The ecology and conservation of *Latrodectus katipo*, New Zealand's endangered widow spider

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Abstract

New Zealand has two endemic widow spider species; *Latrodectus katipo* Powell, 1871 and *L. atritus* Urquhart 1890. This study focused on the population dynamics and habitat usage of *L. katipo*, which has undergone serious decline in its abundance and range over the last thirty years.

Previous population studies have not included male or juvenile katipo because of their smaller size. A survey of katipo populations was conducted along the Manawatu coastline. There was considerable variation in population density and structure between sites. The highest katipo population density of 21.8 per hectare was recorded at Koitiata. Koitiata, Himatangi, Foxton and Tangimoana populations had a large proportion of juveniles. At Wanganui South and Castlecliff beaches no juveniles could be found, suggesting that reproductive output is very low and that these sites may require conservation attention.

Accurate monitoring is critical to the management of any endangered species, however katipo are not monitored regularly in most areas as current population monitoring methods (transect or quadrat searches) are time and labour-intensive, and require highly-trained observers. I investigated the use of artificial cover objects (ACOs) which have a number of advantages over current monitoring methods; in particular they can be quickly and easily checked by observers. Katipo populations at three sites at Himatangi Beach were monitored between January and July, 2005. More traditional habitat searches were completed concurrently to provide population density estimates. The occupancy rate of the ACOs was strongly correlated with population density, and ACOs are therefore proposed as a reliable alternative monitoring method for katipo. The habitat searches showed that katipo have a longer breeding season at Himatangi than reported in South Island based studies, with males and newly hatched juveniles being found in the field up until about June, as opposed to just during summer months. The katipo population density was relatively constant between January and July, 2005, compared to that of *Steatoda capensis*, an introduced South African spider.

Choice experiments were conducted to investigate whether katipo have preference for certain plant species or driftwood as web sites. Native sand-binding shrubs such as *Coprosma acerosa* are favoured by katipo over other plant species

for web construction, and the exotic grass *Ammophila arenaria* is avoided by katipo even when growing at low densities.

L. katipo spiderlings were raised in the laboratory to observe their development. Katipo eggsacs typically produce about 80 spiderlings, however eggsacs I studied contained between 40 and 146 spiderlings. There is substantial variation in the growth rates and abdominal markings of katipo spiderlings during development. Manawatu katipo are unique in that they often retain large areas of white abdominal markings at maturity.

Thesis format and authorship

Each chapter is written as a stand-alone paper. Consequently there is some repetition of material, with references placed at the end of each chapter. I am the principal author of each chapter, with my supervisors Russell Death and Murray Potter providing editing advice.

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General Introduction

The genus *Latrodectus* has a worldwide distribution with 31 species currently recognised (Platnick 2006). New Zealand has two *Latrodectus* species; *L. katipo* and *L. atritus*. The taxonomic status of these two species is currently under review as genetic analysis suggests they are separate phenotypes of the same species (Griffiths *et al.* 2005). *L. katipo* and *L. atritus* are found solely within coastal sand dunes, with their webs constructed in the bases of vegetation, or under driftwood and other debris. *L. katipo* is found in the South Island and lower North Island, whereas *L. atritus* is limited to the northern half of the North Island (Griffiths 2001).

The New Zealand and Australian *Latrodectus* fauna are closely related (Griffiths *et al.* 2005), and *L. katipo* can hybridise in one direction with the Australian redback, *L. hasselti* (Kavale 1986). However, *L. katipo* and *L. hasselti* are highly distinct in terms of morphology, habitat requirements, reproductive behaviour and development, hence their separate species status. *L. hasselti* is not currently established in New Zealand (J. Derraik, Biosecurity NZ, pers. comm.), though it has been in the past, and presents a threat to *L. katipo* through genetic swamping (Garb *et al.* 2004).

L. katipo is an endangered species, having undergone serious population decline and range reduction over the last thirty years; this decline has been attributed largely to habitat loss and degradation (Patrick 2002). An introduced spider, *Steatoda capensis*, which is established throughout New Zealand and has become very abundant in some coastal dune areas, may also have contributed to the decline of katipo (Hann 1990). Patrick (2002) identified 19 key katipo conservation areas, one of which was Himatangi Beach, Manawatu. He also recommended regular monitoring to track katipo populations nationwide, as this will be critical for the conservation of this species. Few of the key conservation sites identified by Patrick have received additional attention since his report. The current status of many katipo populations is unknown, as regular population monitoring is only occurring at a few sites nationwide, for example at Karitane Spit, Otago. The main reason for the lack of monitoring is that current population monitoring methods include transect and quadrat searches, which are time and labour-intensive, and require experienced observers due to the cryptic nature of katipo webs. There is a need for a monitoring method that can be applied nationwide, that is easily and quickly performed. The use of artificial cover objects (ACOs) is a potential solution. ACOs are already used to monitor weta populations in New Zealand, and amphibian populations overseas. They are standardised and replicable, and can be easily checked.

Much of the original coastal duneland in New Zealand has been replaced by pasture or exotic forest cover (Muckersie & Shepherd 1995), with the remaining dunes being highly modified through the planting of exotic sand-binding plants, grazing by introduced mammals, burning and collection of driftwood, rubbish dumping, and the use of four-wheel drive vehicles (Hilton *et al.* 2000). Understanding how katipo populations are affected by habitat alteration will be crucial to their management so that the restoration of appropriate habitat can occur. Griffiths (2001) studied habitat usage by *L. katipo* and found that they show preferences for warmer sites with non-southerly aspects, low slopes and low to medium vegetation cover. *L. katipo* occupy sand-binding shrubs more than predicted from their abundance, and the introduced grass *Ammophila arenaria* (marram) less than expected (Griffiths 2001). Dense marram is said to exclude katipo as it is unsuitable for web construction (Patrick 2002). It is not known whether katipo prefer certain plant species or driftwood as web sites, when other variables such as microclimate and prey abundance are held constant.

Many population surveys of katipo have not included male or juvenile katipo because of their small size, and less obvious webbing. The structure and seasonal dynamics of katipo populations are thus poorly known, with most observations gleaned from South Island populations. North Island katipo populations may have markedly different population dynamics due to climatic and habitat differences. By investigating population structure we can assess population viability, and therefore identify areas where katipo require more conservation attention.

Previous studies have highlighted the need for an effective monitoring program, a better understanding of how katipo utilise their environment, and an understanding of katipo population dynamics. A thorough understanding of the ecology of katipo spiders will be critical to their conservation. The specific objectives of this study were:

- To investigate whether ACOs are suitable as a reliable alternative monitoring method for katipo, that can be applied in areas where time and labour-constraints are preventing monitoring.
- To compare the population structure and dynamics of Manawatu katipo populations to the existing katipo literature, which is largely based on South Island populations.
- To investigate whether katipo prefer certain plant species or driftwood as web sites when factors such as plant density, microclimatic conditions and prey abundance, are held constant.
- To become familiar with katipo at various developmental stages by rearing them in the laboratory, to assist field-based investigations of population structure.

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