A survey of invertebrates in scrublands and forest, Hawke's Bay, New Zealand

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ABSTRACT

Species diversity and the abundance of invertebrates were studied in winter and summer at 4 sites in Hawke's Bay. More invertebrates were caught in summer than in winter. Invertebrate diversity and abundance were significantly greater at the botanically most diverse site than at the less diverse ones. The abundance of invertebrates varied amongst the study sites and seasonally within them.

Keywords: Invertebrate survey, scrubland, native forest, Hawke's Bay.

INTRODUCTION

Species diversity and abundance of invertebrates were studied at 4 sites (Fig. 1) in winter (July, August) 1983 and summer (January, February) 1984.

The study was timed to include the 2 seasonal climatic extremes that affect invertebrate distribution and abundance (Moeed 1976, 1980; Moeed & Meads 1983, 1984, 1985, 1986, 1987a, 1987b, 1987c).

STUDY AREA

The 4 study sites were in mixed native forest at Blowhard Bush, in kanuka/manuka (*Leptospermum* spp.) scrub at Omahake Stream and at Twin Lakes (ungrazed with infrequent forays by sheep at the Twin Lakes site only), and in remnant forest, heavily grazed, at Cape Kidnappers (Fig. 1). Each study site was representative of the vegetation stand as far as was practicable. The Blowhard Bush, Omahake Stream, and Twin Lakes sites were at about 700 m a.s.l., and the Cape Kidnappers site at about 150 m a.s.l.

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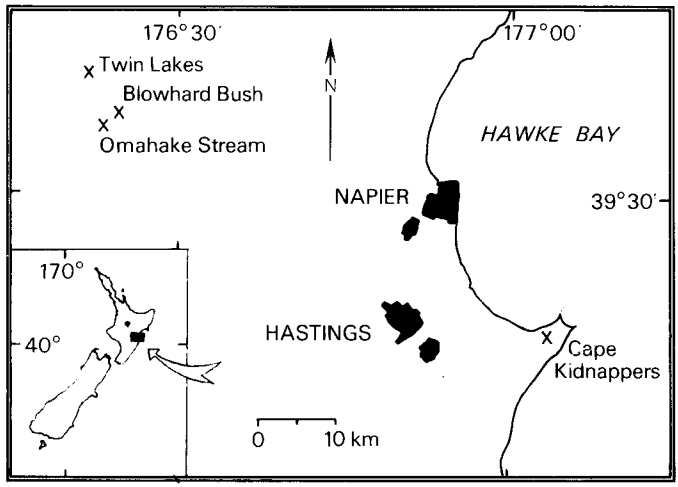

Fig. 1: The location of study sites in Hawkes Bay.

The vegetation of the study sites comprised rimu (*Dacrydium cupressinum*), putaputaweta (*Carpodetus serratus*), mahoe (*Melicytus ramiflorus*), *Hoheria* sp., puka (*Griselinia lucida*), kawakawa (*Macropiper excelsum*), kotukutuku (*Fuchsia excorticata*), kohuhu (*Pittosporum tenuifolium*), black maire (*Nestegis cunninghamii*), rangiora (*Brachyglottis repanda*), miro (*Prumnopitys ferruginea*), *Coprosma* sp., rata vine (*Metrosideros* sp.), and ferns at Blowhard Bush; kanuka (*Leptospermum ericoides*), fivefinger (*Pseudopanax arboreus*), mingimingi (*Cyathodes juniperina*), *Gaultheria antipoda, Olearia furfuracea, Collospermum* sp., *Gahnia* sp., flax (*Phormium tenax*), makomako (*Aristotelia serrata*), ferns, grasses, and mosses at Omahake Stream; manuka (*Leptospermum scoparium*), *Gaultheria antipoda*, tauhinu (*Cassinia leptophylla*), *Olearia furfuracea*, mingimingi, bush lawyer (*Rubus* sp.), ferns, grasses, and mosses at Twin Lakes; and rewarewa (*Knightia excelsa*), kanuka, mahoe, ongaonga (*Urtica ferox*), kaiwhiria (*Parsonsia heterophylla*), ferns, grasses, and clover at Cape Kidnappers.

The topsoil at the Blowhard, Omahake, and Twin Lakes sites consisted of volcanic ash, with leaf-litter and humus layers 80-100 mm thick at Blowhard and 20-40 mm at Omahake and Twin Lakes. The topsoil at Cape Kidnappers consisted of alluvial sandy loam with a 20-40 mm cover of leaf-litter and humus.

METHODS

To obtain an index of invertebrates in the 4 study sites, various sampling techniques were used, because there is no single method that catches all types of invertebrates.

Ten pitfall traps (Moeed & Meads 1985) were left set for a month, in summer and winter, at each site to collect surface-dwelling invertebrates. Similarly, 4 emergence traps (Moeed & Meads 1987c) were left set for a month at each site to collect emerging insects. Galt's solution (Barber 1930) was used as preservative in both the pitfall and emergence traps. Invertebrates were collected once in summer and once in winter, by hand, at night for about an hour soon after dark, at each site.

Leaf litter was collected once in summer and once in winter from five 200 × 200 mm quadrats at each study site. Samples were brought to the laboratory in cloth bags and put through Tullgren extractors (Moeed & Meads 1986) to collect litter-inhabiting invertebrates. Five 200 × 200 mm quadrats of soil, approximately 150 mm deep, were examined on site, and visible invertebrates were collected.

Differences between sites and between seasons in the catches of invertebrates were analysed using a chi-squared test. All these differences are highly significant ($P < 0.05$).

RESULTS

Pitfall traps

Of the wetas (Orthoptera), beetles and weevils (Coleoptera), wasps and ants (Hymenoptera), larvae (Coleoptera, Diptera, and Hymenoptera combined), and spiders (Araneida) (Fig. 2A), wetas (Stenopelmatidae and Rhaphidophoridae) were caught in winter only at the Omahake and Twin Lakes sites, but at all 4 sites in summer. Their numbers at Omahake were higher than at other sites ($P<0.001$). At Omahake, more wetas were caught in summer than in winter ($P<0.001$).

The numbers of beetles and weevils were not significantly different amongst the 4 sites in winter. However, more were caught in summer at Blowhard ($P<0.001$) and fewest at Cape Kidnappers. Summer catches were higher than winter catches at all 4 sites ($P<0.001$).

All 4 sites were about equal in the numbers of wasps and ants combined caught, both in winter and in summer, and more were caught in summer than in winter ($P<0.005$).

More larvae were caught at Blowhard in both winter and summer ($P<0.001$) and fewest at Twin Lakes in winter and at Cape Kidnappers in summer.

Summer catches of larvae were higher than winter catches at Blowhard, Omahake, and Twin Lakes ($P<0.025$). Although slightly more larvae were caught at Cape Kidnappers in winter than in summer, the difference was not significant statistically.

More spiders were caught in winter at Twin Lakes and Cape Kidnappers than at the other 2 sites ($P<0.001$). This trend was reversed in summer when more spiders were caught at Blowhard and Omahake than at the other 2 sites ($P<0.05$).

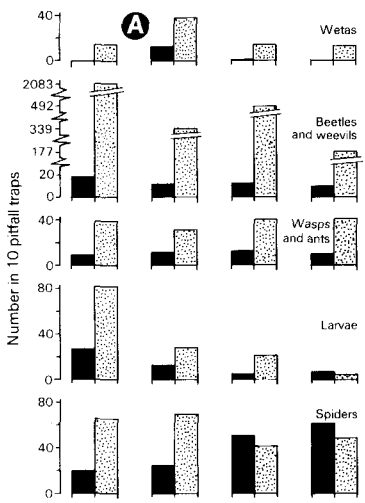

Fig. 2(A): Number of invertebrates pitfall-trapped. Solid histogram, winter; shaded histogram, summer. Localities as in 2(B).

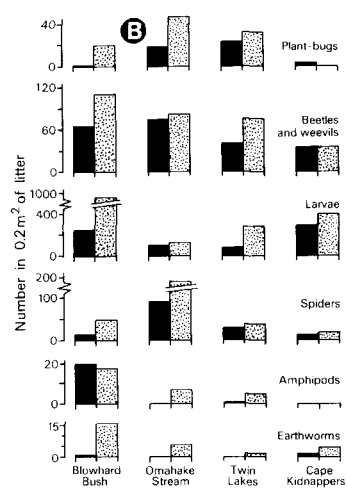

Fig. 2(B): Number of invertebrates extracted from litter. Solid histogram, winter; shaded histogram, summer.

Litter samples

Plant-bugs (Hemiptera), beetles and weevils, larvae, spiders, amphipods (Amphipoda), and earthworms (Terricolae) were extracted from litter (Fig. 2B). In winter most plant-bugs were caught at Omahake and Twin Lakes, and only 1 and 3 specimens at Blowhard and Cape Kidnappers, respectively. In summer, no plant-bugs were caught at Cape Kidnappers, whereas the numbers caught at Omahake were higher than at Blowhard and Twin Lakes ($P<0.005$). Seasonal differences showed significantly higher totals in summer at Omahake only ($P<0.001$).

In winter, catches of beetles and weevils were higher at Omahake than at other sites ($P<0.005$), and summer catches at Blowhard were higher than at other sites ($P<0.001$). Seasonal differences were significant at Blowhard only, where summer catches were higher than winter catches ($P<0.001$).