SURVEY GUIDELINES FOR
THE HASTINGS RIVER MOUSE
(PSEUDOMYS ORALIS)

By T. D. Tweedie and A. York
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RESEARCH DIVISION
FORESTRY COMMISSION OF NEW SOUTH WALES
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SUMMARY

The Hastings River Mouse (*Pseudomys oralis*) is an uncommon native rodent which is regarded as endangered within New South Wales. It is presently known only from a limited number of widely dispersed locations in north-east New South Wales and southern Queensland, but could potentially have a broader, more common distribution. Its apparent low population densities make it difficult to capture, therefore a standardised methodology is required to reliably establish habitat requirements and patterns of relative abundance. This paper outlines the characteristics of the species and the habitats from which it has been caught, and describes a methodology which has proven to be effective in its capture.

Although morphologically similar to some *Rattus* species, the Hastings River Mouse has physical characteristics which, with practice, enable a positive identification to be made. Suitable habitat appears to be eucalypt forest which has an open structure and an understorey characterised by sedges (*Cyperaceae* spp.), rushes (*Juncaceae* and *Restionaceae* spp.), grasses (*Poaceae* spp.) and various ferns.

The recommended trapping methodology utilises 200 (Elliot) traps for 5 nights (1,000 trap nights), but this can be modified in areas of restricted habitat or where other factors apply. Strategies for trap placement and operation are described.

It is important that adequate habitat information is collected at sites where the Hastings River Mouse is caught, and also at sites where it is expected but not trapped. The Forestry Commission of New South Wales has a standardised methodology for floristic description and it is recommended that this is followed in Hastings River Mouse studies.
SUMMARY

The Hastings River Mouse (*Pseudomys oralis*) is an uncommon native rodent which is regarded as endangered within New South Wales. It is presently known only from a limited number of widely dispersed locations in north-east New South Wales and southern Queensland, but could potentially have a broader, more common distribution. Its apparent low population densities make it difficult to capture, therefore a standardised methodology is required to reliably establish habitat requirements and patterns of relative abundance. This paper outlines the characteristics of the species and the habitats from which it has been caught, and describes a methodology which has proven to be effective in its capture.

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INTRODUCTION

The Hastings River Mouse (*Pseudomys oralis*) is an uncommon native rodent found in the north-east of New South Wales and southern Queensland. In New South Wales it is currently classified under the revised Schedule 12 of the National Parks and Wildlife Act as a "threatened" species. Because of these factors it has a high conservation status and is considered to be of special interest when undertaking fauna surveys in conjunction with Environmental Impact Statements, Fauna Impact Statements and research projects.

The animal is difficult to capture and special skills are required to obtain a positive identification.

Trapping results available to the Forestry Commission of New South Wales suggest that the species utilises a variety of habitats but, at best, occurs only at very low densities. However, there are a number of characteristics that are common to most sites where captures have been made and these features may be used to help identify possible *P. oralis* habitats. It is essential that a standardised survey methodology is adopted for the species so that patterns of relative abundance can be established and preferred habitats identified.

BACKGROUND

Until several animals were caught south-east of Warwick Queensland in 1969, the Hastings River Mouse was only known from a 1921 description of two specimens housed in British museums (see Thomas, 1921). Since it was first described, only about 130 individuals have been found across a wide area stretching from Warwick in Queensland to Mt. Royal State Forest near Singleton in New South Wales (see Kirkpatrick and Martin, 1971; King and Chapman, 1983; Dickman and McKechnie, 1985; King and Mackowski, 1986; Read, 1987, 1988). These animals have usually been found on the eastern fall of the Great Dividing Range from altitudes of 410 m to 1000 m above sea level.

The Hastings River Mouse has been located at Mt. Royal State Forest, Werrikimbe National Park, Mt. Boss State Forest, Carrai State Forest, Hyland State Forest, Marengo State Forest, Chaelundi State Forest, Wild Cattle Creek State Forest, Clouds Creek State Forest, Billimbra State Forest, Forest Land State Forest and sites east from Warwick, Queensland. Teeth and skull fragments of the animal have been recovered from owl casts (pellets) or dingo droppings found in the Carrai State Forest, near Carrow Brook (Mt. Royal State Forest), and near Wardell (Read, 1987), although no animals have yet been caught at these localities. Fossil deposits from several widely distributed caves contain remains of the Mouse: in Queensland near Gatton, in New South Wales from Mangrove Creek, Wombeyan Caves, Yarrangobilly Caves, Wyambene Caves, and in eastern Victoria from Pyramids Cave near Buchan (Ride, 1960; Wakefield, 1972).

It is apparent that the Hastings River Mouse once had a much wider distribution than is currently known, and it is likely that further surveys may locate living populations in both areas from which fossil evidence has been found, and other areas where suitable habitats exist. These guidelines describe site characteristics from areas where the species has been caught (see also Read, 1993; New South Wales National Parks and Wildlife Service, 1993) and outline a standardised trapping methodology which has proven to be effective in the capture of the animal.
Plate 1. The Hastings River Mouse (*Pseudomys oralis*)

**Figure 1.** Mammary formulae for females of:

(a) *Pseudomys oralis* 0, 2 = 4 (no nipples in the chest region and two pairs in the groin, making a total of four).

(b) *Rattus fuscipes* 2, 3 = 10 (two pairs of nipples in the chest region and three in the groin, making a total of ten).

(From Covacevich and Easton, 1974).
DESCRIPTION OF PSEUDOMYS ORALIS

The features of the Hastings River Mouse that should be used to help distinguish it from morphologically similar species are:

1. Size
   - weight generally in the range 80-100 grams,
   - head and body length range between 130-170 mm,
   - tail length 110-150 mm (slightly less than or equal to body length),
   - head length 37-44 mm,
   - ear length 15-23 mm,
   - hind foot length 28-34 mm.

Note that for rodents, head-body measurement should be taken from the tip of the nose to the base of the tail, measured dorsally (as opposed to nose-cloaca in marsupials). The ear should be measured from the basal notch to the tip of the extended ear, and the foot from the tip of the longest toe (excluding claw) to the base of the heel.

2. Appearance
   - the long soft fur is light grey on the back and fawn to grey-white on the belly (see Plate 1). All body fur is slate-grey below the tips. If in doubt, a fur sample can be taken from the animal as described in the Trapping Methods section,
   - the animal has protruding eyes with a black eye ring,
   - it has a strongly rounded snout ("Roman" nose),
   - the tail is characterised by long wispy hairs with dark hair on top and light hair underneath (other Pseudomys species also have bi-coloured tails),
   - the feet are covered with fine white hair on top and have five toes. On the hind foot the fifth toe joins the foot well backward of toes two to four, further back than in Rattus species (see Kirkpatrick, 1983), and all six pads on the sole are basically oval-shaped.

3. Other features
   - the species lacks the strong smell which is characteristic of Rattus species,
   - like most Pseudomys species it has a gentle disposition.

The main species that may be confused with P. oralis is the Bush Rat Rattus fuscipes. The white undersurface of the tail of the Hastings River Mouse generally, but not uniquely, distinguishes it from the Bush Rat. Temperament and smell are good supplementary distinguishing features. If females are captured, the teat count for P. oralis is four (two pairs of inguinal teats), while for R. fuscipes it is 8-10 (see Figure 1).

Other Rattus species that might be encountered in P. oralis habitats are Rattus lutreolus and R. rattus. Both are distinctive, R. lutreolus due to its tawny appearance, small eyes, dark feet and short dark tail and R. rattus due to its relatively (very) long tail, strong smell and large size.
SELECTION OF TRAPPING SITES

All known populations of the Hastings River Mouse have been found in tall open eucalypt forests with an overstorey height of 20-40 metres. While the species composition of the overstorey is not seen as an important indicator of *P. oralis* habitat (Read, 1993), the species has been trapped in the following forest environments:

- New England Blackbutt, Ribbon Gum, Messmate, Round-leaf Gum. Usually as a mixed stand of open forest,
- Spotted Gum as a dominant species in open forest,
- Sydney Blue Gum as a dominant species in open forest,
- Ribbon Gum as a dominant species in open forest,
- Grey Gum, Ironbarks, and White Mahogany,
- Coastal Blackbutt, White Mahogany, Tallowwood in a dry open forest type,
- Dry open Brushbox forest in gullies. This forest type is not consistent with moist Brushbox gullies as it is very open and dry.

The Hastings River Mouse has not been trapped in rainforests or wet sclerophyll forest types (such as Forest Type 47, Forestry Commission of New South Wales, 1989) with rainforest understorey and dense shrub layers.

Soil types do not appear to have a bearing on habitats, as the Hastings River Mouse has been located on sedimentary, basalt and granite derived soils. The main factors appear to be an open forest structure with a grass/sedge understorey.

Vegetation Understorey Characteristics

Sites which have a number of the following general features are considered to produce the best trapping success:

- moist areas along creek lines, ridge top or mid slope bogs with sedges and rushes.
  e.g. Cyperaceae spp. (Plate 2), Juncaceae spp. (Plate 3), Restionaceae spp., grasses, ferns with some shrub layer,
- areas with nil or relatively open shrub layer which allows good development of grasses, sedges and ferns as ground cover,
- moist side gullies of more permanent streams with a dense covering of sedges, rushes, grasses and ferns,
- moderate to open eucalypt overstorey with any combination of the above characteristics,
- localised cover in the form of logs,
- localised cover in the form of broken rocks near creeks (not large rock screes),
- sites of very short ground layer where adequate cover is provided by logs, rocks and ferns, etc.
Plate 2. *Cyperus lucidus* (Cyperaceae). A sedge found in broad, moist gullies. Often a good indicator of Hastings River Mouse habitat.

Plate 3. *Juncus continuus* (Juncaceae). A rush typically found in areas of poor drainage. Often a good indicator of Hasting River Mouse habitat.
As can be seen from these characteristics, sedges (Cyperaceae spp.), rushes (Juncaceae and Restionaceae spp.), grasses (Poaceae spp.) and various ferns with an open *Eucalyptus* overstorey are indicators of suitable habitat for the Hastings River Mouse. These are also indicators of seepages, bogs and creeks as these ground cover plant species are associated with high soil moisture levels (Plates 4 and 5).

All habitat types must be considered objectively until more evidence is forthcoming. Care should be taken not to overlook prospective suitable habitats in areas that have been logged, grazed by cattle or recently burnt as the Hastings River Mouse has been found in such disturbed areas. Also, suitable habitats in undisturbed locations with soakages and associated plant species (e.g. sedges, rushes, grasses and ferns) should be considered.

Further consideration concerning the identification of Hastings River Mouse habitats and their protection during forest management operations can be found in Read (1993). Specific localities from which the animal has been trapped are described in an Interim Habitat Identification Guide prepared by the New South Wales National Parks and Wildlife Service (1993).
Plate 4. Typical Hastings River Mouse habitat in Bicks River State Forest. This site shows sedges, rushes, grasses and ferns growing in a minor gully with seepage (upslope from a major flowing creek).

Plate 5. Dry open forest in Bicks River State Forest with a typical moist sedge-bed gully. A high altitude site with an overstorey of New England hardwoods, eg. ribbon gum, messmate, round-leaf gum and New England blackbutt.
TRAPPING METHODS

As with all protected and endangered fauna in New South Wales, an appropriate Authority (Scientific Purposes) from the National Parks and Wildlife Service is required before any trapping can be undertaken. Similarly, methodologies employed must be approved by an approved Animal Care and Ethics Committee. The following approach is recommended by the Forestry Commission of New South Wales and has been approved by their Animal Care and Ethics Committee. It has also been endorsed by the Hastings River Mouse Recovery Team (Endangered Species Program).

It is also necessary to obtain permission from the land holder or administering body before trapping programs are implemented. A Special Purposes Permit is required before any survey can be undertaken in State Forests, and these can be obtained at District Forestry offices (proof of NPWS Authority, appropriate experience and qualifications required).

1. **Trap Installation**

   (a) Ideally 200 (eight boxes) of Type A “Elliott” 33 x 10 x 9 cm aluminium box traps should be used per site (see 2(b) below).

   (b) Locate all of the traps within a grid system of suitable habitat (see 1(c)), placing the traps at intervals of approximately 5 m in parallel lines 20 m apart ensuring that the areas of highest habitat potential are well represented. This method is useful in determining movement patterns of Hastings River Mouse, from gullies to ridges to gullies, in suitable sites.

   (c) Where suitable habitat is available only as a narrow riparian strip, a single line of traps spaced approximately 5 m apart and wandering backwards and forwards from the stream edge to the edge of suitable habitat should be used.

   (d) Place traps in cover under ferns, among rocks, under overhangs, in dense grass or beside logs. In placing traps, consider the likely morning sun position and avoid placing traps where sun could overheat the boxes before the morning inspections have been completed.

   (e) Traps should be placed on solid ground (scrape a patch with your foot) so that the trap will not move as an animal approaches or enters the trap (and be sprung prematurely).

   (f) In cold/wet weather, cover traps with suitable material (such as a plastic freezer bag) being careful to allow adequate drainage. Place leaves/grass inside the trap to minimise body heat loss.

   (g) Bait the traps with a mixture of rolled oats and peanut butter. Peanut oil is not as effective as peanut butter.

   **IMPORTANT:** DO NOT INCLUDE ANY BACON OR OTHER MEATS OR MEAT PRODUCTS IN THE BAIT MIX. This is to reduce the chances of non-target species being trapped. Saturation of the traps with non-target animals reduces the chances of Hastings River Mouse being caught.

   (h) Where very high numbers of non-target animals are being, or likely to be, caught, consideration should be given to placing two traps at each trap station.
2. **Trapping Operation**

(a) Traps are to be checked each morning and cleaned and re-baited as required.

(b) While it is preferable to use 200 trap stations for five successive nights, the number of trap stations will be determined by the size of area being surveyed. Trapping should not be conducted for more than five nights continuously. Extensive surveys for Fauna Impact Statements and Environmental Impact Statements will, for logistic reasons, involve a lower intensity of survey. The results of these surveys can be regarded as indicative of potential Hastings River Mouse populations, with more intensive follow-up surveys being conducted at a later stage.

(c) If trapping is to be conducted from June to October, special care should be taken to avoid cold-induced stress of captured animals. This can be achieved by using methods described in 1(f) above.

(d) All animals captured are to be identified to species, then weighed, sexed and their reproductive status assessed (juvenile, sub-adult, adult, breeding). If identity of the species is uncertain, animals should be accurately measured (head-body, tail, hind foot, ear length). Head and body length in rodents is tip of nose to base of tail, measured dorsally; ear length is from the basal notch to the tip of the extended ear; foot length from the tip of the longest toe (excluding claw) to the base of the heel. Body characteristics should be recorded and a sample (5 mm square) of mid-body flank fur should be collected carefully so that at least 20 primary guard hairs are included. The fur should be clipped with a pair of scissors close to the skin for later microscopic examination using the techniques described by Brunner and Coman (1974).

As Hastings River Mouse can be positively identified from hair samples taken in this manner and in deference to its endangered status, **NO VOUCHER SPECIMENS SHOULD BE TAKEN.**

(e) Every new animal should be given a temporary mark before release. Clipping the fur on the flank with a pair of scissors or marking the ear with a permanent marking pen is sufficient for short-term studies. Ear notching is the recommended technique for long-term marking.

(f) Captured Antechinus should be released away from the trap line (>50 m) to reduce the chance of early recapture and possible adverse health affects.

(g) Trapping results should be recorded on appropriate small mammal survey data sheets (see Appendix 1).

(h) During intensive surveys for the Hastings River Mouse, small vials containing pure alcohol should be carried for collection of faecal samples. This is essential for diet analyses which will also provide information to assist in habitat studies. Note: Care should be taken to clean traps thoroughly after capture of non-target animals so as not to contaminate samples.

(i) Trapping results indicate that Winter and Autumn are the most productive trapping periods. Summer grasses and sedges are fruiting in the Autumn and these provide a known food source for the Mouse.
SITE RECORDING

Because of the special interest in Hastings River Mouse and its relationship with various habitats, characteristics of the site should be accurately recorded (see "Flora Survey Plot Site and Floristic Data" sheets in York et al., 1991). All of the records allowed for on these sheets are valuable but special importance should be placed on the vegetation structure information which describes vertical stratification, cover classes and floristics of the major species in each stratum. Equally important is the collection of data of the floristic composition of the ground cover. This will involve species identification of plants in a 50 x 20 m plot (0.1 ha.) around each capture site.

Additional information about the site and its relationship with surrounding country such as habitat ecotones, distance to different vegetation types, forest boundaries, swamps, rocky areas, creeks, etc. or significant characteristics of the site not covered in the site data sheet plus any other items of interest should be recorded as comments. Guidelines for recording site data are covered under Section 2.0 to 2.4.3 and Appendix 1 of the Forestry Commission's flora and fauna survey guidelines (York et al., 1991).

It is essential that details of sites where Hastings River Mouse are expected but not captured are also recorded so that an effective database of habitat information can be compiled.

For surveys conducted within State Forest or adjoining lands, copies of results and record sheets from each survey should be lodged with the appropriate Forestry Commission District or Regional Office, together with any hair samples. The Regional Research Centre will hold computerised copies of the data and arrange for identification of the hair samples. All relevant data will then be forwarded to the National Parks and Wildlife Service, Northern Region.
ACKNOWLEDGEMENTS

The authors would like to thank Chris Dickman, David Read, Rod Kavanagh and Gary King for helpful comments on earlier drafts of this document. Thanks also to David Read for the photograph of the Hastings River Mouse, Debbie Ryan for typing up preliminary drafts, and to Traecey Brassil and Joy Gardner for co-ordinating the final publication.

REFERENCES


Appendix 1. Small Mammal Survey Data Sheet

(adapted from York et al., 1991)
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**COMMENTS:**

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