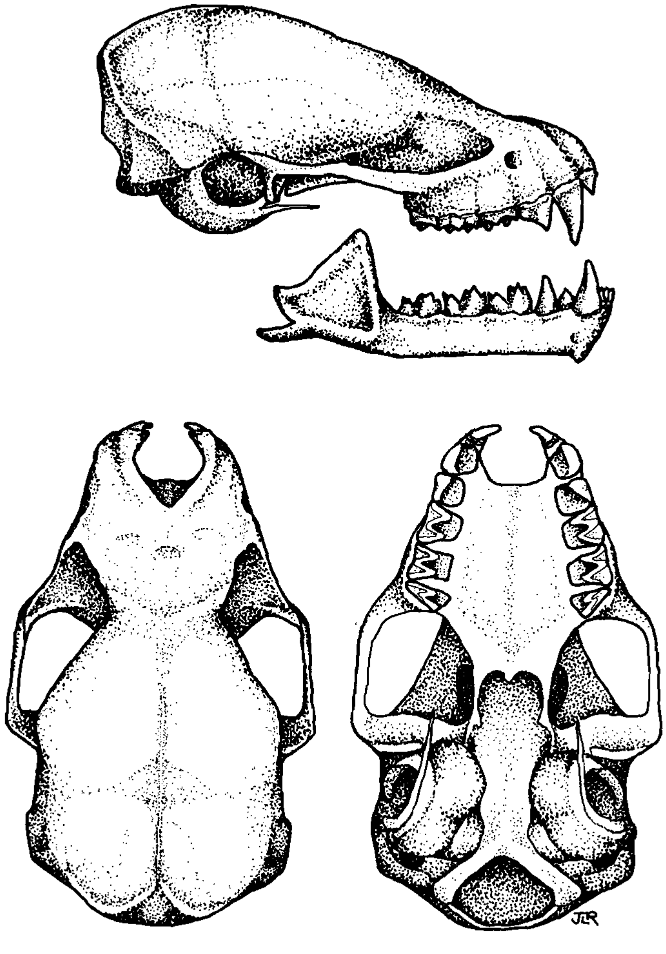
$I\frac{2}{3}$, $C\frac{1}{1}$, $P\frac{1}{2}$, $M\frac{3}{3}$, = 32.



Little Forest Eptesicus

Eptesicus vulturnus x 4

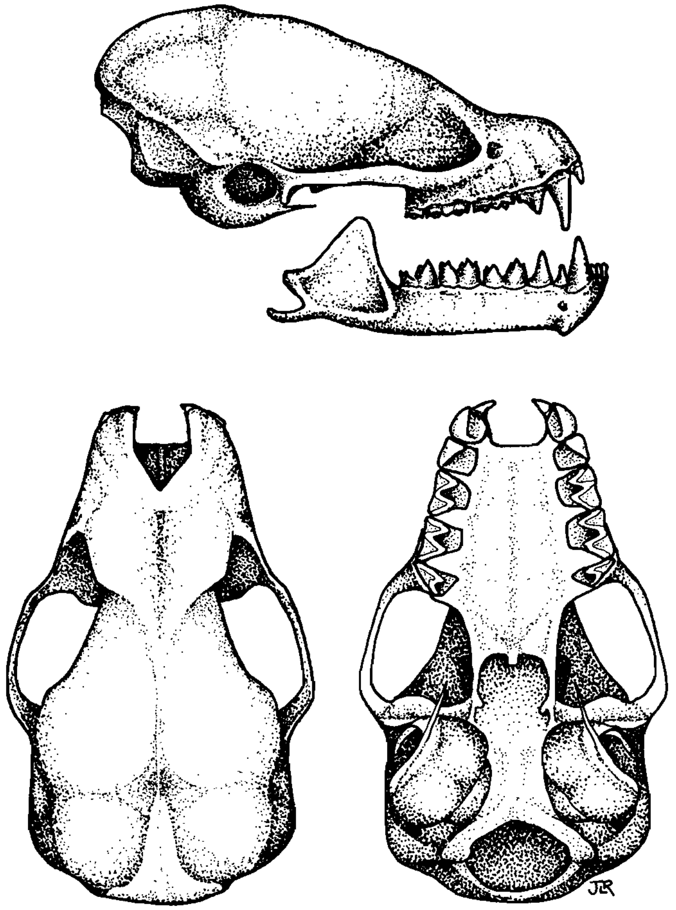
$I\frac{2}{3}$, $C\frac{1}{1}$, $P\frac{1}{2}$, $M\frac{3}{3}$, = 32.



Lesser Long-eared Bat

Nyctophilus geoffroyi x 4

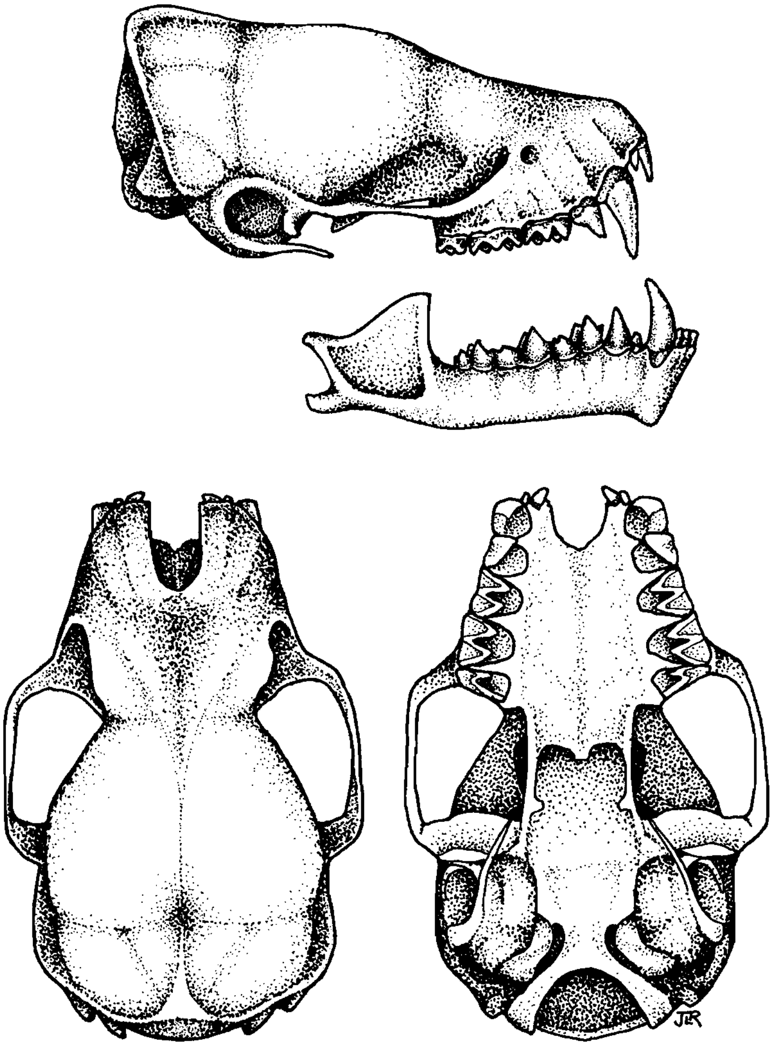
$I\frac{1}{3}$, $C\frac{1}{1}$, $P\frac{1}{2}$, $M\frac{3}{3}$, = 30.



Long-eared Bat

Nyctophilus gouldi x 4

$I\frac{1}{3}$, $C\frac{1}{1}$, $P\frac{1}{2}$, $M\frac{3}{3}$, = 30.



Great Pipistrelle

Pipistrellus tasmaniensis x 4

$I\frac{2}{3}$, $C\frac{1}{1}$, $P\frac{1}{2}$, $M\frac{3}{3}$, = 32.

NOTES

Order RODENTIA
Family MURIDAE

Water-rat *Hyrdomys chrysogaster*

Broad-toothed Rat *Mastacomys fuscus*

Swamp Rat *Rattus lutreolus*

Long-tailed Mouse *Pseudomys higginsi*

New Holland Mouse *Pseudomys novaehollandiae*

*House Mouse *Mus musculus*

*Black Rat *Rattus rattus*

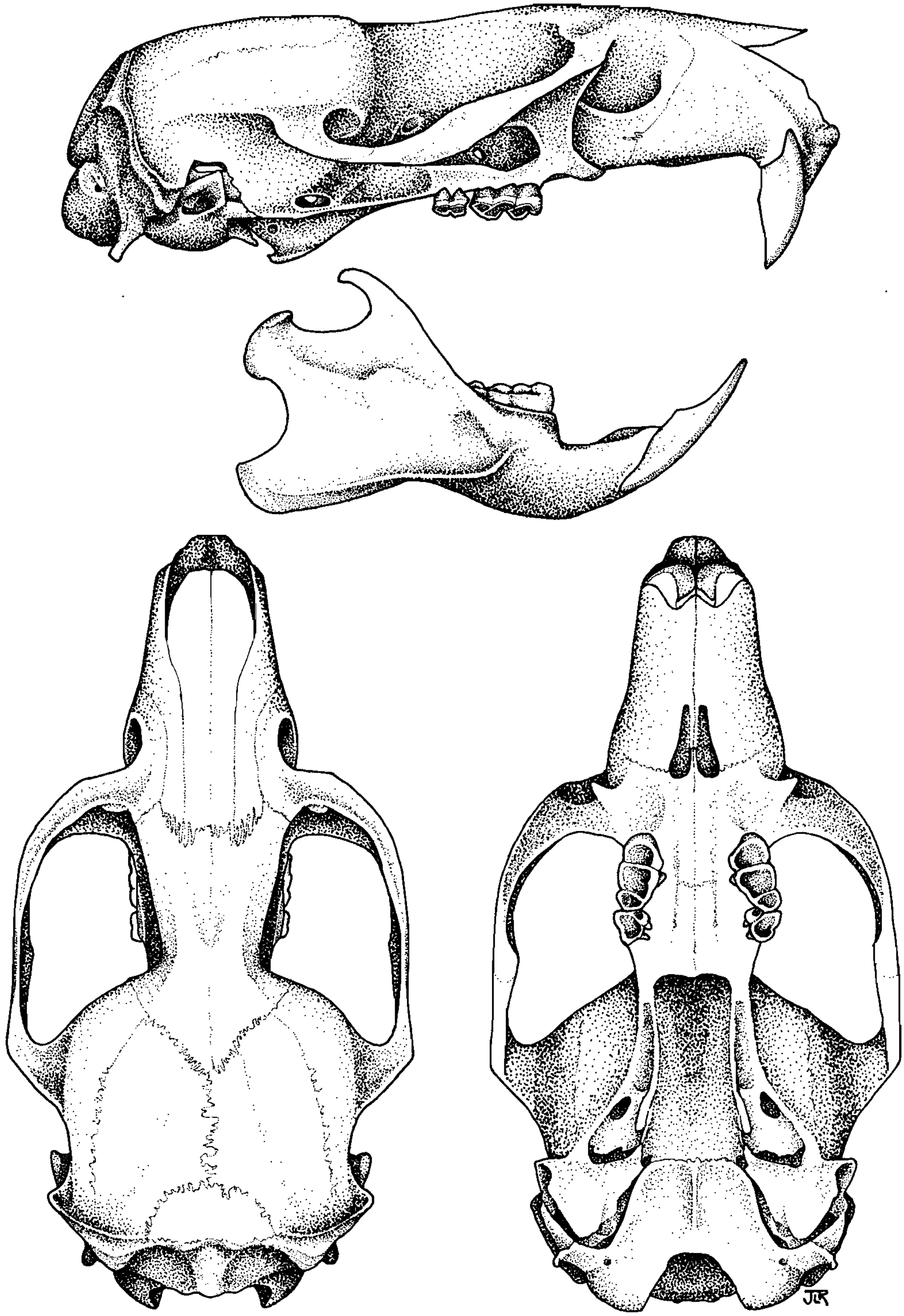
*Brown Rat *Rattus norvegicus*

The rats and mice form a distinctive and specialised family, the native species being quite distinct from their three northern hemisphere relatives, introduced into Tasmania by the early European settlers.

All have a single pair of upper and lower incisors with open roots which grow continuously throughout the animal's life. These teeth have a hard anterior and lateral facing of yellow or orange enamel which is more resistant to wear than the rest of the teeth. This results in the incisors being worn by their gnawing action to a sharp, chisel-like anterior cutting edge.

They are mostly vegetable feeders, the diastema in front of the grinding molars being characteristic of herbivorous mammals.

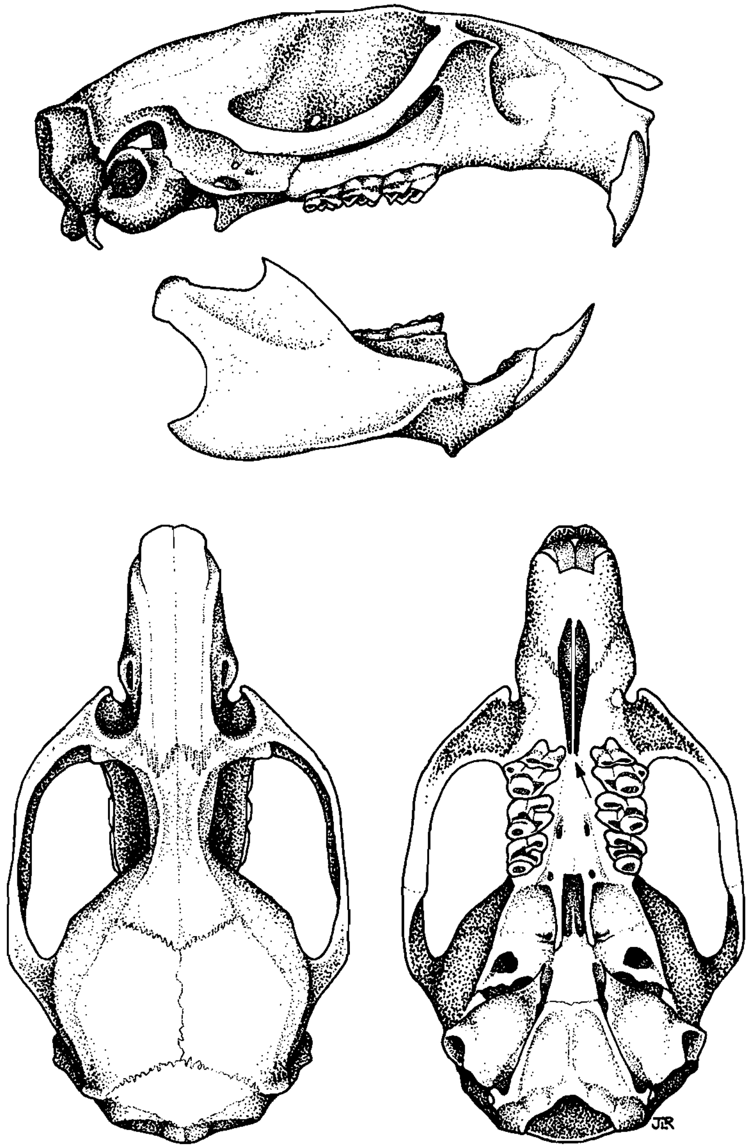
In the Water-rat the molars are reduced to two in both the maxilla and mandible. The Broad-toothed Rat has molars of a breadth equal or greater than the space between the first molars (/). The House Mouse is separable from the New Holland Mouse by the presence of a notch in the back of the upper incisors (/). The Brown Rat is characterised by the elongated brain case and almost parallel lateral crests (/).



Water-rat

Hydromys chrysogaster x 2

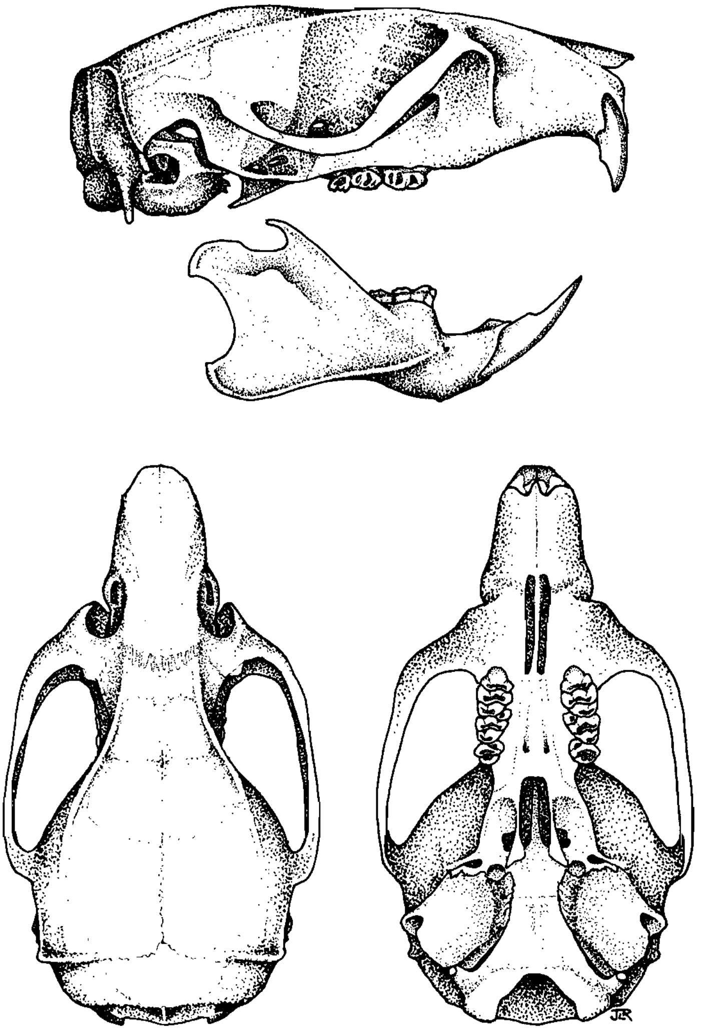
I^{1}_{1}, C^{0}_{0}, P^{0}_{0}, M^{2}_{2}, = 12.



Broad-toothed Rat

Mastacomys fuscus x 2

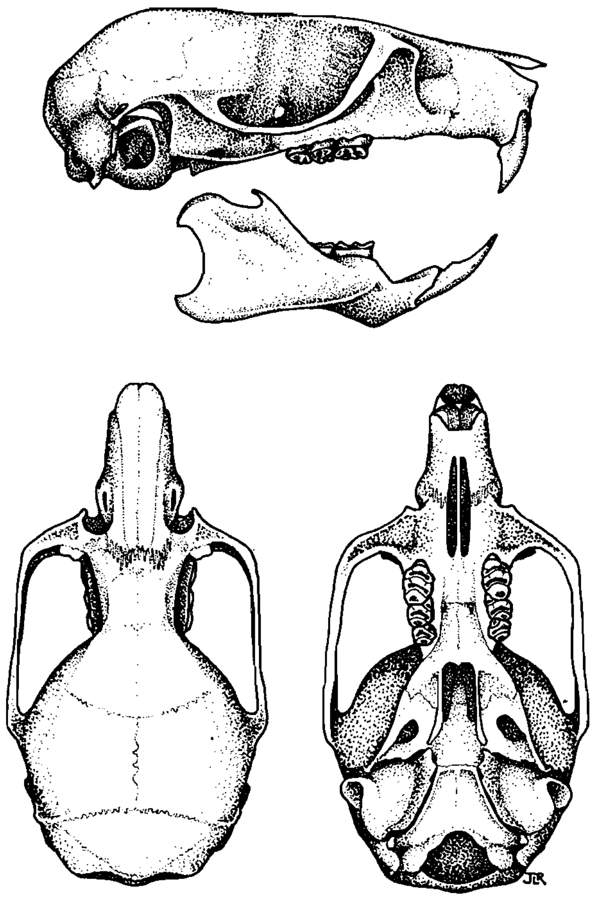
$I\frac{1}{1}$, $C\frac{0}{0}$, $P\frac{0}{0}$, $M\frac{3}{3}$, = 16.



Swamp Rat

Rattus lutreolus x 2

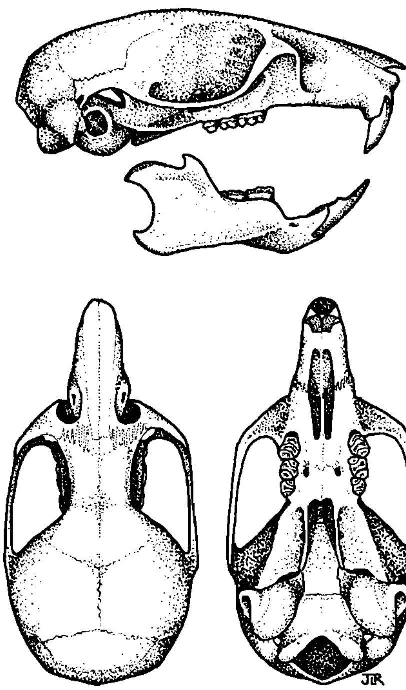
$I\frac{1}{1},\ C\frac{0}{0},\ P\frac{0}{0},\ M\frac{3}{3}, = 16.$



Long-tailed Mouse

Pseudomys higginsi x 2

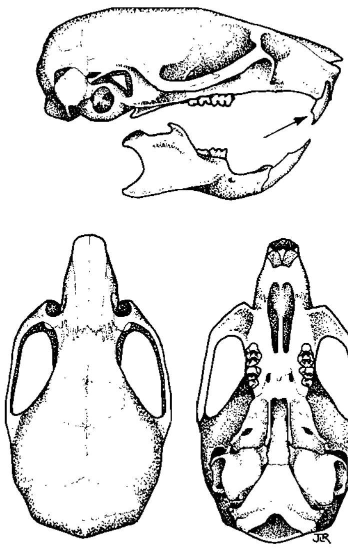
I^{1}_{1}, C^{0}_{0}, P^{0}_{0}, M^{3}_{3}, = 16.



New Holland Mouse

Pseudomys novaehollandiae x 2

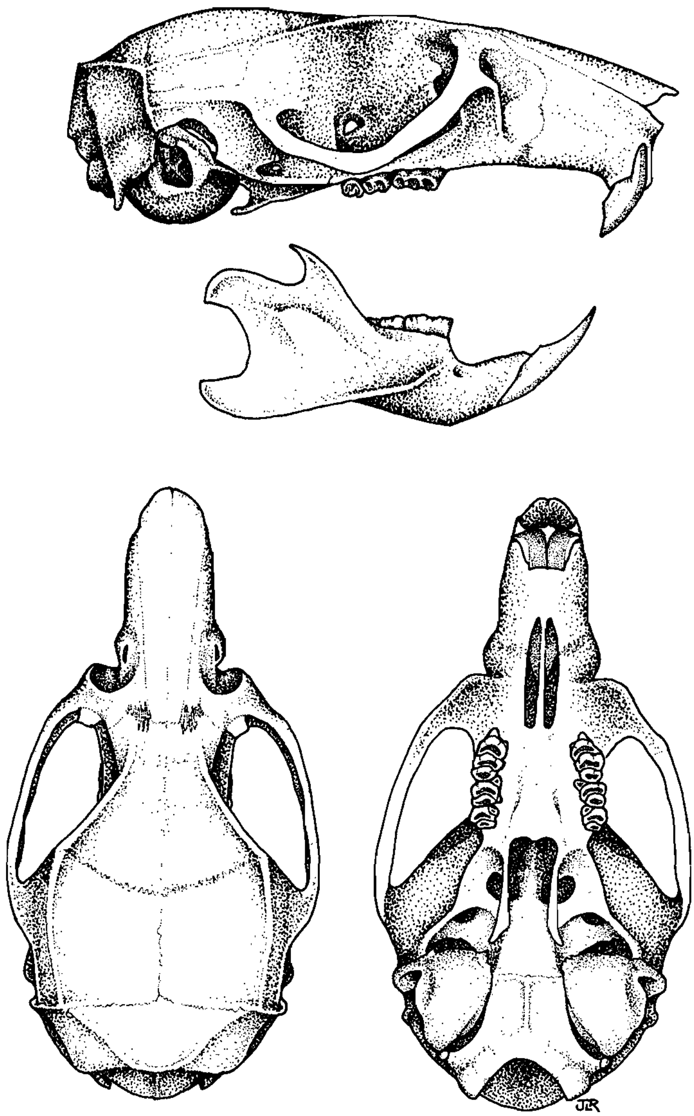
$I\frac{1}{1}, C\frac{0}{0}, P\frac{0}{0}, M\frac{3}{3}, = 16.$



House Mouse

Mus musculus x 2

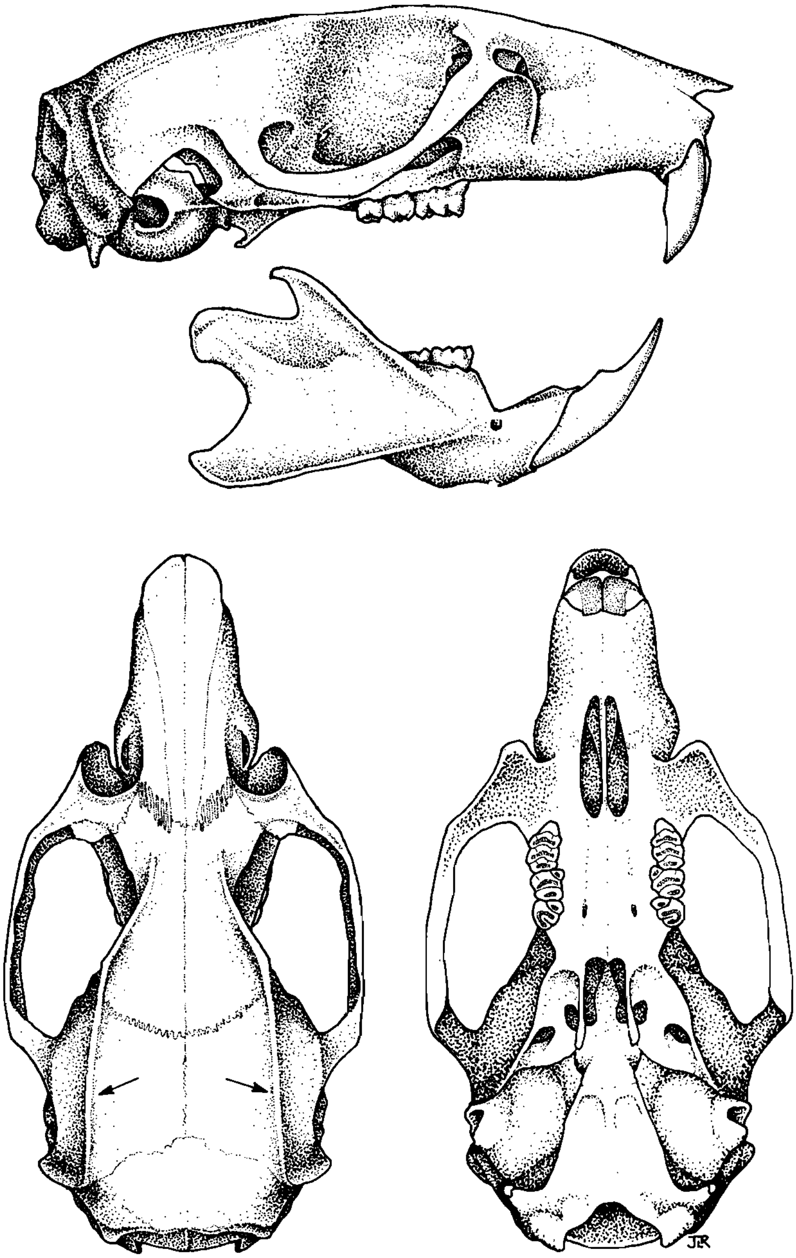
$I\frac{1}{1}$, $C\frac{0}{0}$, $P\frac{0}{0}$, $M\frac{3}{3}$, = 16.



Black Rat

Rattus rattus x 2

$I\frac{1}{1}, C\frac{0}{0}, P\frac{0}{0}, M\frac{3}{3}, = 16.$



Brown Rat

Rattus norvegicus x 2

I^{1}_{1}, C^{0}_{0}, P^{0}_{0}, M^{3}_{3}, = 16.

NOTES

Order CARNIVORA
Family CANIDAE

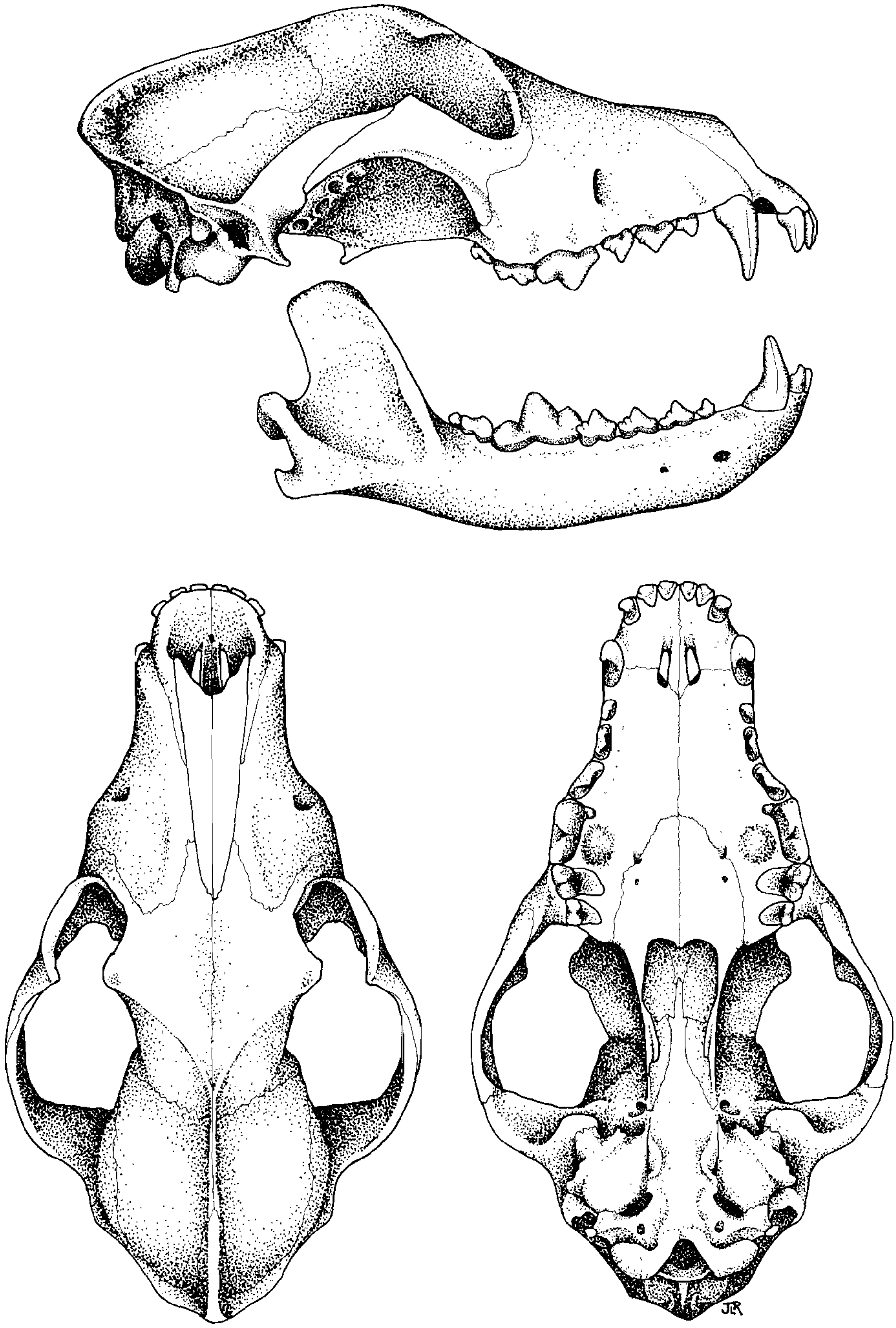
*Dog *Canis familiaris*

Dogs rarely occur in a feral state in Tasmania but skulls of domesticated dogs are often found in the bush.

Because of the great variety of breeds a typically shaped dog skull cannot be assigned. We have therefore chosen an example we believe to be both near to the ancestral form and to the dingo of the Australian mainland.

The skulls of some breeds of large dogs are somewhat similar to that of a Thylacine and are occasionally mistaken for it. This similarity demonstrates similar predatory habits and is an example of convergent evolution.

Upon examination of a dog skull, it will be found to differ from that of the Thylacine, having fewer incisors, lateral cusps on the incisors, nasal bones which are narrowest posteriorly, a relatively larger brain case and lacking an inflexion of the angle of the mandible (see page 7).



Dog,

Canis familiaris x 0·5

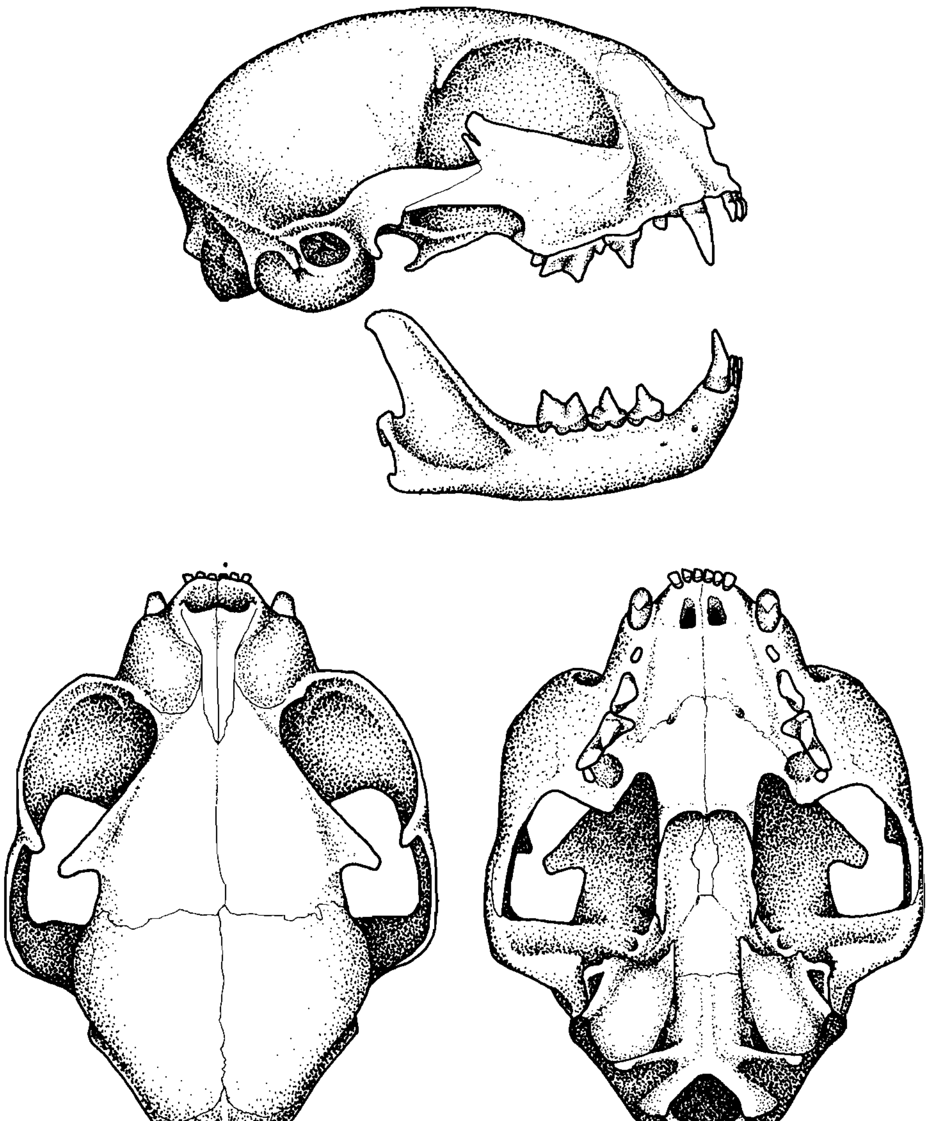
I^{3}_{3}, C^{1}_{1}, P^{4}_{4}, M^{2}_{3}, = 42.

Order CARNIVORA
Family FELIDAE

*Cat *Felis catus*

Introduced at the time of early European settlement, the cat is now widely distributed in a feral and domestic state. It is primarily carnivorous but insects are also eaten, especially by feral cats.

The relatively short snout, large brain case, ear bones and eye sockets and the interlocking canines all indicate a highly developed and efficient predator. Relatively small incisors, a reduced complement of cheek teeth and the absence of a sagittal crest indicate a less powerful bite and a selective feeder which deals only with small prey.



Cat

Felis catus nat. size

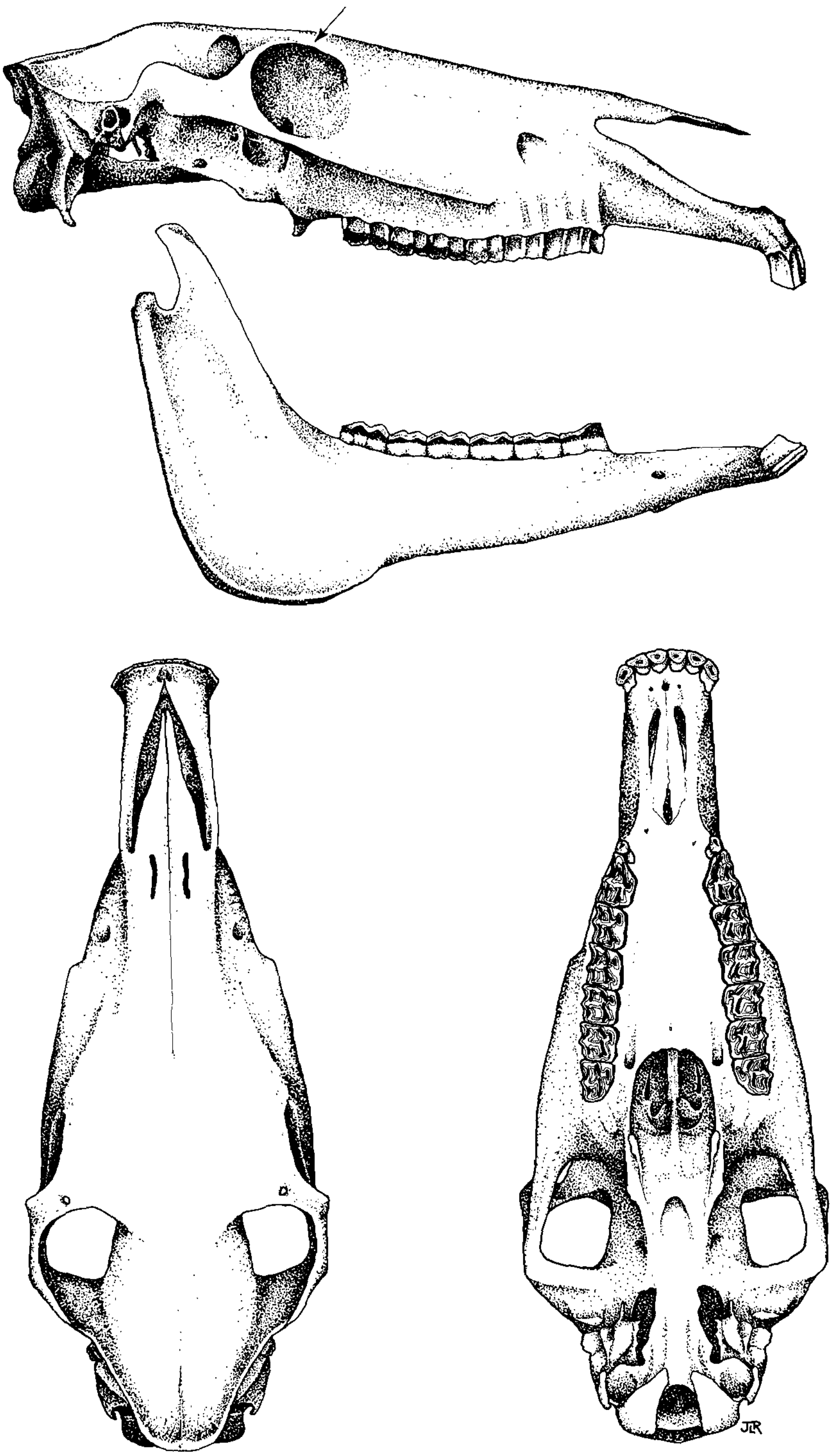
I^{3}_{3}, C^{1}_{1}, P^{2}_{2}, M^{2}_{1}, = 30.

Order PERISSODACTYLA
Family EQUIDAE

*Horse *Equus caballus*

The dentition of the horse is typically that of a herbivorous mammal. The neatly opposing incisors, projecting slightly forward across the front of the mouth, are well suited for the close cropping of vegetation. Vestigial canines are usually present in males but absent in females, suggesting their use as fighting teeth in sexual competition among stallions. A rudimentary, peg-like upper premolar is usually present against the first molar. By comparison with the smaller fossil forms, the modern horse has a considerably expanded diastema. The massive, relatively uniform molars are strongly implanted in powerful jaws for efficient mastication of vegetable foods.

Unlike the skulls of most mammals, the eye socket is surrounded by a complete ring of bone (↗).



Horse

Equus caballus x 0·2

$I\frac{3}{3},\ C\frac{0-1}{1},\ P\frac{4}{3},\ M\frac{3}{3},$ = 40-42.

Order ARTIODACTYLA
Family BOVIDAE

*European Cattle *Bos taurus*

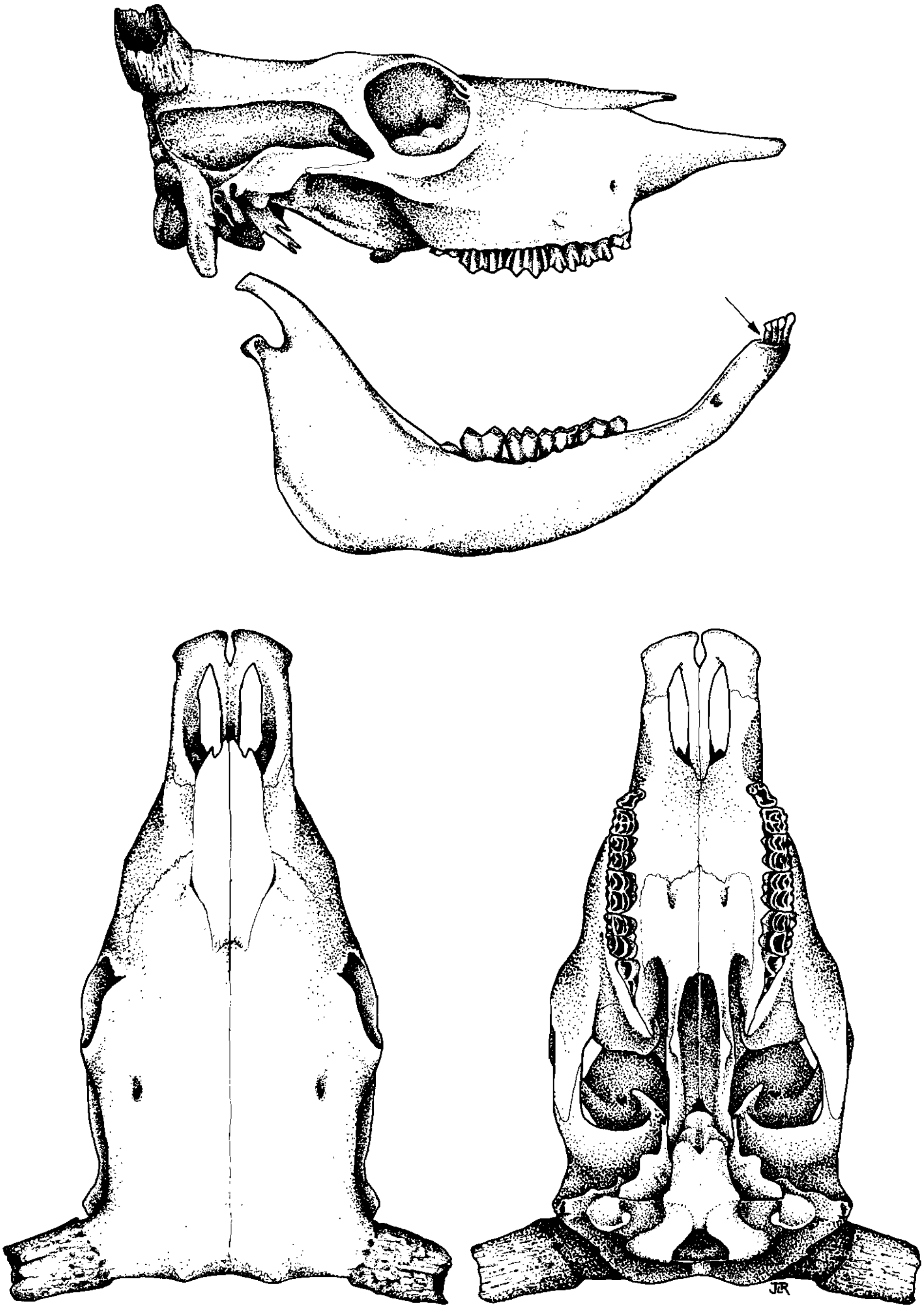
*Goat *Capra hircus*

*Sheep *Ovis aries*

Skulls of members of this family of herbivores are typified by the lower incisors and canines being opposed to a toothless pad on the premaxilla. The canines (/) have evolved to serve as incisors and appear as a fourth such pair. The diastema is large, a sagittal crest is lacking and the eye socket is surrounded by a ring of bone.

Horns are present in cattle, except in some modern breeds where they have been selectively bred out and the animals are now hornless or poll. Selective breeding in sheep has similarly produced some poll breeds while others still retain horns. In some breeds of sheep and goats, the horns of males develop to a considerable size and are used in fighting.

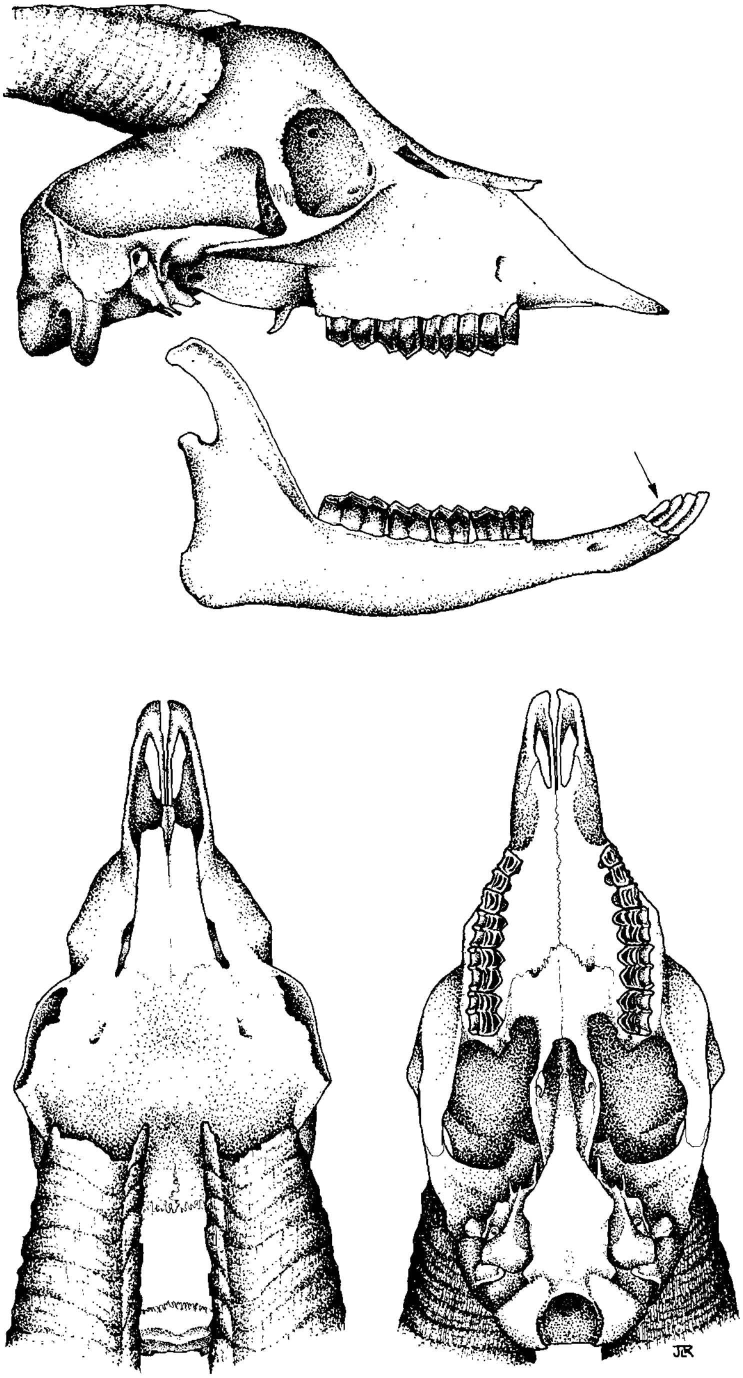
Individuals can be aged approximately by reference to the front teeth. All the small, juvenile or milk teeth persist for at least one year, after which the centre pair are pushed out and replaced by a much larger pair of adult teeth. This process is repeated at about yearly intervals by a similar replacement of the laterally adjacent pair and all are so replaced by adult teeth in about four years.



European Cattle

Bos taurus x 0·2

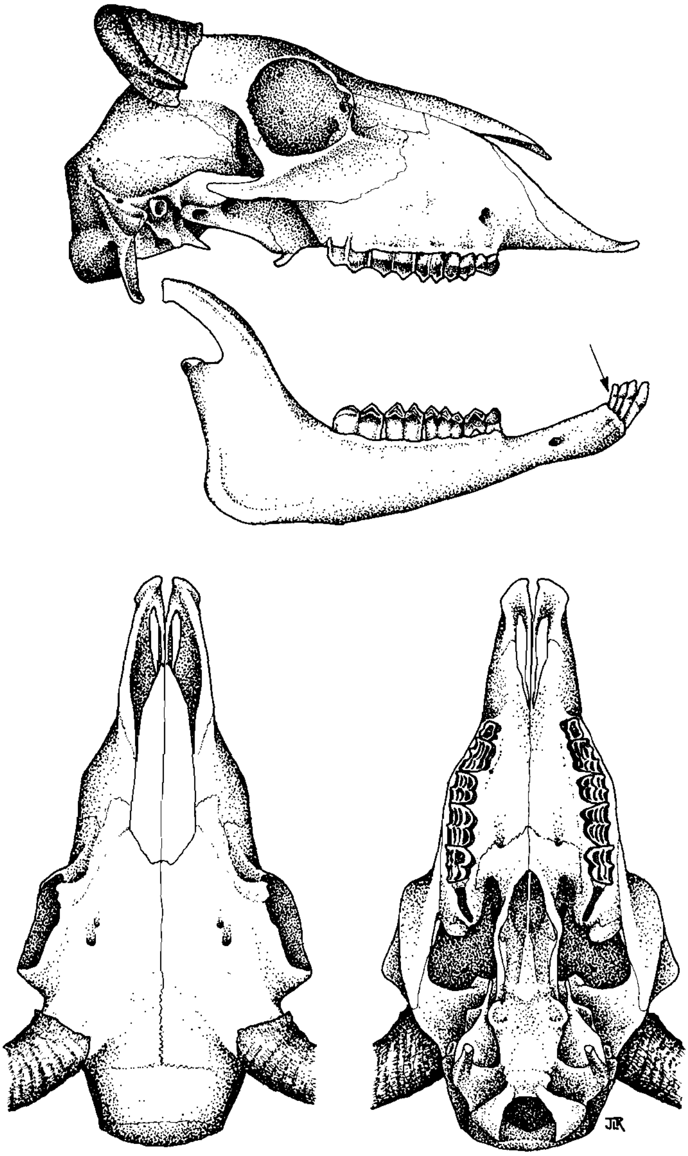
$I\frac{0}{3},\ C\frac{0}{1},\ P\frac{3}{3},\ M\frac{3}{3},\ = 32.$



Goat

Capra hircus x 0·4

$I\frac{0}{3}, C\frac{0}{1}, P\frac{3}{3}, M\frac{3}{3}, = 32.$



Sheep

Ovis aries x 0·4

$I\frac{0}{3}$, $C\frac{0}{1}$, $P\frac{3}{3}$, $M\frac{3}{3}$, = 32.

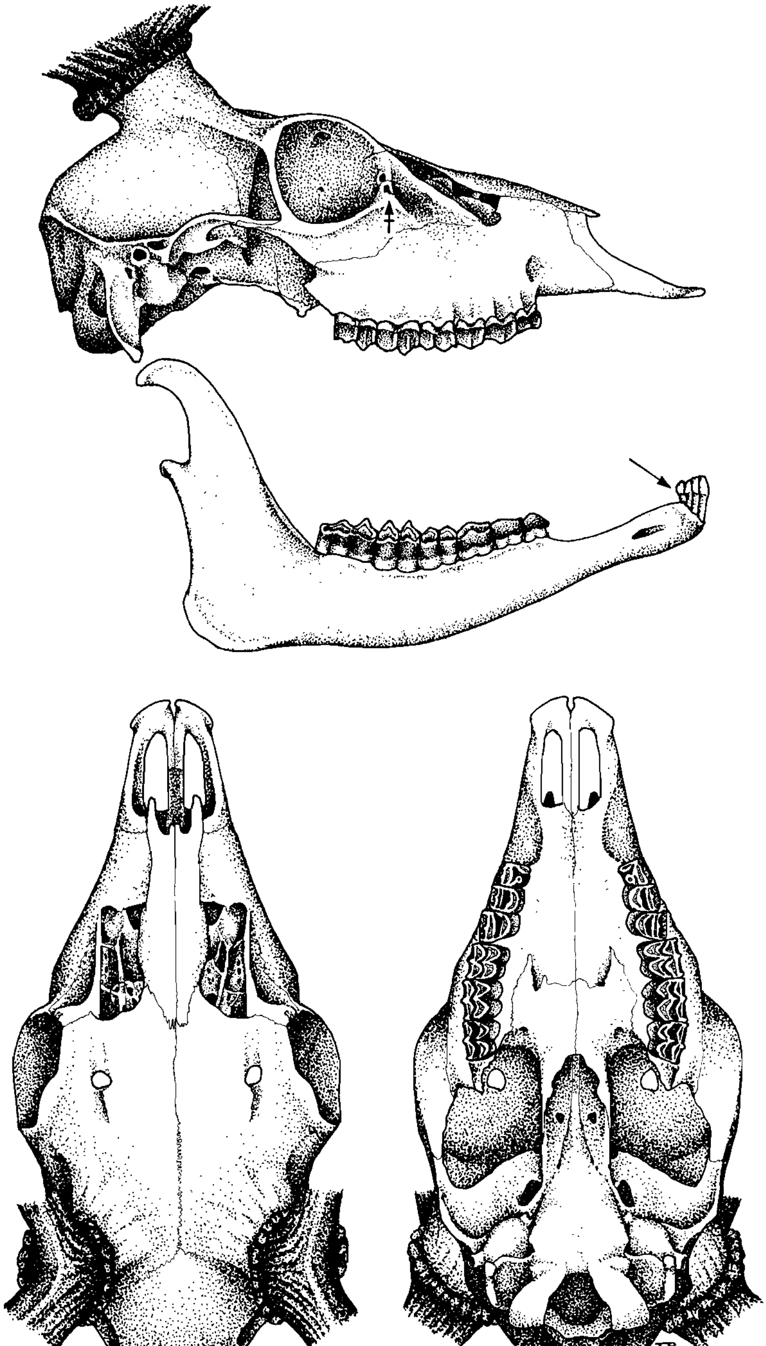
Order ARTIODACTYLA
Family CERVIDAE

*Fallow Deer *Dama dama*

This is the only member of the family in Tasmania. Introduced in the nineteenth century, it is now well established. It is totally herbivorous and, like the family BOVIDAE, lacks upper incisors and canines (though canines may be present in other species) and canines in the lower jaw (↗) have evolved to serve as incisors. A large diastema precedes the cheek teeth.

Antlers are grown by males only, being shed and regrown annually and increasing in size with the animal's age.

In the absence of antler's, the skull of a Fallow Deer can be easily distinguished from that of a sheep or goat by the small, round holes (↗) in the rim at the front of the eye socket being paired as opposed to singular.



Fallow Deer

Dama dama x 0·4

I^{0}_{3}, C^{0}_{1}, P^{3}_{3}, M^{3}_{3}, = 32.

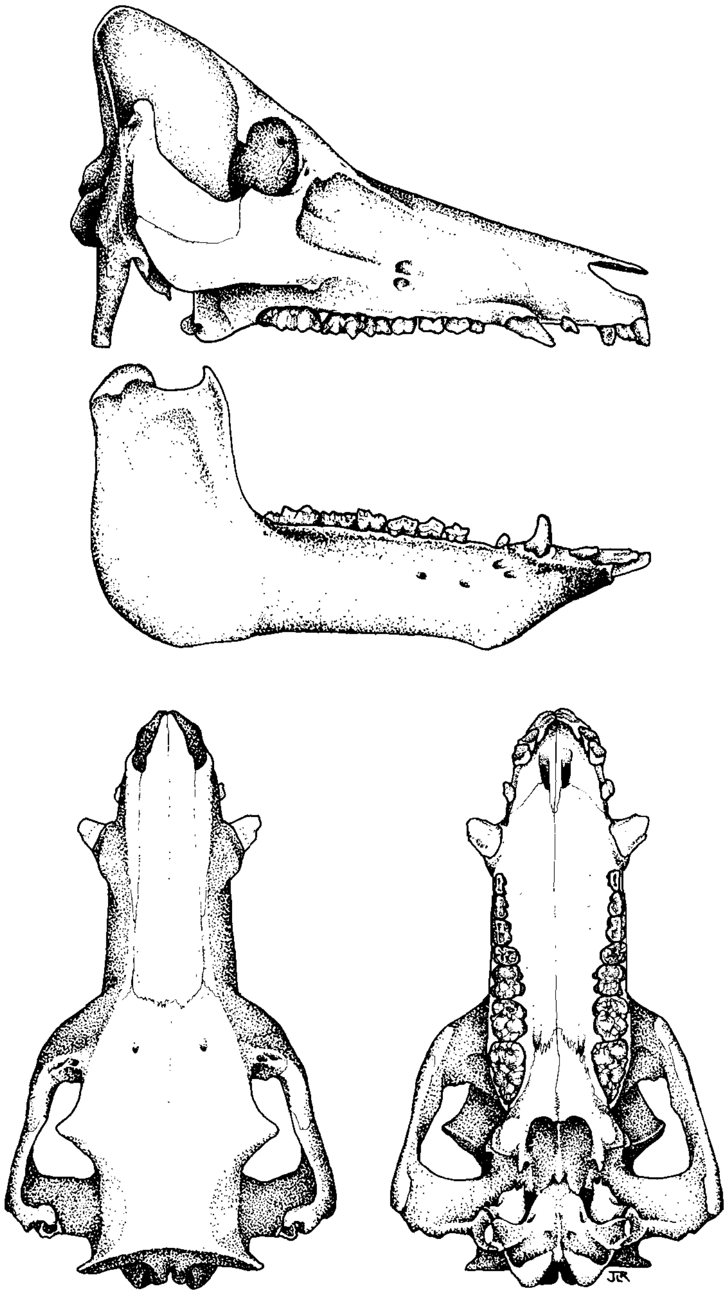
Order ARTIODACTYLA
Family SUIDAE

*Pig *Sus scrofa*

The pig occurs only in the domesticated state on the Tasmanian mainland but a feral population lives on Flinders Island. It has an omnivorous diet and in the wild state, will occasionally kill small mammals and reptiles for food.

Large canines grow at an angle from the jaw and in males may eventually develop to form prominent tusks projecting well beyond the mouth. They are used for digging and also serve as fighting teeth. The tips usually oppose each other and wear to prevent excessive lengthening but if they become misaligned, their growth may eventually result in the teeth curling back against the jaw and causing injury.

The cheek teeth are progressively larger posteriorally and their grinding surface, when unworn as in younger animals, has a complex arrangement of many cusps.



Pig

Sus scrofa x 0·25

I^{2-4}_{2-3}, C^{1}_{1}, P^{4}_{4}, M^{3}_{3}, = 40-46

Order LAGOMORPHA
Family LEPORIDAE

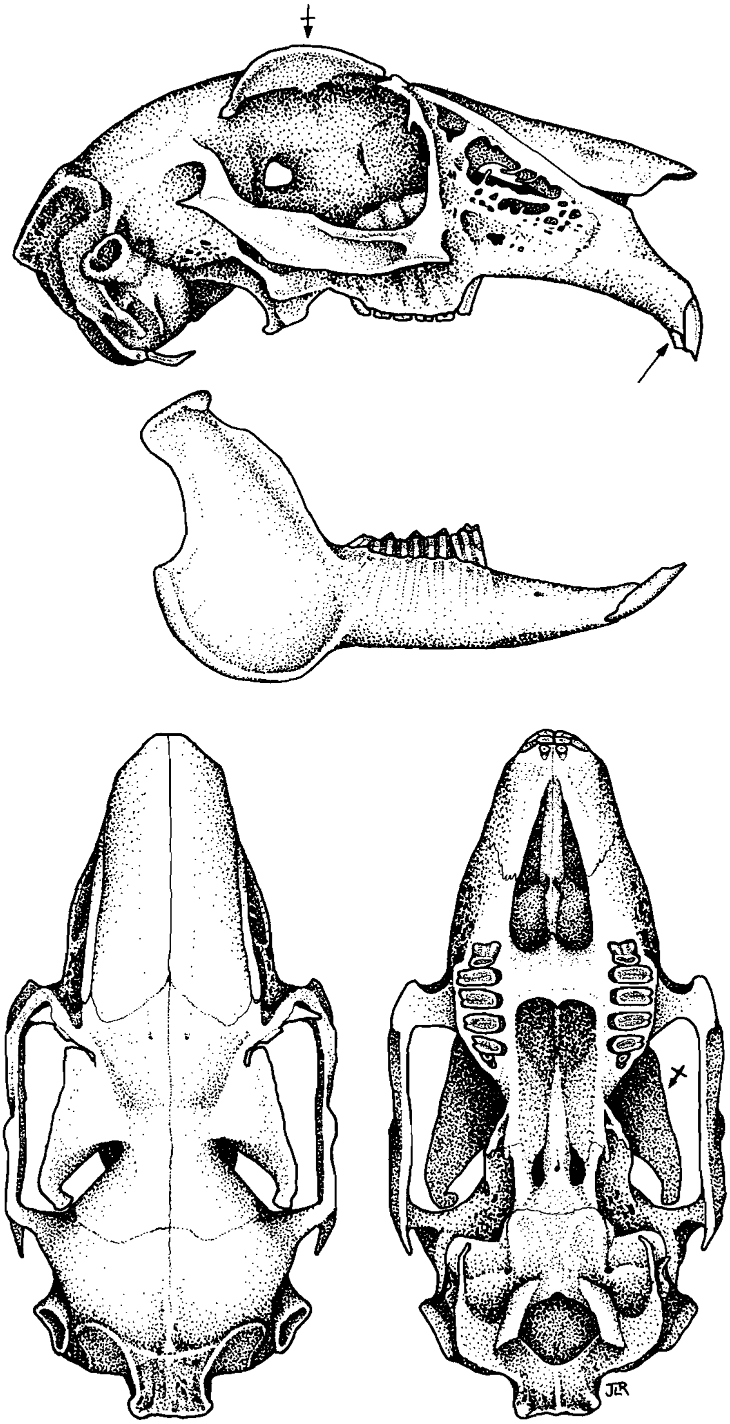
*Brown Hare *Lepus capensis*

*European Rabbit *Oryctolagus cuniculus*

The two members of this family were introduced by the early European settlers and are now widely distributed in a wild state. They are totally herbivorous, and have a diastema between the incisors and pre-molars which is of greater length than the molar row.

The teeth are open rooted and grow continuously throughout the animal's life, their length being regulated by wear. If, however, an injury to the jaws results in tooth misalignment and the opposing tips do not meet to wear down, the incisors continue to lengthen and may take on an exaggerated, spiral, grotesque form. There is a very small, secondary pair of incisors immediately behind the upper pair(/) which readily distinguishes the skulls of hares and rabbits from those of other Tasmanian mammals.

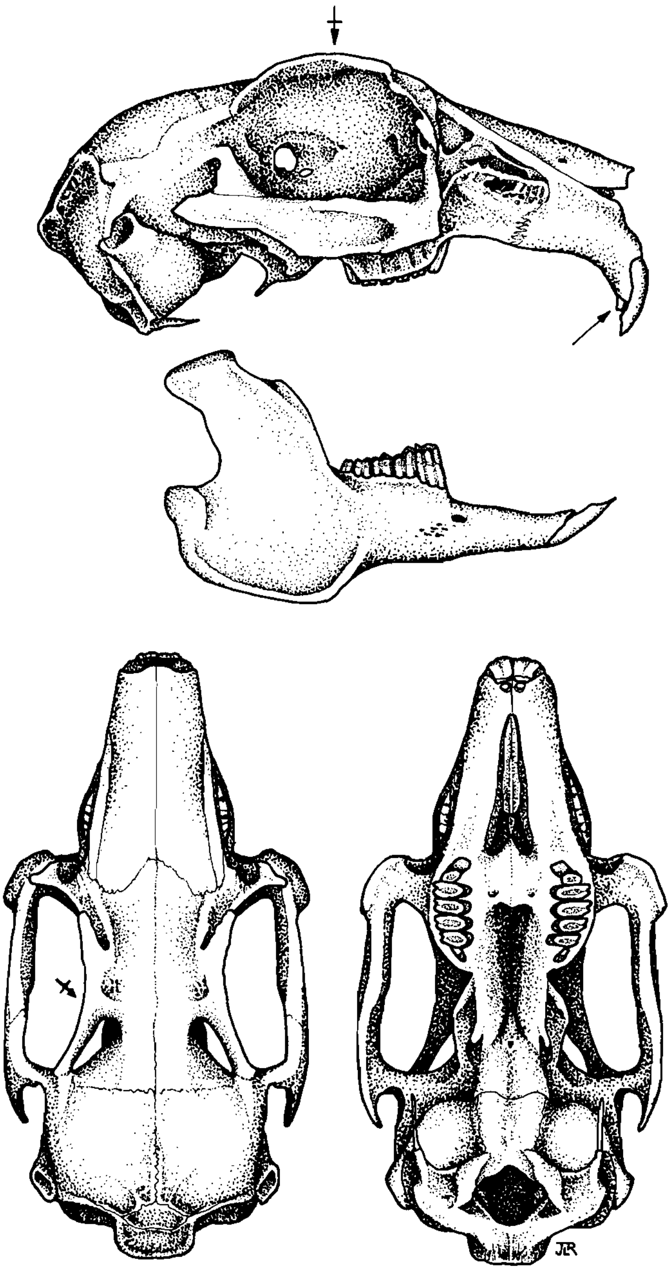
These two lagomorphs may be separated by reference to the shape of the frontal bone appendages above the eye socket (/), it being broad and triangular in the hare and narrow and elongated in the rabbit.



Brown Hare

Lepus capensis nat. size

I^{2}_{1}, C^{0}_{0}, P^{3}_{2}, M^{3}_{3}, = 28.



European Rabbit

Oryctolagus cuniculus nat. size

$I\frac{2}{1}$, $C\frac{0}{0}$, $P\frac{3}{2}$, $M\frac{3}{3}$, = 28.

NOTES

Order PINNIPEDIA
Family OTARIIDAE

Australian Sea-lion *Neophoca cinerea*

Australian Fur-seal *Arctocephalus pusillus*

New Zealand Fur-seal *Arctocephalus forsteri*

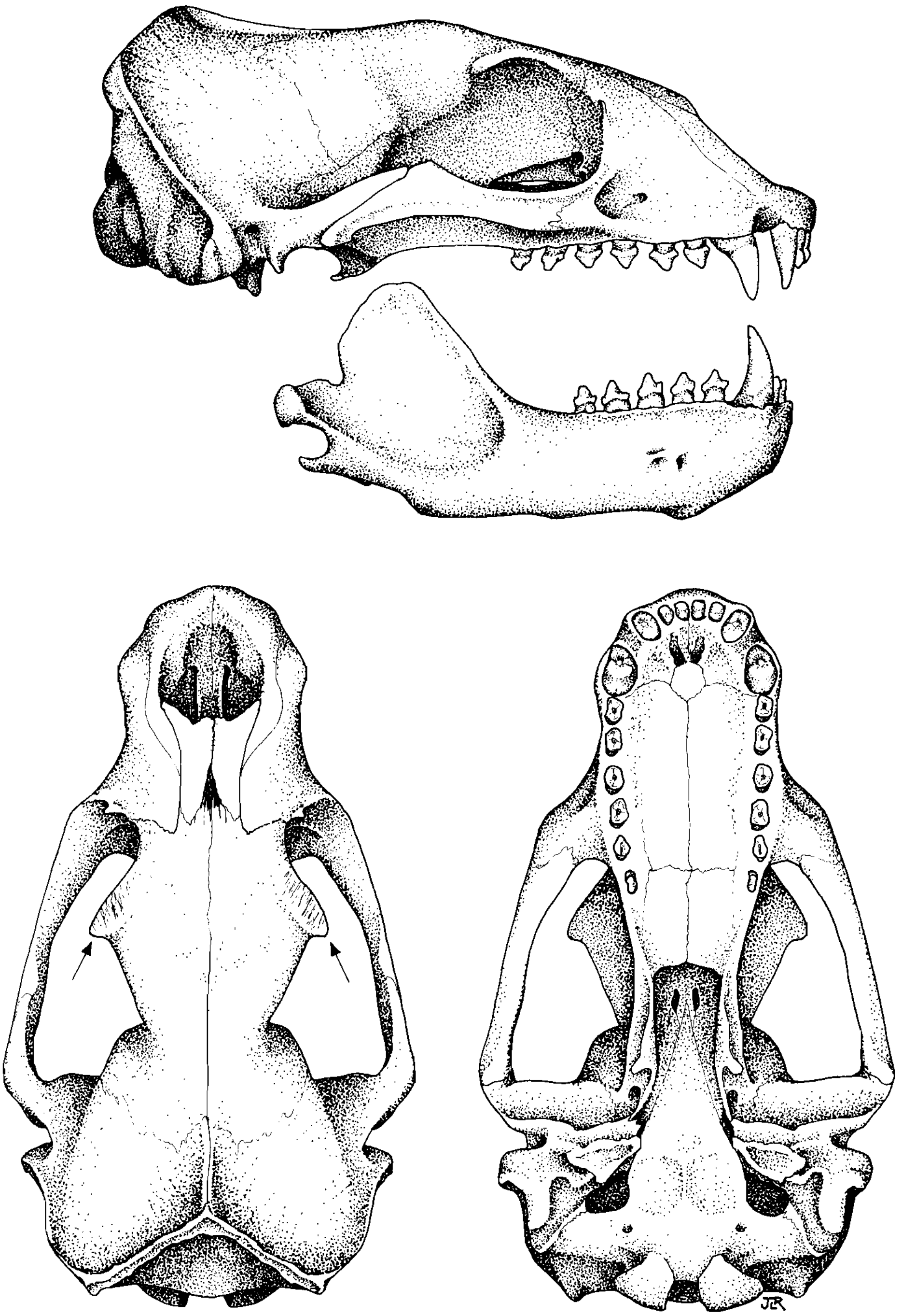
Externally this family is distinguished from the PHOCIDAE by its members having small external ears and a quadrupedal progression on land. Their skulls clearly differ in the inter-orbital region, the OTARIIDAE possessing strongly developed lateral processes (↗).

Seals have evolved a dentition to suit their carnivorous feeding habits of catching fish, squid and octopus and eating them without hauling out onto land. The prominent canines and small pointed cheek teeth are for seizing and handling prey. The soft bodied nature of their food and the habit of swallowing it without mastication renders unnecessary the typical molars of terrestrial carnivores. As there is no difference between the molars and premolars the set is usually referred to as Post Canines (P C).

In the Australian Sea-lion the skulls of males are much larger and more massive than those of the females, the canines are also much larger and there is an extra pair of upper cheek teeth and some differences in general form.

In the Australian Fur-seal small boney, horn-like lumps may be present on either side of the brain case of fully mature males, the skulls of which are considerably larger and more robust than those of females. Males also have a pronounced sagittal crest and very much larger canines.

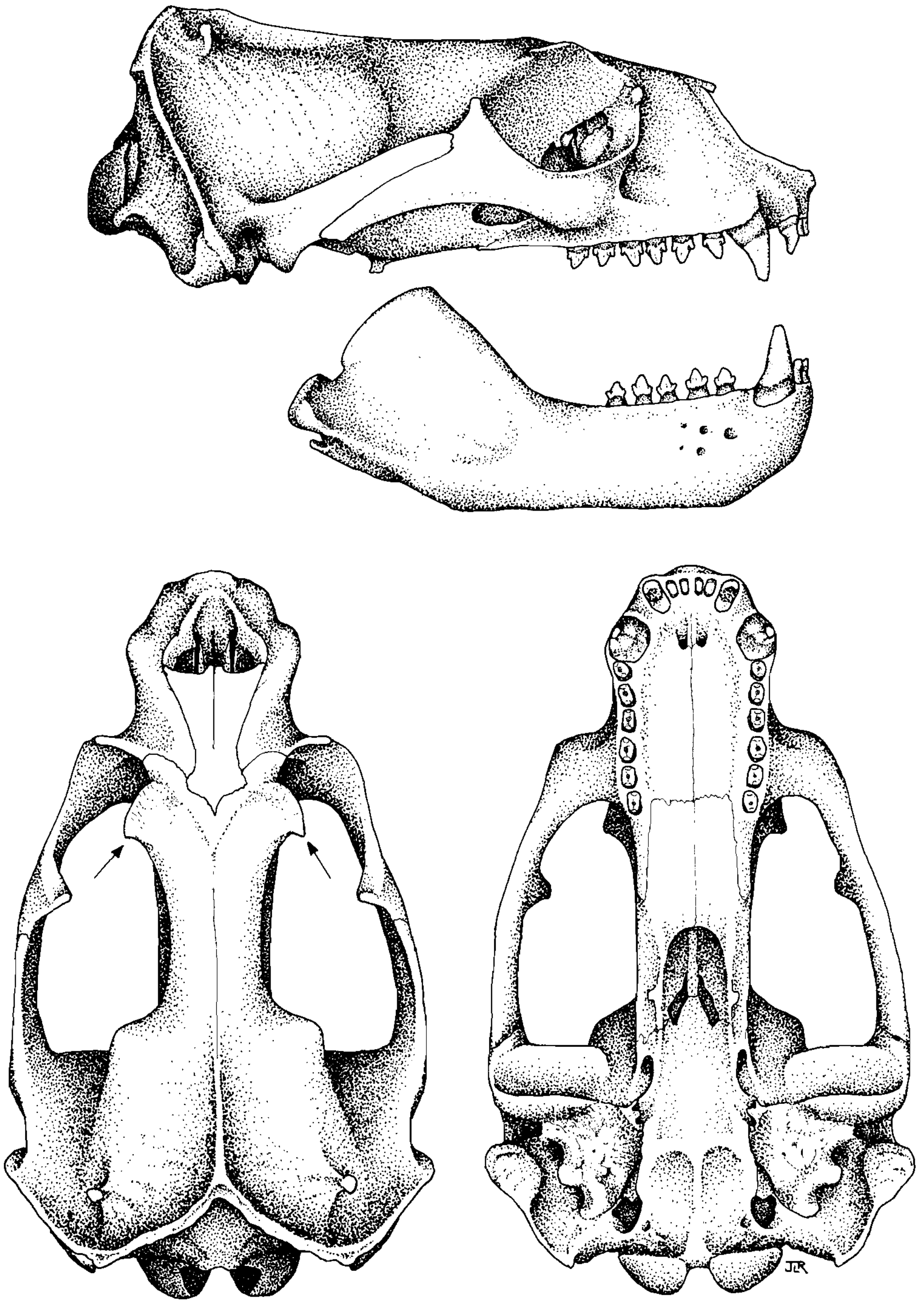
The skull of the New Zealand Fur-seal is similar to that of the Australian Fur-seal but may be separated from it by the absence of posterior secondary cusps on the cheek teeth. Supernumerary cheek teeth are sometimes present.



Australian Sea-lion

Neophoca cinerea x 0·4

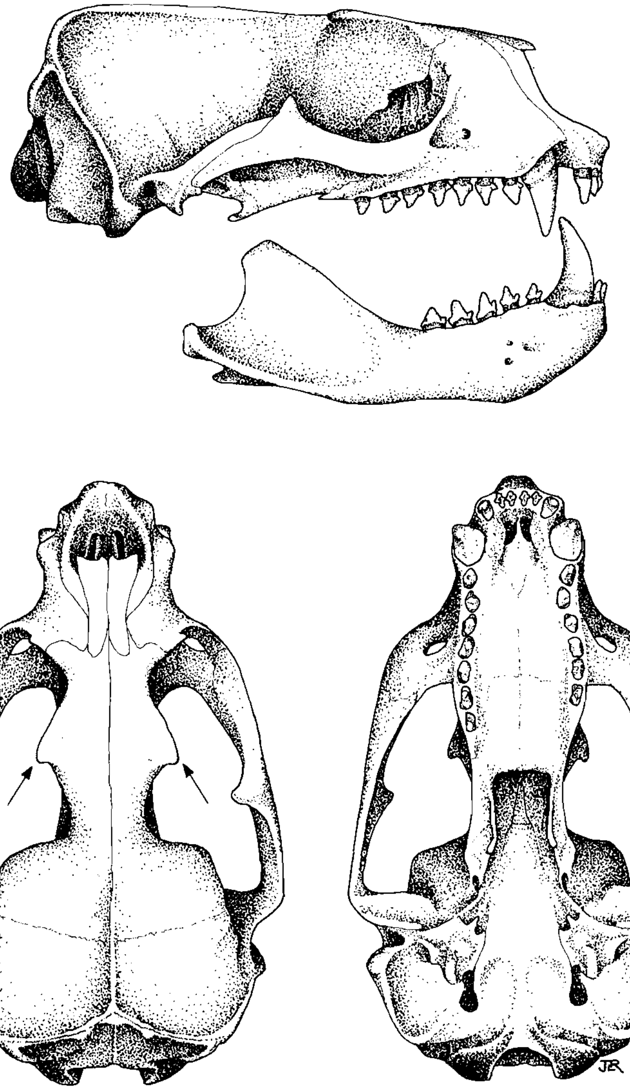
I^{3}_{2}, C^{1}_{1}, PC^{6}_{5}, = 36.



Australian Fur-seal

Arctocephalus pusillus x 0·4

I^{3}_{2}, C^{1}_{1}, PC^{6}_{5}, = 36.



New Zealand Fur-seal

Arctocephalus forsteri x 0·4

$I\frac{3}{2}$, $C\frac{1}{1}$, $PC\,\frac{6-7}{5}$, = 36-38.

Order PINNIPEDIA
Family PHOCIDAE

Leopard Seal *Hydrurga leptonyx*

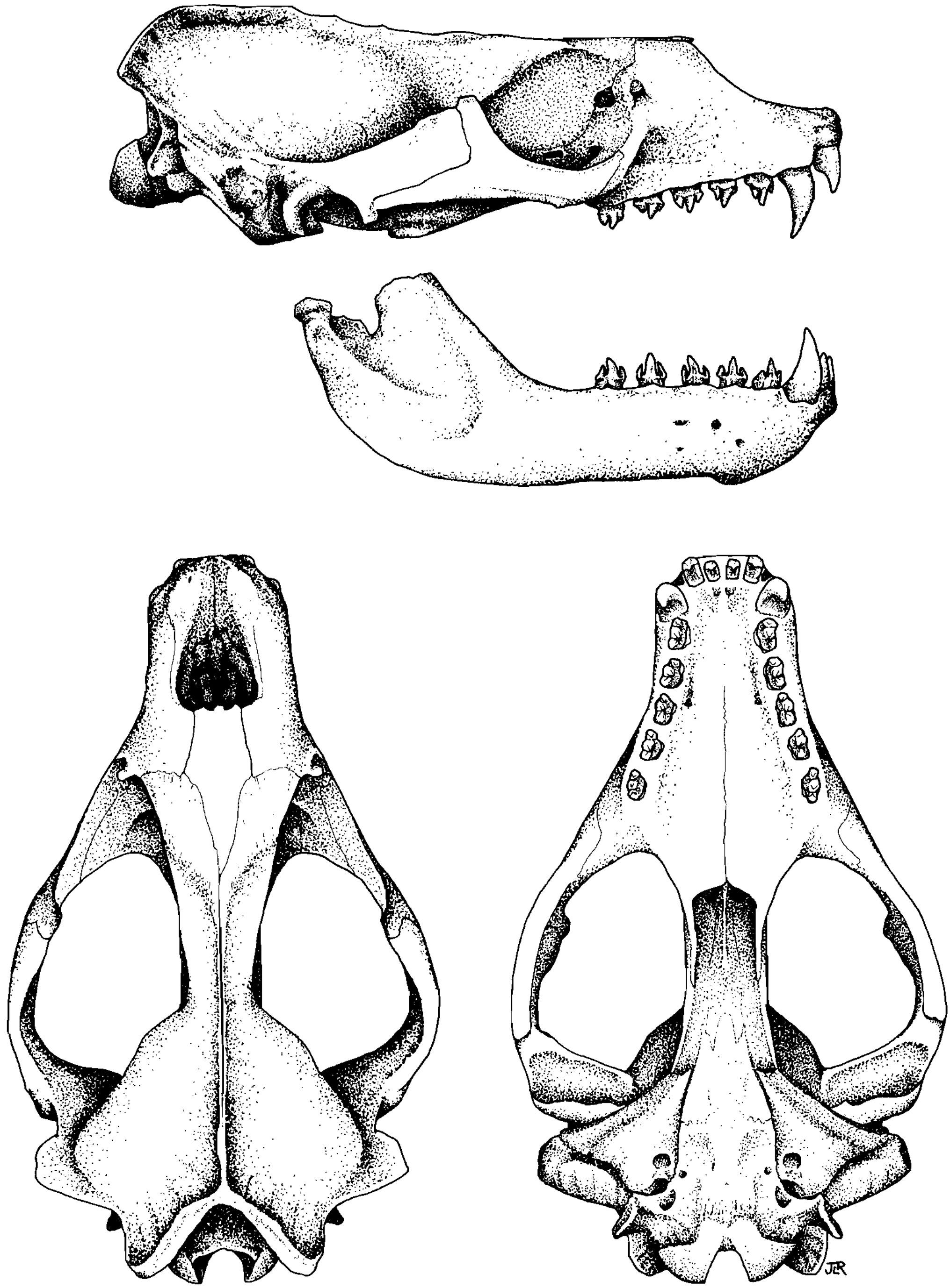
Elephant Seal *Mirounga leonina*

These seals lack external ears but still have good hearing.

The Leopard Seal has powerful canines and incisors, sharp tri-cusped cheek teeth and a pronounced sagittal crest. There is little if any difference between the skulls of males and females. It is a predacious carnivore and feeds on the young of other Antarctic seals, penguins, fish and krill (small shrimp-like crustaceans), swallowing its prey whole or in large lumps. The interlocking of the multi-cusped cheek teeth provides an effective 'strainer' enabling the Leopard Seal to sieve krill from the water.

The teeth of the Elephant Seal are, by comparison, mere pegs but as such they are well suited for catching its food of squid, cuttlefish, skate and small shark. A sagittal crest is lacking and there are no masticatory teeth, indicating that it swallows its soft food whole. Males are very much larger than females and this is reflected in their very much larger and more robust skulls and canines.

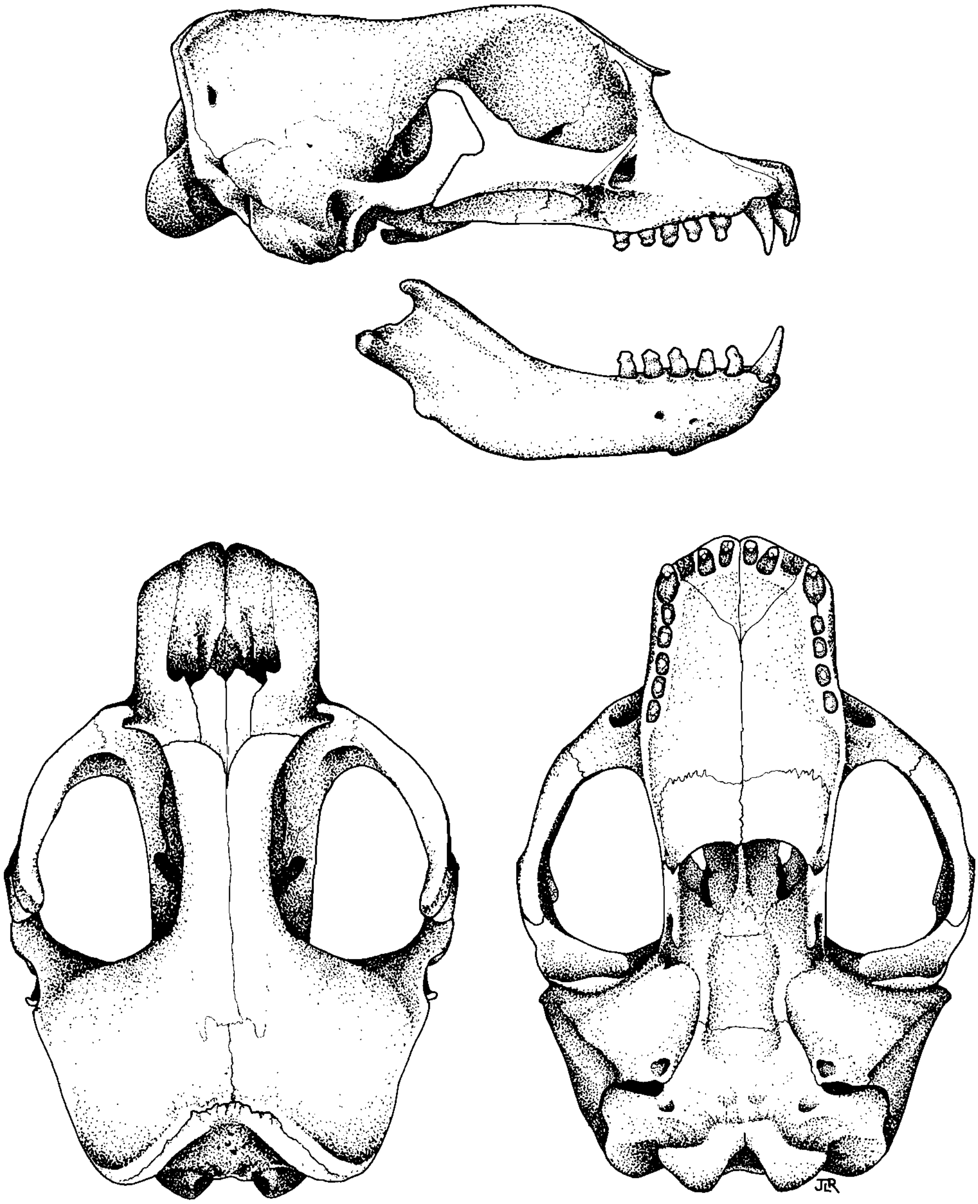
A third Antarctic species, the Crab-eater Seal *Lobodon carcinophagus,* does on rare occasions visit southern Australian waters but these are extra-limital records and its inclusion in this key is unwarranted.



Leopard Seal

Hydrurga leptonyx x 0·25

$I\,\frac{2}{2},\ C\,\frac{1}{1},\ PC\,\frac{5}{5},\ = 32.$



Elephant Seal

Mirounga leonina x 0·25

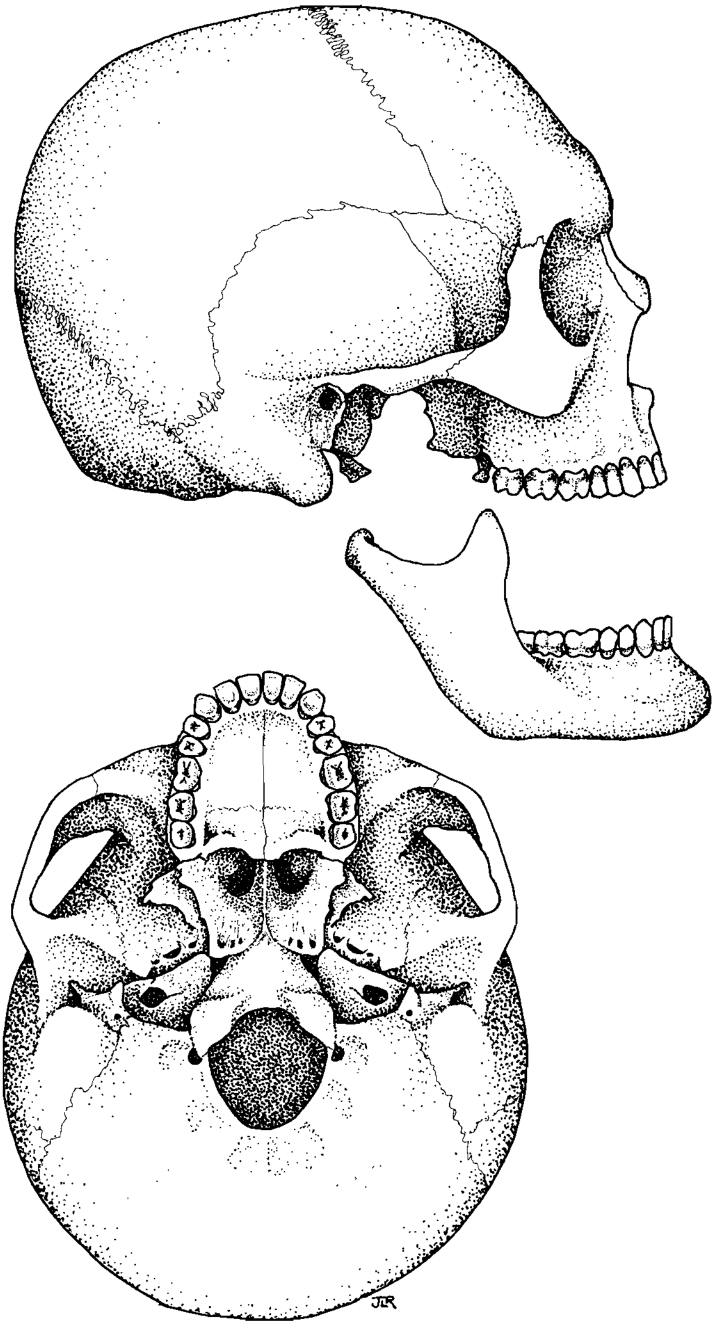
$I\frac{2}{2},\ C\frac{1}{1},\ PC\frac{4-5}{5},\ = 28\text{-}30$

NOTES

Order PRIMATES
Family HOMINIDAE

Man *Homo sapiens*

The skull of man is included to show the relatively huge brain case and small mandible and the dentition for comparison with the skulls of other mammals.



Man

Homo sapiens x 0·5

$I\,\frac{2}{2},\ C\,\frac{1}{1},\ P\,\frac{2}{2},\ M\frac{3}{3},\ = 32.$

APPENDIX I

Dichotomous Key to the Skulls of Mammals in Tasmania

Many diagnostic keys are of necessity detailed and complex, and therefore of limited practical use to students unfamiliar with the relevant terminology. In order to simplify this key as much as possible, we have limited separation to family level. The size range (length) of skulls of the adults examined in each family is given in parentheses.

Students who wish to identify skulls to genus or species should then refer to the text under the family and compare their material with the relevant illustrations.

Scientific terms have been kept to a minimum and these are explained in the illustrations on pages 8 and 9. The descriptions and illustrations are based mostly upon skulls of mature individuals and a list of the actual specimens used is included (Appendix II).

The symbols (/ and /) in the key mean the feature is indicated in the illustration by an arrow.

Number of teeth quoted is for one side only.

1. No true (normal) teeth in adults, horny molar plates may be present 2
   True (normal) teeth present 3
2. No molar plates, front of skull greatly elongated and tapering, mandible slender and weak (7-12cm) .... **TACHYGLOSSIDAE page 10**
   Horny molar plates, front of skull elongated and flat, premaxillae pincer shaped (6-11cm) .... **ORNITHORHYNCHIDAE page 12**
3. Upper incisors absent, horns sometimes present 4
   Upper incisors present, horns absent 5
4. A single orifice about 3mm diameter in the front edge of the eye socket, horns, if present, attached to a bony core and not branched ($>$ 15cm) .... **BOVIDAE, page 72**
   A pair of orifices in the front edge of the eye socket (/), horns, if present, may be branched as antlers and attached to a flattened bony boss (15-27cm) .... **CERVIDAE page 76**
5. Eye socket completely surrounded by bone (orbit) 6
   Eye socket not completely surrounded by bone 7
6. Skull elongated $>$ 25cm, eye socket lateral .... **EQUIDAE page 70**
   Skull rounded $<$ 25cm, eye socket anterior .... **HOMINIDAE page 92**
7. Canines directed at an outward angle ($>$ 20cm) .... **SUIDAE page 78**
   Canines, if present, directed vertically 8
8. Skull length $\geq$ 21cm 9
   Skull length $<$ 21cm 10

9. Upper post canine teeth 6-7 (21-30cm) .... **OTARIIDAE page 84**
Upper post canine teeth 4-5 (25-40cm) .... **PHOCIDAE page 88**

10. One pair of upper incisors (excepting an inferior pair immediately behind as in hares and rabbits) 11
More than a single pair of upper incisors 13

11. Upper incisors grooved longitudinally and with a secondary pair immediately behind them (/), frontal bones expanded laterally to form roof-like appendages over the eye sockets (/) (5-10cm) .... **LEPORIDAE page 80**
Incisors not grooved, lacking secondary incisors and without frontal bone appendages 12

12. Skull length $\geq$ 8cm (8-18cm) .... **VOMBATIDAE page 44**
Skull length $<$ 8cm (1-7cm) .... **MURIDAE page 56**

13. Canines larger than incisors. Lower incisors 3 or 4 14
Canines absent or smaller than central incisors. Lower incisors 1 or 2 19

14. Skull length $\leq$ 2cm (1-2cm) .... **VESPERTILIONIDAE page 46**
Skull length $>$ 2cm 15

15. Upper incisors 3, frontal bones broad anteriorally 16
Upper incisors $>$ 3, frontal bones not broad anteriorally 17

16. Diameter of eye sockets $>$ their distance from the canines (6-10cm) .... **FELIDAE page 68**
Diameter of eye sockets $<$ their distance from the canines (7-20cm) .... **CANIDAE page 66**

17. Upper incisors 5 with a space between incisors 4 and 5 (6-9cm) .... **PERAMELIDAE page 24**
Upper incisors 4 18

18. Skull length $<$ 15cm (2.5-14cm) .... **DASYURIDAE page 14**
Skull length $\geq$ 15cm (15-21cm) .... **THYLACINIDAE page 22**

19. Skull length between 1.5 and 2.4cm .... **BURRAMYIDAE page 30**
Skull length $>$ 2.5cm 20

20. Upper premolars 3 (3-7cm) .... **PETAURIDAE page 34**
Upper premolars 2 (7-10cm) .... **PHALANGERIDAE page 28**
Upper premolars 1 (7-21cm) .... **MACROPODIDAE page 38**

APPENDIX II

The registered numbers, sex and page numbers of skulls illustrated.

Species	Registered Number	Sex	Page
Tachyglossus aculeatus	1965/1/163	F	11
Ornithorhynchus anatinus	1964/1/246	M	13
Dasyurus maculatus	1975/1/39	?	15
Dasyurus viverrinus	1964/1/189	F	16
Sarcophilus harrisii	1964/1/206	M	17
Antechinus minimus·	1978/1/340	M	18
Antechinus swainsonii	1963/1/190	M	19
Sminthopsis leucopus	R.H.G. Coll.	M	20
Thylacinus cyanocephalus	1962/1/54	?	23
Isoodon obesulus	1981/1/70	M	25
Perameles gunnii	1966/1/48	M	26
Trichosurus vulpecula	1960/1/13	F	29
Cercartetus lepidus	1980/1/76	M	31
Cercartetus nanus	1982/1/148	F	32
Petaurus breviceps	1965/1/152	M	35
Pseudocheirus peregrinus	1960/1/6	?	36
Bettongia gaimardi	1962/1/45	M	39
Potorous tridactylus	1976/1/138	M	40
Thylogale billardierii	1978/1/298	F	41
Macropus rufogriseus	1967/1/60	M	42
Macropus giganteus	1977/1/36	M	43
Vombatus ursinus	1982/1/150	?	45
Chalinolobus gouldii	1964/1/51	M	47
Chalinolobus morio	1963/1/99	M	48
Eptesicus regulus	1980/1/93	M	49
Eptesicus sagittula	1982/1/35	M	50
Eptesicus vulturnus	1980/1/114	F	51
Nyctophilus geoffroyi	1964/1/290	F	52
Nyctophilus gouldi	1978/1/351	M	53
Pipistrellus tasmaniensis	1962/1/71	F	54
Hydromys chrysogaster	1981/1/153	M	57
Mastacomys fuscus	1965/1/150	F	58
Rattus lutreolus	1965/1/126	F	59
Pseudomys higginsi	1978/1/579	M	60
Pseudomys novaehollandiae	1978/1/355	M	61
Mus musculus	1982/1/149	?	62
Rattus rattus	1981/1/73	M	63
Rattus norvegicus	1962/1/44	F	64
Canis familiaris	1978/1/348	?	67

Species	Registered Number	Sex	Page
Felis catus	1980/1/58	F	69
Equus caballus	1982/1/37	F	71
Bos taurus	1980/1/488	?	73
Capra hircus	1982/1/38	M	74
Ovis aries	1980/1/80	M	75
Dama dama	1973/1/18	M	77
Sus scrofa	1980/1/506	F	79
Lepus capensis	1980/1/84	?	81
Oryctolagus cuniculus	1980/1/503	?	82
Neophoca cinerea	1957/1/9	M	85
Arctocephalus pusillus	1979/1/12	M	86
Arctocephalus forsteri	C6189	M	87
Hydrurga leptonyx	1979/1/20	?	89
Mirounga leonina	1957/1/19	F	90
Homo sapiens	1982/1/168	M	93

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NOTES

DESCRIPTIONS AND ILLUSTRATIONS OF THE SKULLS OF 54 MAMMALS

LIVING IN TASMANIA

2 MONOTREMES
20 MARSUPIALS
32 EUTHERIANS

INCLUDING 13 INTRODUCED SPECIES

WITH A KEY TO AID IN THE IDENTIFICATION