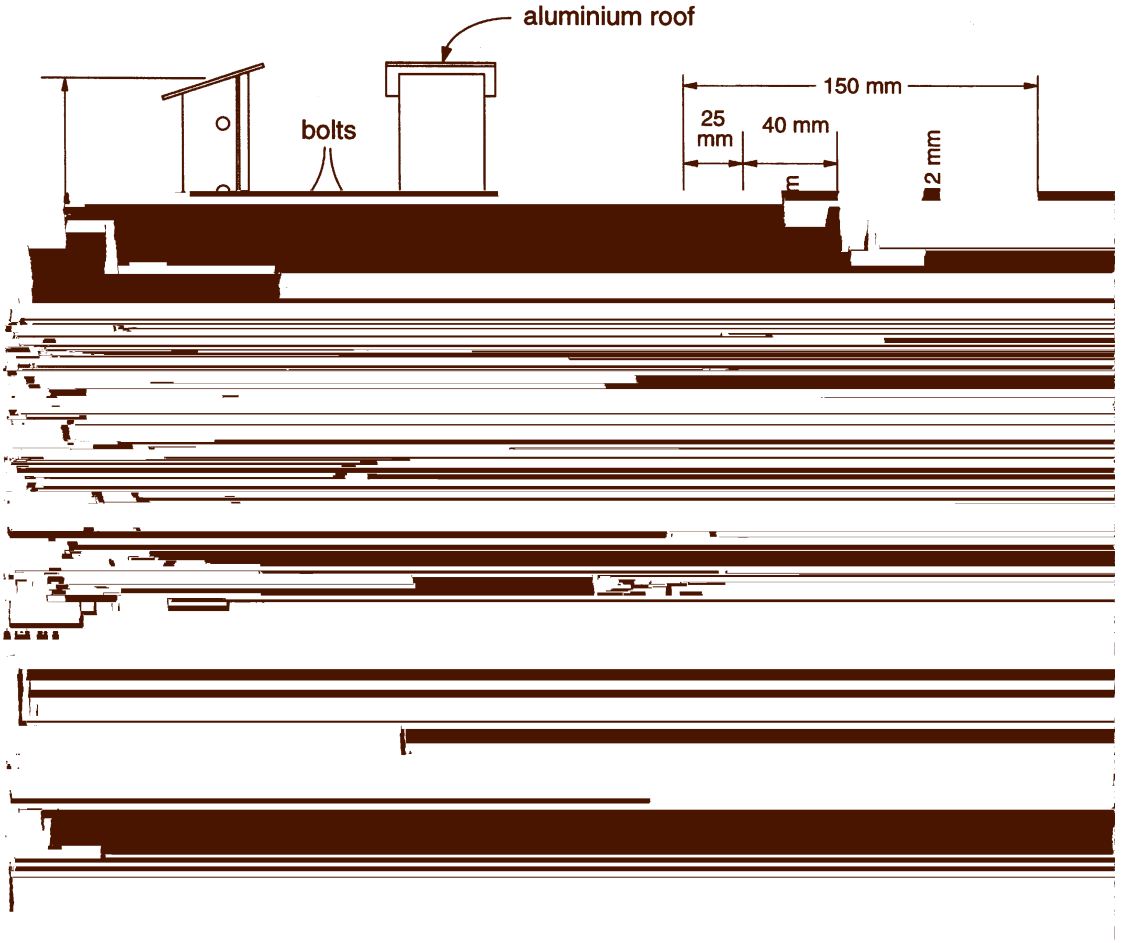


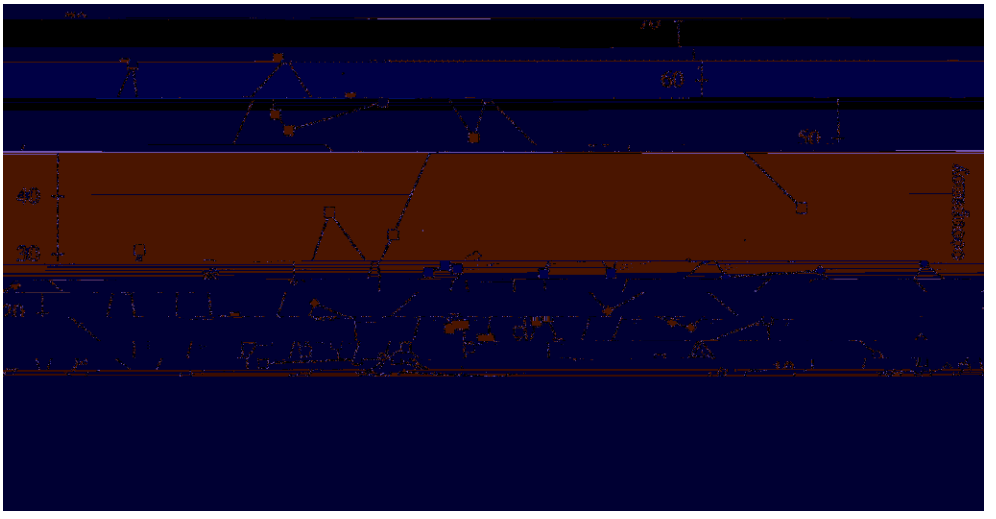
1. Design of original weta roosts deployed at Mohi Bush in 1994.

Morgan-Richards, 1995), that would allow observation of weta *i i* . We apply the term 'roost' to a unit containing a number of separate cavities each with an entrance.

The first roost built was designed to be planted like a fence post. The roost had a hinged door that opened to reveal 26 cavities each with a separate entrance channel (Figure 1). The cavities and entrance slots were manufactured with a router and the entire surface was protected by perspex sheet. This transparent cover provided a tactile surface for the weta and a window for the observer when the door was open. The tendency of tree weta to move further into their respective cavities rather than emerge from the roost when disturbed by light made this an effective compromise, and one used previously by Ordish (1992).

A smaller and simpler roost design with 18 cavities (Figure 2) was subsequently developed that could either be planted into the ground or attached to tree trunks. This roost included one large compartment at the top, with a wider opening and space for nine or ten adult weta inside, in addition to a set of smaller compartments. The large compartment was expected to be attractive to adult males which are known to develop 'harems' by permitting adult female weta to occupy a protected cavity thus allowing resident males preferential mating access (Moller, 1985; Gwynne and Jamieson, 1998).

Six roosts of the original design were placed in Mohi Bush Scenic Reserve, Hawke's Bay (40°



3. Temporal variation in use of artificial roost cavities by invertebrates at Mohi Bush over five years. Cavity use expressed as proportion (%) of available cavities and includes data from up to 12 roosts. Lines join consecutive sampling events for each group, symbols indicate: filled squares- all invertebrates; filled diamonds- cave weta; open squares- spiders; filled triangles- H. thoracica; open diamonds- H. trewicki. Horizontal axis units are days following installation of roosts. Intervals are annual and indicate 31 July of years 1995-1999.

weta species females slightly outnumbered males (*H. e ic i*: 53% females; *H. h acica*: 65% females). In natural cavities at Mohi Bush, (assessed prior to installation of roosts) we found 60% of tree weta were *H. e ic i* (n=98). Both tree weta species were found in most roosts, either at the same time or sequentially. Of the six major roosts at Mohi Bush, only in roost #1 have we seen just one species (*H. e ic i*). Other roosts show a range of frequencies of the two species (Figure 5).

V a - -

The total number of weta and other invertebrates using the roosts at Mohi Bush increased during the first three years of study and showed marked seasonal fluctuations (Figure 3). By July 1997 (end of year 3) maximum occupancy of available cavities reached 60%. Total observed occupancy by all animals was highest at winter visits (June/July) but this seasonality was not so obvious from the data for individual species or groups. The first animals recorded in a roost were cockroaches which were seen just six weeks after roost deployment. These were followed by cave weta and spiders. The first tree weta were not seen until five months after installation.

V a - - - a

Although Mohi Bush is a small forest remnant (~60 ha) with a relatively homogenous climate and a single management regime, we observed considerable variation in the use of identical roosts by invertebrates during this study. Although total numbers of animals in roosts tended to increase over time, differences in occupancy rates of different roosts persisted (Figure 4). In addition, the proportion of different taxa varied among roosts set only a few hundred metres apart (Figure 5). Secondary roosts (#7-9, #10-12) placed within 15 metres of roosts #1 and #3 were little used by tree weta in the four years after installation (Figure 6). Tree weta began using roosts (#10-12) near roost #3, three years after installation and 1.5 years after large numbers of weta first occupied roost #3.

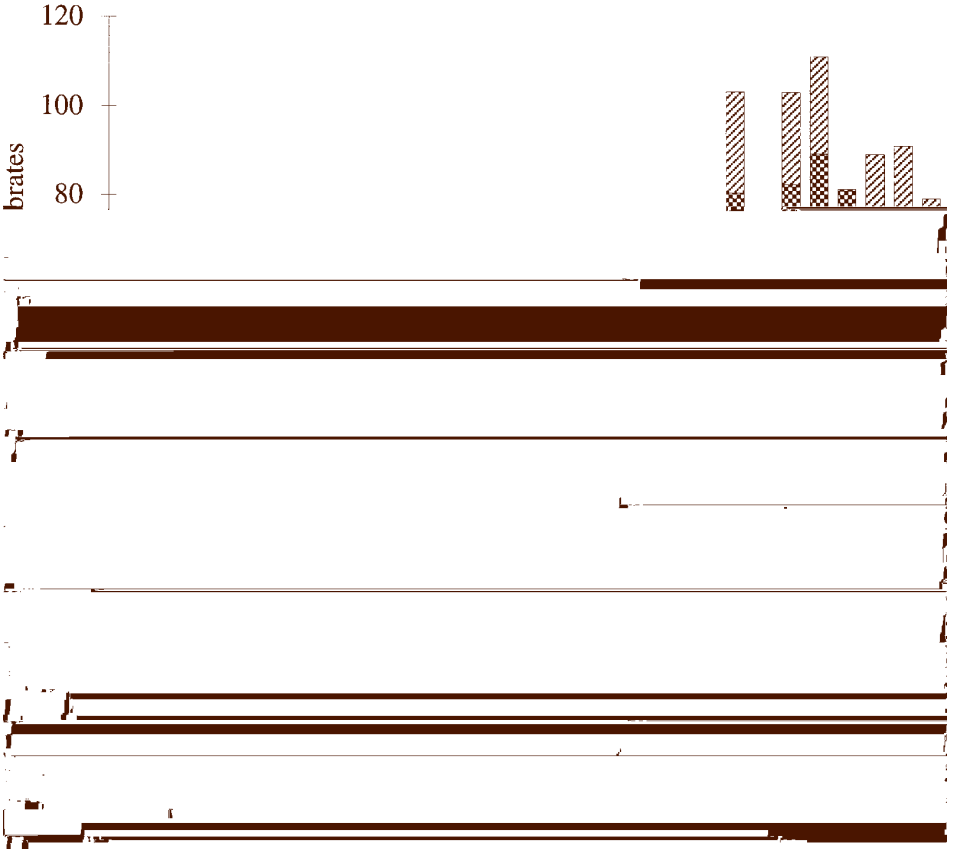
I - a a - -

The use of individual cavities did not appear to be random. On sequential observation visits, cavities that had previously been occupied by any invertebrate tended to be occupied again, often by the same taxon. Cave weta and tree weta appeared to be especially faithful and frequently same sex individuals (unmarked) were seen in the same cavity over sequential visits and through increasing size categories. Cavity-faithfulness is illustrated by data from roost #1 for thirty observation events over five years (Table 1). It is interesting to note that after initial colonisation of roost #1 by a cohort of juvenile *H. e ic i*, occupation by this species diminished two years later (the normal life expectancy of tree weta), to become the domain of cave weta.

Table 1. An example of individual cavity use by weta in artificial roost #1 at Mohi Bush in 1994-1999. Occupancy of left (L) or right (R) cavity of thirteen pairs of separate cavities numbered from the top down, by: *H. trewicki* – 1; two unidentified tree weta – T; cave weta – 3; *H. trewicki* and cave weta – 1'; two cave weta – 3'.

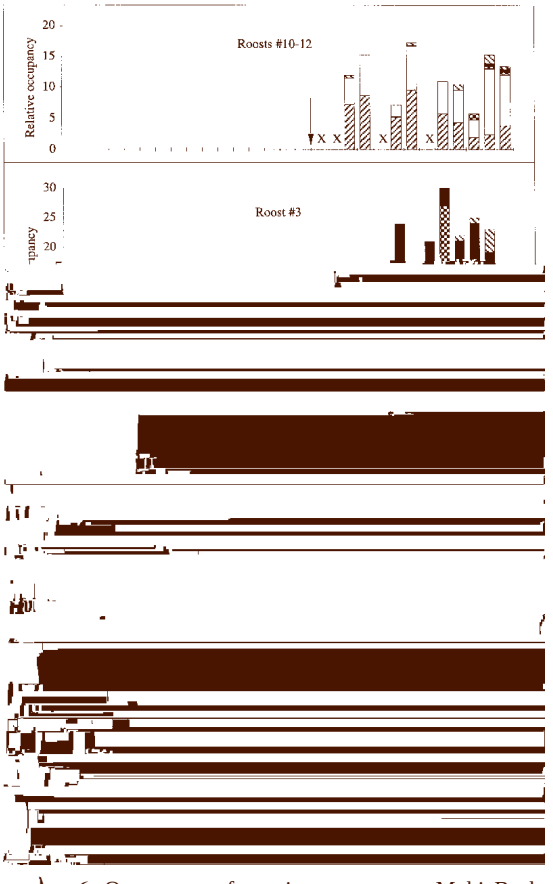
Discussion

The location of the roosts appeared to influence the number of animals that used it. Whether this resulted from environmental heterogeneity or underlying patchiness arising through chance cannot be determined from these data. However, three empty roosts (#2, #4 and #6) which had initially been placed in comparatively dark and cool parts of the bush (>100 m from the edge) where low-level foliage was sparse remained almost unused by any invertebrate for one year. After relocation to bush-edge positions occupancy rates increased within a month. The patchiness of distributions is also evident



4. Variation in the number of invertebrates using six artificial roosts at Mohi Bush from 1994-1999. Values are total observed numbers on each visit.

5. Spatial variation in relative roost occupancy levels among invertebrate groups in six artificial roosts at Mohi Bush (1994-1999).



6. Occupancy of proximate roosts at Mohi Bush (1994-1999). Data from primary roosts #1 and #3 (positioned in 1994) are accompanied by data from secondary roosts #7-9 and #10-12 placed within 15 m of these respectively (arrows indicate installation date). Invertebrate numbers in secondary roost cavities are pooled and adjusted to be equivalent to the 26 holes available in primary roosts. X's indicate no data collected.

estimations of population density and aspects of behaviour such as hole-faithfulness.

The roosts appear to be appropriate devices for monitoring weta and other invertebrate populations through time but 1. may require a long time from establishment before occupancy is sufficient to provide useful information, 2. probably monitor a very small area, 3. cannot easily be compared between sites. Therefore weta roosts once established should not be moved if possible, and analyses should be focused on temporal rather than spatial changes. This requires the deployment of the roosts some years prior to implementation of new management procedures. We suggest that attachment of artificial roosts to trees already inhabited by tree weta may result in more rapid occupation than artificial roosts placed even a matter of metres away from existing habitat. Therefore, for studies that are directed primarily at monitoring changes in weta numbers over time it may be more effective to use large numbers of single or few-hole roosts placed directly on trees at high density and with site replication. Simple roosts of this type can be examined without opening using a torch so that rapid censuses can be made at appropriate intervals.

Acknowledgements

Many thanks to Alan Lee and others at Hawke's Bay Department of Conservation for assistance with the construction, deployment and monitoring of roosts at Mohi Bush. The Karori Reserve Trust provided access to Karori Reserve. George Gibbs, Ralph and Mary Powlesland, Judith and Llyn Richards installed and monitored roosts on their own property. This programme was assisted by grants from the New Zealand Entomological Society 21st Anniversary Trust and the Royal Forest and Bird Protection Society James Sharon Watson Conservation Trust.

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