

# BiblioRakali: the Australian water rat, *Hydromys chrysogaster* Geoffroy, 1804 (Muridae: Hydromyinae), a subject-specific bibliography

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## ABSTRACT

Eighty-six references relating to the Australian water rat or Rakali (*Hydromys chrysogaster* Geoffroy), have been collated to create this bibliography. References were taken from available written literature (published and unpublished, with or without peer review) to provide a comprehensive resource for researchers. Using these references we present a summary of the distribution, status and biology of the species. In addition, each reference has been sorted into the following groups: behaviour, conservation status, description, diet, distribution, ecology, evolution, general, genetics, species management, parasites, physiology, reproduction and threatening processes.

## DESCRIPTION

The Australian water rat, or Rakali, *Hydromys chrysogaster*, was described by Geoffroy (1804) and is part of the Family Muridae (Vernes 1998) within the order Rodentia (Olsen 1983). The Hydromyinae includes all the native Australian rodents in the Muridae, except for the genus *Rattus* (Hinds et al., 2002).

*Hydromys chrysogaster* is thought to have radiated from New Guinea to Australia (Vernes 1998), and is one of the few amphibious mammals found in Australia (Hinds et al. 2002). Water rats have effectively colonised a niche which few mammals have successfully colonised, and have evolved adaptations to live a semi-aquatic and semi-nocturnal lifestyle (McKenzie, 1998). Water rats have a flattened head with small ears and eyes, dorsally located nostrils on a blunt nose and a large number of whiskers (Australian Museum, 2003). Their hind feet are broad and partially webbed for efficient swimming (Olsen 1983). The fur of the water rat is waterproof and the colouring depends on where it is found in Australia. It varies from black to grey on the dorsal surface and white to orange on the ventral surface (Olsen, 1983). Its tail is covered by dark fur and usually terminates with a white tip (Olsen, 1983). In south-eastern Australia, adult males ranged in length (head and body) from 231 – 345 mm (mean 310 mm), with a weight range of 400 – 1275 g (mean 755 g), while adult females were on average slightly smaller with head and body lengths of 245–370 mm (mean 290 mm) and weights from 340–992 g (mean 606 g; Olsen 1983). Olsen (1983) also reported that mean tail lengths were very similar between males and females at 275 and 272 mm respectively.

## DISTRIBUTION

Water rats live near permanent water whether it is fresh, brackish or marine (Olsen 1983). Water rats can be found in wetlands, rivers, estuaries and along beaches and on islands. Natural areas are not the only places offering suitable habitat, as artificial water sources and even polluted urban water bodies can support water rat populations (Watts & Aslin 1981).

Water rats are found in suitable habitats throughout Australia, New Guinea and the offshore islands. In Australia, *H. chrysogaster* is a widespread species (Vernes 1998), and can be found in all states and territories (Olsen, 1983, 1995). In Western Australia, they can be found along water courses and in wetlands on the Swan Coastal Plain, and along rivers in the Darling Range (Kitchener, Chapman & Barron 1978). The abundance of water rats in suitable habitats within Australia ranges from sparse to common (Olsen 1983).

A specimen list originally constructed by Kitchener et al. (1978) and updated by the Western Australian Museum (Ric How pers. comm., 2005<sup>1</sup>) gives an indication of the distribution of water rats in Western Australia from the late 1800s to 2002. Specimens have been sent to the Western Australian Museum from various places such as Kununurra, Shark Bay, Balingup and Albany. The majority of specimens were from regional country towns with only 13 specimens from Perth (all collected prior to 1983). A specimen was recently recovered from Lake Goollelal in Perth (Mike Bamford pers. comm. 2005<sup>2</sup>). The distribution

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Figure 1. Distribution of *Hydromys chrysogaster* (records prior to 1850 indicated by ★, 1950–1999 by □ and 2000 onwards by ●) in Western Australia based on specimens located in Australian museums (adapted from BioMaps (<http://www.biomaps.net.au/biomaps/> Retrieved 20/6/07) and FaunaBase (<http://www.museum.wa.gov.au/faunabase/prod/index.htm> Retrieved 20/6/07)).

of water rats in Western Australia as compiled from national, state and territory Museum records (FaunaBase and BioMap Databases) is shown in Figure 1.

### Conservation Status

Along rivers, water rat populations appear to be sparsely distributed. However in Victorian irrigated areas and drainage swamps, water rat populations have been found to be quite dense (Olsen, 1983). In these areas water rats are said to be a pest by some as they profit on the easy availability of prey and their burrows are thought to cause damage to irrigation structures (McNally 1960). However, they prey upon the burrowing freshwater crayfish (*Cherax destructor*), which could cause more damage if not kept in check by the water rat (Olsen 1983).

In the past, particularly in south-eastern Australia, the water rat was hunted to almost extinction for its fur, as it

was highly prized for use in clothing manufacture (McKenzie 1998). It is now a protected species across Australia and this is believed to have led to a recovery in abundance.

The current range of the water rat in Australia is similar to that occupied prior to European settlement (Watts & Aslin 1981). However, this does not reflect localised losses associated with clearing, pollution and secondary salinisation (Lee 1995). Lee (1995) believed that degradation and salinisation of southwestern Australian waterways had resulted in a substantial decline in populations. Water rats are considered to be secure nationally, however little is known of abundance and health of Western Australian populations. Water rats are not listed as a threatened species in the 2000 IUCN Red List of Threatened Species, the *Wildlife Conservation Act 1950* (Western Australian Government), or the *Environmental Protection and Biodiversity Conservation Act 1999*

(Commonwealth Government). However in Western Australia, it is listed as a Priority 4 species (Department of Environment and Conservation), that is, one that is not threatened at this time, but is in need of monitoring.

Oral histories (Sanders 1991) suggest that in the wheatbelt of Western Australia water rats declined during the 1950s and then the species disappeared from wetlands. This may have come about through falling numbers of the prey species (fish, frogs and crustaceans), which resulted from the increased salinity in the region (Sanders 1991; Lee 1995; Scott & Grant 1997).

The natural predators of the water rat are birds of prey, snakes and large fish but they are also taken by feral cats and foxes (Scott & Grant 1997). The impact of feral predators and cane toads on water rats is poorly understood.

Barrett (1950) controversially described the Western Australian populations as a different species to the eastern populations. Olsen (1983) however stated that subspecies had been described but were unlikely to be valid. Genetic studies are required to determine the taxonomic relationships between the various Australian populations as this may affect the imperatives for conserving each of these populations.

Despite the broad distribution and abundance of the species in Australia, it has attracted comparatively little scientific interest with only 85 publications found compared to the 294 for Chuditch (Smith et al. 2004). The possibility of a subspecies in Western Australia and the few publications available on western populations suggests that more research on this species is needed in the west.

## DIET

Water rats are not completely nocturnal and are most active around sunrise and sunset but can also be seen foraging during the day. Occasionally they climb trees in search of food but mainly forage in the water (Olsen 1983). Water rats will take captured prey to consume at feeding middens to allow their bodies to warm up between hunts, especially when the water temperature is low, as they don't have insulated fur (Scott & Grant 1997). Water rats are opportunists and will feed on fish, aquatic insects, mussels, crustaceans, small waterbirds, small mammals, lizards, frogs and even household rubbish. They consume little plant material and will only do so if their preferred prey is unavailable (Olsen 1983).

## REPRODUCTION

Water rats have been recorded as breeding at anytime of the year but according to Olsen (1983) the most common times are spring and summer. Any regional differences in breeding times are unknown. Females can start breeding at four months of age but usually begin at eight months. Nests generally consist of tunnels dug into a river bank, or occasionally logs. The gestation period lasts for 34 days

and 3–4 young are born. Typically one or two litters are produced a year but more litters are possible if conditions are optimal. The young are suckled for approximately four weeks but stay with the mother for another four weeks gaining independence before dispersing (Olsen 1983). A single male water rat will keep a large home range which may contain several female home ranges within it (Scott & Grant 1997). Water rats are territorial animals and will fight in overcrowded areas often resulting in damaged tails (Olsen, 1983).

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## BIBLIORAKALI

This bibliography of information on the Rakali or Australian water rat, *Hydromys chrysogaster*, lists the majority of known and available references that focus solely on the water rat and relevant literature that contains some information on the water rat.

The bibliography was built using titles extracted from the Web of Science and Streamline Online Databases at Edith Cowan University and the Department of Environment and Conservation (Western Australia) library at Woodvale. Some references have been taken from the World Wide Web and although useful may not be completely reliable sources of information. The URLs have been included in the reference but may change over time.

The references have been listed in alphabetical order and given a number. These numbers have been placed under 14 broad subject groups in relation to the information given in each reference.

### BEHAVIOUR:

2, 3, 10, 14, 21, 26, 28, 35, 40, 41, 44, 48, 49, 51, 54, 55, 56, 57, 60, 71, 75, 76, 79, 80, 81, 86

### CONSERVATION STATUS:

5, 8, 10, 14, 18, 19, 30, 37, 38, 40, 44, 46, 58, 59, 62, 64, 70, 79, 80

### DESCRIPTION:

1, 2, 3, 5, 8, 10, 14, 15, 18, 24, 25, 26, 28, 31, 34, 40, 41, 42, 49, 50, 51, 54, 57, 60, 64, 70, 71, 74, 75, 79, 80, 81

### DIET:

3, 5, 6, 8, 10, 14, 19, 34, 41, 44, 50, 51, 54, 55, 56, 57, 60, 71, 74, 75, 79, 80, 81, 86

**DISTRIBUTION:**

1, 2, 3, 4, 5, 8, 9, 10, 11, 14, 16, 18, 22, 25, 26, 28, 29, 30, 34, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 48, 50, 51, 54, 56, 57, 58, 59, 60, 62, 64, 67, 68, 70, 71, 73, 74, 76, 79, 80, 81, 82, 83, 84, 85

**ECOLOGY:**

3, 26, 28, 50, 56, 70, 79, 81, 86

**EVOLUTION:**

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**GENERAL:**

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**GENETICS:**

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**MANAGEMENT:**

10, 19, 40, 60, 80, 81

**PARASITES:**

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**PHYSIOLOGY:**

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**REPRODUCTION:**

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**THREATENING PROCESSES:**

5, 8, 10, 24, 30, 37, 38, 40, 41, 44, 50, 51, 52, 59, 60, 71, 79, 80

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### Additional Reference cited

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The rakali, *Hydromys chrysogaster*, also known as the rabe or water-rat, is an Australian native rodent first described in 1804. [2] The change to the aboriginal name Rakali was intended to foster a positive public attitude by Environment Australia. [3]. "BiblioRakali: the Australian water rat, *Hydromys chrysogaster* Geoffroy, 1804 (Muridae: Hydromyinae), a subject-specific bibliography" (PDF). *Conservation Science Western Australia*. 7 (1): 65–71. The Australian water rat, or Rakali, *Hydromys chrysogaster*, was described by Geoffroy (1804) and is part of the Family Muridae (Vernes 1998) within the order Rodentia (Olsen 1983). The Hydromyinae includes all the native Australian rodents in the Muridae, except for the genus *Rattus* (Hinds et al., 2002). *Hydromys chrysogaster* is thought to have radiated from New Guinea to Australia (Vernes 1998), and is one of the few amphibious mammals found in Australia (Hinds et al. 2002). Water rats have effectively colonised a niche which few mammals have successfully colonised, and have evolved adaptation The Australian water rat, *Hydromys chrysogaster* Geoffroy, is a murid rodent which frequents the waterways of much of Australia and the lowland areas of New Guinea. It obtains much of its food from the water (Woollard et al. 1978) and therefore may be faced with water temperatures approaching 0°C during winter in southern parts of its range. Methods and Materials The water rats used in these experiments were obtained from a colony maintained in outdoor pens in Canberra. At the University of New South Wales they were housed individually or in pairs in outdoor cages of 2 . 3 m<sup>2</sup>. They were provided with wooden boxes and straw for nesting, and a small pool for swimming.