

TABLE 2. CANTERBURY CONSERVANCY RED KATIPO DATA FROM JAMES GRIFFITHS 1998-1999.

STUDY SITE	ASPECT	SLOPE(°)	HABITAT TYPE	VEGETATION COVER	NO. OF ADULT FEMALES
Woodend 2	West	1-10°	Marram grass	33-66%	3
Woodend 2	East	11-20°	Marram grass	33-66%	2
Woodend 1	North	20+°	Marram grass	1-33%	2
Woodend 1	North	11-20°	Marram grass	1-33%	1
Woodend 1	East	11-20°	Marram grass	1-33%	1
Woodend 1	North	11-20°	Marram grass	1-33%	1
Woodend 1	North	11-20°	Marram grass	1-33%	1
Woodend 1	East	20+°	Marram grass	1-33%	1
Woodend 1	North	11-20°	Marram grass	1-33%	1
Waikuku	East	11-20°	Marram grass	33-66%	2
Waikuku	East	11-20°	Marram grass	33-66%	1
Waikuku	North	20 +°	Marram grass	33-66%	1
Spencer B.	East	11-20°	Marram grass	33-66%	1
Spencer B.	East	20+°	Marram grass	33-66%	1
South Spit	North	20+°	Marram grass	33-66%	1
Kaitorete Spit 3	No Aspect	0°	Driftwood	1-33%	1
Kaitorete Spit 3	No Aspect	0°	Driftwood	1-33%	1
Kaitorete Spit 3	No Aspect	0°	Driftwood	1-33%	1
Kaitorete Spit 3	No Aspect	0°	Driftwood	1-33%	1
Kaitorete Spit 3	No Aspect	0°	Driftwood	33-66%	4
Kaitorete Spit 3	No Aspect	0°	Driftwood	33-66%	1
Kaitorete Spit 3	No Aspect	0°	Pingao	1-33%	2
Kaitorete Spit 3	No Aspect	0°	Pingao	1-33%	1
Kaitorete Spit 3	East	11-20°	Pingao	1-33%	1
Kaitorete Spit 3	No Aspect	0°	Pingao	1-33%	1
Kaitorete Spit 3	West	11-20°	Pingao	1-33%	1
Kaitorete Spit 2	No Aspect	0°	Driftwood	1-33%	2
Kaitorete Spit 2	No Aspect	0°	Driftwood	1-33%	2
Kaitorete Spit 2	No Aspect	0°	Driftwood	1-33%	1
Kaitorete Spit 2	No Aspect	0°	Driftwood	33-66%	3
Kaitorete Spit 2	No Aspect	0°	Driftwood	33-66%	1
Kaitorete Spit 2	No Aspect	0°	Driftwood	33-66%	1
Kaitorete Spit 2	No Aspect	0°	Pingao	33-66%	2
Kaitorete Spit 2	West	1-10°	Pingao	33-66%	1
Kaitorete Spit 1	West	1-10°	Driftwood	1-33%	3
Kaitorete Spit 1	No Aspect	0°	Driftwood	1-33%	2
Kaitorete Spit 1	No Aspect	0°	Driftwood	1-33%	1
Kaitorete Spit 1	No Aspect	0°	Driftwood	33-66%	3
Kaitorete Spit 1	No Aspect	0°	Pingao	1-33%	2
Kaitorete Spit 1	West	11-20°	Pingao	1-33%	2
Kaitorete Spit 1	No Aspect	0°	Pingao	1-33%	2
Kaitorete Spit 1	East	11-20°	Pingao	1-33%	2
Kaitorete Spit 1	East	11-20°	Pingao	1-33%	2
Kaitorete Spit 1	West	11-20°	Pingao	1-33%	1
Kairaki	North	20+°	Marram grass	1-33%	5
Kairaki	West	1-10°	Marram grass	1-33%	4
Kairaki	North	11-20°	Marram grass	1-33%	1
Kairaki	East	11-20°	Marram grass	1-33%	1
Kairaki	East	20+°	Marram grass	1-33%	1
Kaipoi	East	20+°	Marram grass	1-33%	2
Kaipoi	North	11-20°	Marram grass	1-33%	1

TABLE 2. CONTINUED

STUDY SITE	ASPECT	SLOPE (°)	HABITAT TYPE	VEGETATION COVER	NO. OF ADULT FEMALES
Brooklands Spit	North	11-20°	Marram grass	33-66%	3
Brooklands Spit	East	11-20°	Marram grass	33-66%	2
Brooklands Spit	North	11-20°	Marram grass	33-66%	2
Bottlelake Park	North	11-20°	Marram grass	1-33%	1
Bottlelake Park	North	11-20°	Marram grass	1-33%	1
Bottlelake Park	North	20+°	Marram grass	33-66%	1

3.2 KATIPO HABITAT

Katipo are strictly coastal specialists found in a variety of sand-dune systems associated with driftwood (Figs 5-7), vegetation (Fig. 4), rubbish (Fig. 8) or stones (Fig. 5). Katipo have been found associated with dunes several kilometres from the sea, where these extend inland for considerable distances (Powell 1871).

In this study, both red katipo and black katipo were generally found on the landward side of dunes closest to the coast. Here, they are sheltered from the most violent extremes of storms and sand movement. They usually inhabit the foremost dunes, which are usually foredunes or incipient foredunes (Hesp 2000). However, on eroding coasts, or on coasts where foredunes are unable to form, this habitat may be of another dune type. Where both foredunes and incipient foredunes are present, they are separated by a depression termed the swale. Red and black katipo may also inhabit this swale.

In near-natural dune systems, red katipo were found amongst a variety of plants and substrates. Low-growing native shrubs were a favourite site for their snares, as described by Ralph (1857). During the present study, red katipo and their snares were found within prostrate shrubs of *Carmichaelia appressa*, itself a local endemic species on Kaitorete Spit, and also sand coprosma (*Coprosma acerosa*), *Muehlenbeckia complexa* and sand pimelea (*Pimelea arenaria*) at other sites. They were also found within turf rush (*Isolepis nodosa*), pingao (*Desmoschoenus spiralis*) and spinifex (*Spinifex sericeus*). Katipo can be extremely difficult to locate in such natural situations, so data collection records will probably underestimate their actual abundance and extent. Driftwood is another favourite haunt of *L. katipo* in near-natural dunes, especially where it occupies blowouts caused by episodic storm events.

Where encountered during the present survey, it was found that black katipo (*L. atritus*) were similar to red katipo in their choice of snare location, also utilising low-growing shrubs, sedges and driftwood when available. They, too, were found in marram grass in more modified dune systems. Both red and black katipo were found separately and in abundance at several sites under low shrubs of sand coprosma: red katipo south of Cape Campbell, Marlborough, and black katipo at Whangamata on the Coromandel Peninsula. Peeling back the shrub from the sand revealed many snares on the underside of the twiggy, small-leaved plant.

4. Discussion

4.1 DISTRIBUTION AND HABITAT OF THE KATIPO

It is clear that *L. katipo* has suffered a dramatic reduction nationwide, in both numbers and distribution. This study showed it to be absent from 72% of the sites sampled within the previously recorded distribution of the species. Hann (1990) stated that in the period 1975–90, he and fellow observers had noticed a decline in the numbers of *L. katipo* in the lower North Island. Using Hann's data from collections, *L. katipo* may have disappeared from 54% of sites where it had been previously found.

Figure 3 shows the 90 sites sampled for *L. katipo*, whereas Table 2 lists the key sites. This shows a concentration of red katipo sites in the central region of New Zealand, especially the lower North Island. *L. katipo* is rare or extinct in the north of the North Island and sparse in the south of the South Island.

Although Griffiths found *L. katipo* at nine sites in north to mid-Canterbury, only one of these sites can be described as natural in terms of landform, vegetation and processes. The other eight sites are dominated by marram grass and pine trees and have a significant human presence. The future does not augur well for such sites and red katipo may have a precarious existence there where they are present.

4.2 THREATS TO THE KATIPO AND ITS HABITAT

The plight of *L. katipo* epitomises the predicament of much of New Zealand's sand dunes and their faunal inhabitants. Sand dunes are aeolian (wind-formed) landforms, composed of small grains of various minerals such as quartz. They are a feature of 1100 km of the New Zealand coastline (Hesp 2000), covering approximately 39 000 ha (Hilton et al. 2000). Hesp (2000) clarifies the form, function and origin of sand dunes in the New Zealand context. In doing so, he has also described sand-dune dynamics and clarified terminology. Sand dunes are extremely dynamic ecosystems with little or no organic matter. They are extreme environments where the inhabitants have to combat incessant winds and drifting sand, together with extremes of dryness and temperature. Red katipo survive in dunes by placing their snares off the sand substrate and hidden amongst dense vegetation or dead driftwood.

Nationwide, New Zealand's coastal sand dunes are under tremendous pressure from forestry, farming and recreation (Hilton et al. 2000). This pressure follows over a century of dramatic change to the form, composition and extent of New Zealand's sand dunes following European settlement. Hilton et al. calculated that the area of coastal sand dunes has declined from 129 000 ha in 1900 by 70% to 38 700 ha. Regions such as Northland, Auckland and the Manawatu, which had the largest areas of active sand dunes, have also experienced the largest decline. Large-scale modification of the dunes began with European farming practices of fire and grazing. These activities led to widespread destabilisation

by the early twentieth century, which culminated in influential reports by Leonard Cockayne to the New Zealand government (Cockayne 1909, 1911). It is sadly ironic that it was Cockayne, one of New Zealand's foremost ecologists and botanists, who advised on the planting of the exotic species marram grass (*Ammophila arenaria*) and tree lupin (*Lupinus arboreus*), and also afforestation (mainly with Monterey pine, *Pinus radiata*) on New Zealand's dunes. While this dune stabilisation programme was extremely successful, it resulted in the loss of huge areas of natural sand-dune country (Hilton et al. 2000).

What remains of New Zealand's dune systems today are but vestiges of the original ones, with very little that can still be described as being in an original, unmodified state. Although it is understandable that sand dunes close to population and recreation centres are more modified than those in more remote areas, it is surprising that the dunes of the less populated South Island are considerably more modified than those of the North Island (Johnson 1992; Partridge 1992). The two islands last had a similar human population around 1900, suggesting that these changes to dune habitat occurred soon after European settlement commenced. An alternative explanation is that marram grass is better adapted to the cooler southern areas of New Zealand and exerts more pressure on the native flora in the south.

Given the scarcity of near-natural dunes remaining in New Zealand, it is indeed fortunate that red katipo can survive in semi-natural to highly modified dune systems. They opportunistically utilise a range of exotic vegetation such as marram grass, and also human rubbish, including a range of metal items (Forster & Forster 1973). Although sparse marram can provide a habitat for katipo, dense marram is associated with their absence (see also Smith 1971). Hence, owing to the almost ubiquitous presence of marram and its ability to change drastically the form and composition of New Zealand dunes, katipo are threatened with extinction in highly modified systems. Katipo also utilise driftwood and stones in modified dunes, but the former is commonly collected for firewood by people living or recreating nearby, and may be scarce as a result.

L. katipo has only one known direct predator. A tiny and undescribed species of native wasp in the family *Ichneumonidae* has been observed feeding on the egg masses of red katipo (A.C. Harris pers. comm.). The wasp also has larvae feeding on orbweb spider egg masses. It has been suggested that red katipo can be displaced by the South African spider *Steatoda capensis*. *L. katipo* and *S. capensis* were found together in the same dune systems and even co-existing under the same piece of driftwood during the present survey (Fig. 6). While this is not proof that the introduced *S. capensis* does not displace katipo, it may suggest that the two species can co-exist in stable ecosystems. Hann (1990) found that the apparent displacement of *L. katipo* by *S. capensis* was due to replacement once the former had disappeared owing to other factors such as storm damage. He suggested that *S. capensis* might react more quickly to changes to its habitat and colonise sites from which *L. katipo* had been displaced, because it breeds year-round, produces more offspring and lives in a greater range of habitats. He found no evidence that *L. katipo* is inferior to *S. capensis* in predation experiments.

The reality for *L. katipo*, then, is that its specialist habitat has been increasingly degraded or eliminated since European settlement (Fig. 9), first by introduced animal grazing and associated disturbance, and then by fires, reclamation, weed invasion and mining. Many sand-dune systems are naturally highly dynamic, but European settlement further destabilised dune systems nationwide. Marram grass and tree lupin continue to spread over New Zealand's dunes, although the latter suffers from a root fungus that regularly impacts on its population levels. In contrast, marram grass is not only still spreading, but also increasing in terms of abundance and biomass (Walls 1998). In greatly modified habitat, most often dominated by marram, red katipo populations are eliminated once marram thickens to a point where it may no longer provide a suitable habitat for web construction and/or protection from predators. Spiders can only survive in these highly modified dunes while storm events or other processes temporarily keep the marram or lupin at bay, or the vegetation cover sparse (Fig. 7). No katipo were found in areas where marram cover exceeded 66%, even though such areas are commonly encountered (Table 2). As habitat suitable for *L. katipo* is lost, while at the same time becoming more fragmented, the prospects for the katipo's continued existence diminish. Under these circumstances, young red katipo spiderlings dispersing by ballooning (L. Forster pers. comm. 1998) are less likely to land in suitable habitat elsewhere. Additionally, seemingly innocuous activities such as the collection of driftwood have an impact on red katipo, since this is a favourite site for their snares.

Several times during this survey, I witnessed dune buggies being driven over dune systems of reasonably high conservation value in the Waikato and Manawatu, and driftwood being collected from dunes of the Coromandel. It is telling that at only one site did I find *L. katipo* co-existing with humans—interestingly, a site with a relatively low human population, namely Karamea Beach. Here, katipo were found under driftwood and in vegetation just a few metres from sunbathers.

Figure 9. Squeezed between the ocean and human settlement, a typical New Zealand sand-dune system at New Brighton, Christchurch. Marram-covered dunes are criss-crossed by recreational tracks and backed by housing and roads.



L. katipo needs not only greater statutory protection of its habitat, but also additional physical protection from weeds and disturbance from introduced animals and humans.

4.3 DECLINE OF OTHER SAND-DUNE BIOTA

The decline of katipo is mirrored by that of many other coastal specialist species. These include plants such as sand pimelea (*Pimelea arenaria*), sand tussock (*Austrofestuca littoralis*), New Zealand sea spurge (*Euphorbia glauca*), sand gunnera (*Gunnera hamiltonii*) and pingao (*Desmoschoenus spiralis*) (Dopson et al. 1999), and also insects such as the moths *Ericodesma aerodana*, *Kupea electilis*, *Kiwaia jeanae* (Patrick & Dugdale 1999) and at least another 12 moths in the genus *Notoreas* (Patrick 1998). In a recent list of New Zealand's threatened vascular plants, Dopson et al. (1999) noted that 16 category A and B species live primarily in dunes and coastal herbfields. This equates to 10.4% of the total category A and B species.

4.4 LIMITATIONS OF THE PRESENT STUDY

Ironically, it is much easier to search for katipo in highly modified dune systems than in semi-natural or complex natural systems. Highly modified dune systems often consist of marram grass, tree lupin and little else, which makes searching for katipo very easy. In contrast, more complex natural dunes have a variety of habitats within the dune system. These typically include an abundance of driftwood, dense native woody vegetation and tangled native grasses and sedges. This mix of cover makes it much more difficult to find katipo, and hence ascertain with confidence their true numbers or possible absence.

As a result, this survey is likely to have underestimated both the presence and relative numbers of katipo at sites that are either semi-natural or near-natural. Sand dunes that fit this description are mostly found in the North Island, in the Northland, Wairarapa, Wellington, Manawatu and Hawke's Bay regions.

Both the Bay of Plenty and East Cape, North Island regions were under-surveyed in this study compared with other regions. Consequently, any conclusions regarding the status of *L. katipo* in these two regions are incomplete.

Katipo numbers at any site appear to vary considerably from season to season (L. Forster, pers. comm.; G. Foster, pers. comm.), making it difficult to make comparative studies between sites within a three-year study. For instance, immediately before my visit to Flat Point, Wairarapa, Garry Foster and colleagues had recorded 33 red katipo in 30 min, whereas when I returned with him only seven were found at the exact same site over the same length of time. Long-term studies, conducted over a reasonable number of sites using robust scientific criteria, will be required to obtain informative numerical data.

4.5 KEY SITES FOR KATIPO

On the basis of the number of individuals found within the 30-min survey time, the overall naturalness of the site(s) within the dune system, its robustness (size and potential to buffer from external changes) and geographical coverage (a spread of sites nationwide to capture variation in the red katipo population), I propose 19 key sites for *L. katipo* (Table 1). These are listed for each DOC conservancy where red katipo were found (Fig. 3) and include two sites identified by James Griffiths. There will be other sites that should be added to this list, so it should be considered indicative rather than exhaustive.

Both Partridge (1992) and Johnson (1992) also listed key sites for sand-dune systems in New Zealand, based primarily on botanical values. Criteria that they both used were native plant diversity and coverage, degree of invasion of weeds, degree of human or animal interference and diversity of landform and dune communities. However, it is hard to reconcile their key sites with known occurrences of rare plant and insect species, including *L. katipo*. Many semi-natural sites that score low on botanical criteria support rare and endangered species of insects, spiders and plants, which should automatically make them key sites for conservation. This is underlined by the fact that DOC is monitoring rare plants, including sand pimelea, at several of these sites. While some key sites such as Kaitorete Spit, Canterbury, are listed unanimously by a range of authors assessing different groups (Johnson 1992; Patrick 1994), others such as Karitane Spit, Otago, have few other values apart from the presence of *L. katipo*, there at its present southern limit.

What is urgently needed is an integrated nationwide assessment of sand-dune systems that takes account of all the above factors for all native biota and landform types. Only then can statutory authorities such as DOC commit the necessary resources to the task of fully protecting and rehabilitating representative samples of coastal sand-dune ecosystems nationwide.

4.6 WHY IS THE KATIPO IMPORTANT?

Both the red katipo and the black katipo are endemic New Zealand spiders that belong to a genus (*Latrodectus*) with a worldwide distribution. Using the criteria of Molloy & Davis (1992), the fact that this genus contains many species and has a widespread distribution, lowers its score—and hence its conservation status. I believe the opposite should be true. Genera with a wide distribution and generally allopatric speciation are extremely informative in terms of biogeographical patterns and relationships. The presence in New Zealand of two species of the worldwide genus *Latrodectus* is arguably more informative than if they belonged to an endemic genus.

Whether admired or feared, katipo add colour or interest to New Zealand's fauna and the coastal ecosystems that support them. *L. katipo* is symbolic of the state of New Zealand's coastal environments. Its habitat has been lost, grossly modified or otherwise impacted on, and its distribution has become highly fragmented. Very little of New Zealand's sandy coastline has remained untouched by humans and their activities, while much of the least modified area is well outside the distribution of red katipo, e.g. Fiordland, Stewart Island.

The red katipo is an invertebrate icon in New Zealand, appearing on t-shirts, websites, email addresses, stamps and telephone cards in recent years. Katipo was known to Maori and a chant is recorded that would have been used to cure someone who had been bitten (Smith 1997). It can be viewed as a symbol of invertebrate conservation in New Zealand, small and easily overlooked amongst a multitude of other conservation priorities.

4.7 HOPE FOR THE FUTURE

Despite the dramatic decline of *L. katipo* that has occurred, there is still hope for the species. Firstly, owing to New Zealand's extensive coastline, abundance of dune systems and relative remoteness of some of these, there are still habitats that remain largely unmodified, are relatively undisturbed by humans and have high numbers of katipo, e.g. Cape Campbell, Marlborough. Secondly, I am amazed at the number of coastal dune revegetation projects that are currently happening nationwide (Figs 10 and 11). Most of these projects have been instigated and are run by local groups concerned at the demise of local dunes and their plant life. Information panels adorn many such sand-dune areas nationwide, advertising the objectives of the group. It is unlikely that these groups would normally consider *L. katipo* for re-introduction to these sites once the flora has been restored. Nevertheless, they present a challenge and opportunity for red katipo advocates to raise the possibility of katipo re-introductions into these restored dune systems. Thirdly, increasing scientific attention is being given to New Zealand's fragile coastal dunes and their inhabitants. The following is an annotated list of key papers on the subject.

Ward (1998) highlighted the plight of *L. katipo* in the Manawatu dunes and made recommendations on the long-term monitoring of key populations. Meanwhile, Walls (1998) gave an excellent description of the Ocean Beach dunes, Hawke's Bay. Amongst the many recommendations that he made were legal protection of the dunes, exclusion of domestic and introduced mammals, public education and monitoring of flora and fauna. Hilton et al. (2000) graphically documented the decline of New Zealand's active coastal dunes over the last century and warned that opportunities for conserving what remains may be limited to just the next ten years. A series of at least four excellent reports produced, surprisingly, by the Forest Research Institute under the banner of the Coastal Dune Vegetation Network have spotlighted the dynamics and terminology of dune systems, and provided guidelines for the re-establishment of pingao, spinifex and sand tussock (Bergin 2000; Hesp 2000). Additionally, Bergin & Kimberley (1999) provide concise instructions for coastal rehabilitation in New Zealand using native sand-binding species. Hence, the current attitude to dune systems differs dramatically from that of Cockayne (1909), nearly 100 years ago.

Figure 10. Coastal dunes are being increasingly maintained by a variety of groups for a variety of reasons including public access, use and stability of the dunes.

While this potentially augurs well for the future, an understanding of sand-dune dynamics is essential if a full range of biota is to survive. Pictured is Porangahau, Hawke's Bay, which has a population of *L. katipo*.



Figure 11. Impressive plantings of rare sand-dune flora at Waimairi, Christchurch features New Zealand sea spurge (*Euphorbia glauca*) amongst a wide variety of species. In areas with high public use, this is probably the best strategy for reintroducing native sand-dune flora as part of an advocacy programme. More remote sites that have been rehabilitated can be fenced and monitored without public disturbance.



4.8 CONSERVATION STATUS OF THE KATIPO

Molloy & Davis (1992) assessed the conservation status of many New Zealand invertebrates that various experts considered to be threatened with extinction. This assessment was updated by Tisdall et al. (1994). Neither report listed the katipo as a threatened species under any category. Ward (1998) used these criteria to assess the conservation status of *L. katipo* and found that it qualified as a 'category A threatened species', the highest threatened status.

According to the criteria of Tisdall et al. (1994), I propose that *L. katipo* be classified as a **Category B threatened species** with a score of 44 (mid-range). This makes it a second-priority threatened species in accordance with that classification. I find that black katipo (*L. atritus*), too, is a Category B threatened species. The following list gives the scores that I determined under each criterion:

Distinctiveness	2
Status	14
Threats	12
Vulnerability	10
Values	6
Total	44

4.9 CONSERVING THE KATIPO NATIONWIDE

The author recommends:

- Conducting regional surveys of both *L. katipo* and *L. atritus* to confirm, expand on and follow up the findings of this broad survey of presence and abundance.
- Conducting regional monitoring of key populations of *L. katipo* using Table 1 as a starting point. It is important that a standardised survey method be used in order that different regions and their respective dune flora, fauna and morphology be compared with confidence.
- Securing legal protection of significant dune systems nationwide, both those with confirmed presence of *L. katipo* (Table 1), *L. atritus* (J. Griffiths, unpubl. data), and those described by Partridge (1992) and Johnson (1992). In this way, we will be providing for translocation options for katipo in the future.
- Integrating botanical, faunal and geomorphological information to produce a prioritised list of New Zealand coastal sand-dune systems for conservation action.
- Conducting Protected Natural Area Programme (PNAP) surveys of coastal dune systems nationwide, with an emphasis on a landscape approach to identification and protection recommendations (Park 2000).
- Encouraging relevant local authority, government agency and conservation groups physically to protect key sites for *L. katipo*, where real threats to its long-term survival are identified, i.e. fencing to keep out vehicular traffic from dunes.
- Conducting investigation into the survival of *L. katipo* in marram-dominated dune systems, in order to determine the density of marram at which *L. katipo* disappears. This is particularly important in the South Island coastal dunes where marram grass is more prevalent.

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Appendix 1

KATIPO SPIDER SURVEY RESULTS

MONTH	LOCALITY	DOC CONSERVANCY	TOTAL SPIDERS	HABITAT DESCRIPTION	OBSERVER/ OTHER
Nov	Ocean Beach near Whangarei	Northland	0	<i>Spinifex</i> with cottontail and <i>Lotus</i> , <i>Calystegia</i> and <i>Hypochoeris</i> ground cover on rear of foredune	R.C. Crow
Nov	Kaikai Beach at end of Waimamaku Rd	Northland	0	<i>Spinifex/Juncus</i> /cottontail grass with ground-cover of <i>Calystegia</i> and <i>Lotus</i> —on front, top and back of dune, with scattered driftwood	R.C. Crow 12 females, all <i>Steatoda</i>
Nov	Mitimiti	Northland	0	Degraded dunes with cattle and horses on them. Scattered clumps of <i>Spinifex</i>	R.C. Crow
Jan	Baylys Beach to Kaipara Head north	Northland	0	Long beach backed by cliffs, then extensive dunes towards Kaipara Heads. Dune lakes, steep dunes and shrubland	B. & H. Patrick
Jan	Woolleys Beach	Northland	0	<i>Spinifex</i> dominate dunes, giant cacti? <i>Muehlenbeckia complexa</i> . Modified dunes	B. Patrick
Jan	Muriwai	Auckland	0	Modified dune—high impact from humans	B. Patrick
Jan	Piha Beach	Auckland	0	Narrow margin of dunes near Lion Rock Marram and lupin	B. & H. Patrick
Jan	Kariotahi Beach	Auckland	0	<i>Spinifex</i> dunes, natural area, plus native shrubs and bare sandstone	B. Patrick
Nov	Kariotahi Beach	Auckland	0	Scattered <i>Spinifex</i> clumps on back of foredune at base of Pliocene sandstone cliffs Introduced Compositae and <i>Lotus</i>	R.C. Crow
July	Karekare	Auckland	0	Modified dunes	B. Patrick
Aug	Whatipu	Auckland	0	Complex system—highly modified. Much exotic grass/herbs and <i>M. complexa</i> in back areas. <i>Spinifex</i> , gorse, marram in front areas and wetlands	B. Patrick and G. Hall/R. Hoare
Nov	Pakiri Beach	Auckland	0	<i>Pingao</i> and <i>Spinifex</i> (scattered) on foredune, with <i>C. soldonella</i> groundcover. Some of the <i>Spinifex</i> clumps had <i>Muehlenbeckia complexa</i> plants among them	R.C. Crow
Jan	Waikaretu Stream	Waikato	0	Low dune of <i>Spinifex</i> with dune hollow containing tall <i>Lepidosperma australe</i> . Female <i>L. atritus</i> in <i>Spinifex</i> and <i>Lepidosperma australe</i>	B. & H. Patrick 2 female <i>L. atritus</i> seen
Jan	Waikawau Beach	Waikato	0	Cliff site, shrubs and sedges	B. Patrick
Jan	Awakino	Waikato	0	Modified dunes, lupin and weeds	B. Patrick
Jan	Awakino Seaview	Waikato	0	Marram grass, <i>M. complexa</i> and grasses Much driftwood	<i>L. atritus</i> under driftwood
Jan	Taharoa	Waikato	0	Large area of dunes, <i>Spinifex</i> and volcanic rocks <i>Pseudognaphalium</i> , <i>Lepidosperma</i> and <i>Disphyma</i>	B. Patrick
Jan	Ruapuke Beach	Waikato	0	Marram grass, <i>M. complexa</i> and grasses	B. & H. Patrick
Jan	Port Waikato	Waikato	0	Large dune areas with much <i>Spinifex</i> , pingao, <i>M. complexa</i> and <i>Ozothamnus leptophyllus</i>	B. & H. Patrick
Jan	Port Jackson Cape Colville	Waikato	0	Low dunes of marram	B. Patrick
Jan	Ohuka Creek	Waikato	0	Driftwood in storm area in dunes near cliffs of Ngatutura Point. Locally common under large logs	B. & H. Patrick 7 <i>Steatoda</i> 1 m/f collected

MONTH	LOCALITY	DOC CONSERVANCY	TOTAL SPIDERS	HABITAT DESCRIPTION	OBSERVER/ OTHER
Jan	Whangamata	Waikato	0	Open flat hind dunes with excellent vegetation of low shrubs of <i>M. complexa</i> , <i>Pimelea arenaria</i> , <i>C. soldanella</i> , <i>C. acerosa</i> and clumps of pingao and abundant <i>Spinifex</i>	B. & H. Patrick 17 <i>L. atritus</i> found
Nov	Taharoa	Waikato	0	Ironsand mining, large dune system <i>Spinifex</i> on foredune front, many native species. Extensive degraded dune system	R.C. Craw Several <i>Steatoda</i> seen
Nov	Mohakatino Beach	Waikato	0	Very steep black ironsand dunes with marram grass, lupin, <i>Lotus</i> , <i>Hypochoeris</i> . Just N. of river—dunes directly in front of Mohakatino Wetland	R.C. Craw
Jan	Papamoa Beach	Bay of Plenty	5	Reasonably large dunes with <i>M. complexa</i> common, with <i>Oxalis</i> , <i>S. elegans</i> and <i>Spinifex</i> . Katipo in <i>Spinifex</i> and <i>M. complexa</i>	B. & H. Patrick 1 juvenile
Nov	Herbertville (N. of Tauture River)	East Coast/ Hawke's Bay	2	Low, flat white sandy area below foredune just in from river mouth. Abundant driftwood of various sizes - amongst scattered marram, cottontail, <i>Lotus</i> , <i>Spinifex</i> , <i>Calystegia</i> , <i>Hypochoeris</i> —22 m from high tide mark	R.C. Craw
Feb	Herbertville	Hawke's Bay	15	Extensive dunes of varying topography at South end of beach. Northern end very disturbed Marram, <i>Spinifex</i> , pingao, <i>Pimelea</i> , sand <i>Coprosma</i> and <i>M. complexa</i> present	B. Patrick
Feb	Porangahau	Hawke's Bay	1	Modified marram dunes	B. Patrick
May	Ocean Beach	Hawke's Bay	5	Large area of semi-natural dunes. <i>Spinifex</i> , marram dominant in places	B. Patrick
May	Waimarama	Hawke's Bay	0 5	Marram, <i>Spinifex</i> , <i>Calystegia</i> and <i>Convolvulus</i> Many exotics, including sea rocket	B. Patrick <i>Steatoda</i> found
Nov	Te Paerahi Beach, Porangahau	Hawke's Bay	3	Area of low flat dunes between beach and pine trees. Rushes, marram, cottontail, <i>Lotus</i> , <i>Calystegia</i> . 26 steps from beach	R.C. Craw 1 male found
Nov	Koitiata dunes W. Turakina	Wanganui	0	Marram, <i>Spinifex</i> and scattered clumps of pingao on top of dune in hollows at top, just in from river mouth	R.C. Craw
Nov	Koitiata dunes	Wanganui	0	Rear slope of foredune down to macrocarpa trees with marram, <i>Spinifex</i> , rushes, scattered cossirum, lupin, purple flowered senecio, yellow-flowered compositel shrub, cottontail and <i>Muehlenbeckia</i>	R.C. Craw
Nov	Wainui Beach near Waitotora	Wanganui	0	Foredune, black ironsand beach, from driftwood <i>Spinifex</i> zone up into back of foredune/ hollows— <i>Spinifex</i> , marram, <i>Pingao</i> , <i>Lotus</i> <i>Calystegia</i> , <i>Hypochoeris</i> , rushes, intro. grasses	R.C. Craw Many <i>Steatoda</i>
Nov	Moana Roa Beach	Wanganui	0	Back of low flat foredune, with large areas of open sand and abundant scattered driftwood. Scattered <i>Spinifex</i> , pingao and marram	R.C. Craw Only <i>Steatoda</i>
Nov	Moana Roa Beach	Wanganui	3	Along from where 4WD track runs from carpark to south of carpark. Areas of small driftwood and some large logs. Marram, pingao, <i>Spinifex</i> , <i>Conzya</i> , <i>Hypochoeris</i>	R.C. Craw <i>Steatoda</i> under driftwood
Apr	Whangaehu River	Wanganui	3	Reasonably natural dunes: much <i>Spinifex</i> , <i>Pimelea arenaria</i> , pingao and <i>Convolvulus</i>	B. & H. Patrick 3 fem. <i>Steatoda</i>
Apr	Tangimoana	Wanganui	0	Extensive dunes—very active. High natural values	B. & H. Patrick Adult <i>Steatoda</i> under driftwood

MONTH	LOCALITY	DOC CONSERVANCY	TOTAL SPIDERS	HABITAT DESCRIPTION	OBSERVER/ OTHER
Apr	Foxton Beach	Wanganui	3	Modified dune system. Mainly marram and weeds (grasses, boxthorn and lupin). Some <i>Coprosma acerosa</i> , driftwood	B. & H. Patrick
Apr	Himatangi Beach	Wanganui	3	Extensive dune. Fore-dune of marram, open areas inland—scattered Pingao, <i>Spinifex</i> , sand coprosma and sand <i>pimelea</i> —high natural values	B. & H. Patrick
Apr	Bell Block	Wanganui	1	Steep, eroded dunes. Marram, small-leaved <i>Muehlenbeckia complexa</i> , some lupin, pingao diverse herbs and grasses.	B. & H. Patrick 2 <i>Steatoda</i> juv.
Nov	Te Humenga Point	Wellington	4	Back of gravelly, sandy flat beach—marram, <i>Spinifex</i> , cottontail and <i>Pimelea</i> . C. 70 steps in from high tide line, with scattered driftwood	R.C. Crow 1 male found few <i>Steatoda</i>
Nov	Bt. Te Humenga Point & Otakaha Stream (in dunes)	Wellington	1	Low flat fore-dune with <i>Spinifex</i> , <i>Hypochoeris</i> , <i>Calystegia</i> , cottontail grass—21 steps from high tide—directly in line with small green house	R.C. Crow
Nov	Riversdale	Wellington	0	Highly modified dunes—housing and recreation	B. Patrick
Feb	Flat Point	Wellington	7	Broad, semi-natural dunes, extensive in length	B. Patrick & G. Foster
Feb	Uruti Point	Wellington	3	Good-quality blowouts with lots of driftwood in piles with katipo on margin. Katipo under stones within dunes, katipo under sand coprosma, in marram	1 male, 2 sub-adult female with white edging
Feb	Uruti Point	Wellington	3	Marram dunes, driftwood	B. Patrick
Oct	Uruti Point	Wellington	1	Some pingao and <i>Spinifex</i>	A. Rebergen
Oct	Uruti Point	Wellington	1	Under driftwood. Sand pimelea present	A. Rebergen
Feb	Makara Beach	Wellington	0	sand sedge present	B. Patrick
Feb	Makara Beach	Wellington	0	Small beach set amid tall cliffs on each side. Surprising quality of dune vegetation: <i>Raoulia</i> , <i>Pimelea</i> , <i>Colobantibus</i> , <i>Spinifex</i> , <i>Pingao</i>	B. Patrick
Feb	Castlepoint	Wellington	2	Marram-dominated with sand pimelea, sand coprosma pingao and <i>Spinifex</i> , driftwood	B. & H. Patrick
Apr	Lake Onoke Spit	Wellington	5	Highly natural system. Narrow fore-dune with gravel hind-dune pingao/ <i>Spinifex</i> / <i>Austrofestuca</i> in fore-dune, then driftwood, then much <i>Pimelea</i> on gravel/ <i>Raoulia</i> / <i>C. soldanella</i>	B. & H. Patrick & A. Rebergen. <i>Steatoda</i> present under driftwood
Oct	Wharariki Stream	Nelson	0	Extensive dunes with marram and mostly modified sand coprosma and rocky areas nearby	B. & H. Patrick
Oct-Nov	Hansen Creek six sites	Nelson	0	Steep, marram-dominated dunes against high cliffs	B. & H. Patrick
Nov	Motueka Bar	Nelson	0	<i>Senecio</i> /marram/sea rocket	B. & H. Patrick
Nov	Waikaki Bay	Nelson	0	Excellent small, natural dune system with stream through the middle	B. & H. Patrick & team
Nov	Tahunanui Beach	Nelson	1	Pingao and <i>Spinifex</i> , driftwood	<i>Steatoda</i> seen
Nov	Tahunanui Beach	Nelson	1	Highly modified dunes, marram-dominated. Fore- and hind-dunes present. Some driftwood	B. & H. Patrick 3 <i>Steatoda</i>
Nov	Boulder Bank	Nelson	0	Highly modified with many weeds and stones	B. & H. Patrick
Nov	South Bank Ure River	Nelson	0	Marram mainly, <i>Raoulia</i> in 'back dune' and lupin	B. & H. Patrick
Nov	Ure River mouth	Nelson	0	Modified dunes	B. & H. Patrick
Nov	Ure River mouth	Nelson	0	Highly modified marram dunes	B. & H. Patrick
Oct	Oyster Bay	Nelson	0	Small dunes with marram and little else	B. & H. Patrick
Nov	Ward Beach	Nelson	0	Marram-dominated, but many natives also. <i>Raoulia</i> , <i>Discaria</i> , <i>Wahlenbergia</i>	B. & H. Patrick
Nov	Cloudy Bay Rarangi to Wairau Div.	Nelson	0	Low, semi-natural dunes north of Wairau Bar; marram present. Many native grasses, low shrubs, driftwood and grasses	B. & H. Patrick

MONTH	LOCALITY	DOC CONSERVANCY	TOTAL SPIDERS	HABITAT DESCRIPTION	OBSERVER/ OTHER
Dec	South of Cape Campbell	Nelson	5	High back dunes with many native species: pingao, sand coprosma, <i>Raoulia</i> , <i>Carex pumila</i> , <i>Olearia solandri</i> , <i>A. littoralis</i> , <i>L. australe</i>	B. & H. Patrick
Dec	Inner Farewell Spit	Nelson	14	Open area behind low dune of marram. 4km from the base of Farewell Spit. Under driftwood	B. & C. Patrick
Dec	Tip of Farewell Spit	Nelson	5	Open areas with sparse <i>Spinifex</i> /marram and driftwood. Found inside marram, under driftwood and in old debris. N. and E. of lighthouse	B. Patrick
Oct	Kaikoura	Nelson	0	Highly modified narrow dunes; marram and lupin	B. & H. Patrick
Dec	Marfells Beach	Nelson	0	Highly modified and dense marram	B. & H. Patrick
Jan	Delaware Bay end of spit Maori Pa Beach	Nelson	7	Under isolated driftwood in quite exposed area above high tide. Marram-dominated dunes nearby; male and female <i>L. katipo</i>	N. Fijn 17 juvenile <i>Steatoda</i> 45 juveniles
Jan	Red Jacket Creek	West Coast	0	Reasonably weed-free with <i>I. nodosa</i> , <i>C. pumila</i>	B. & H. Patrick
Jan	Karamea Beach	West Coast	5	Low, mainly marram-covered dune between sea and estuary. Patches of pingao, driftwood	B. & C. Patrick
Jan	Karamea Road	West Coast	0	Semi-natural to modified narrow dunes	B. & H. Patrick
Apr	Orari River Mouth	Canterbury	0	Marram only, highly modified site	B. & H. Patrick
Nov	Motunau Beach	Canterbury	0	Marram with some pingao and weeds	B. & H. Patrick
Nov	Leithfield Beach	Canterbury	0	Mostly marram with <i>O. leptophyllus</i> , sand coprosma, lupin and many native herbs	B. & H. Patrick
Nov	Spencerville	Canterbury	1	Mainly marram with shrubs of <i>Ozothamnus leptophyllus</i>	B. & H. Patrick
Nov	Rakaia Huts	Canterbury	0	Marram with some pingao and <i>Austrofestuca</i> at southern end	B. & H. Patrick
Nov	Wakanui Beach	Canterbury	0	Marram, <i>Muehlenbeckia axillaris</i> , <i>C. soldanella</i> , <i>C. pumila</i> , <i>I. nodosa</i> , <i>M. complexa</i>	B. & H. Patrick
Nov	Lowcliffe	Canterbury	0	Modified dune with some natives including <i>Calystegia</i> and <i>M. complexa</i>	B. & H. Patrick
Nov	Rangitata Huts	Canterbury	0	Highly modified gravel beach	B. & H. Patrick
Nov	Opihi River mouth	Canterbury	0	Mostly marram dominated dunes	B. & H. Patrick
Oct	The Beach Pareora	Canterbury	0	Boxthorn, <i>M. complexa</i> , <i>Convolvulus</i> , <i>Calystegia</i> highly modified	B. & H. Patrick
Apr	Temuka—Prattley Road to Browns Beach	Canterbury	0	Marram and driftwood. <i>M. complexa</i> common on roadside nearby	B. & H. Patrick
Aug	North New Brighton Waimairi	Canterbury	0	Marram, <i>Senecio elegans</i> , lupin and <i>Caprodetus</i> common. Dune planting project evident CCC sign Erosion protection: planted pingao, <i>Euphorbia</i> , sand coprosma, <i>H. elliptica</i> , flax, <i>Anthropodium</i>	B. & H. Patrick
Oct	South of Wharanui	Canterbury	0	Dense marram dunes	B. & H. Patrick
Oct	Kekerangi	Canterbury	0	Marram low dunes with some <i>Ozothamnus leptophyllus</i> . <i>Raoulia</i> cushionfield present	B. & H. Patrick
Nov	Ashburton River North & South of mouth	Canterbury	0	Cliffs, dissected gullies a feature of coastline to the Hinds River. Driftwood, <i>M. complexa</i> , <i>Carmichaelia</i> , <i>M. crassifolius</i> , <i>Convolvulus</i> , <i>Geranium</i> , <i>C. tetramera</i> , <i>M. ephedroides</i> , <i>M. axillaris</i>	B. & H. Patrick
Nov	Gore Bay	Canterbury	3	Low-lying hind dune north end of beach over river Sparse marram, <i>Pimelea</i> , prostrate matagouri, driftwood	B. & H. Patrick
Dec	Kaitorete Spit	Canterbury	12	Dry, low, rolling landscape, rich in native flora	B. & H. Patrick

MONTH	LOCALITY	DOC CONSERVANCY	TOTAL SPIDERS	HABITAT DESCRIPTION	OBSERVER/ OTHER
Dec	Hinds River mouth	Canterbury	0	Semi-natural coastal sites. Much <i>M.complexa</i> , <i>Raoulia</i> , <i>M.eppedroides</i> , <i>M.alpinus</i> , <i>Carmichaelia</i> , <i>Discaria</i> , <i>R.monroi</i> on stony ground in gullies	B. & H. Patrick
Dec	Wainono Lagoon	Canterbury	0	Hook Beach Road. Semi-natural dunes on storm beach stones. Some grasses and much driftwood	B. & H. Patrick
Dec	Wainono Lagoon (near Hook)	Canterbury	0	Back slope of shingle beach: scattered piles of driftwood amongst <i>Muehlenbeckia eppedroides</i> mats, <i>Plagianthus divaricatus</i> clumps, scattered gorse and Lupins, <i>Calystegia</i> and <i>Galium</i> ground-cover	R. C. Craw
Dec	Waitaki Huts (North side of river mouth)	Canterbury	0	Abundant driftwood of all sizes on shingle bank of river mouth with scattered clumps of lupin, <i>Haloragis</i> , <i>Acaena</i> and introduced Compositae	R. C. Craw
Dec	Orari River Mth Reserve, near Clandeboye	Canterbury	10	Back of sand/gravel beach between wetland/pond (highly modified) and beach amongst scattered marram with <i>Calystegia</i> and <i>Hypochoeris</i> ground-cover with abundant driftwood. North of carpark	R. C. Craw
Nov	Caroline Bay	Canterbury	0	Mainly marram and other exotics Highly modified	B. & H. Patrick
Mar	Warrington Dunes	Otago	0	Diverse dune vegetation of both native and exotic plants. Little driftwood. Marram, <i>M.australis</i> , <i>C.acerosa</i> , mahoe, <i>S. quadridentata</i> , salt turf and <i>P. luteoalbum</i>	B. & H. Patrick R. Craw
Sept	All Day Bay	Otago	0	Marram-dominated dune	B. Patrick
Sept	Karitane Spit	Otago	0	Dense lupin and marram Exotic plants only. Sow thistle, lupin, <i>Pinus radiata</i> plantation to north	B. & H. Patrick L. Forster 2 males seen
Nov	Long Beach	Otago	0	Modified dune system and <i>P.divaricatus</i> . Dense marram on foredune	B. & H. Patrick Ent. Society
Dec	Katiki Beach	Otago	0	Mostly marram, but with one patch of <i>Euphorbia glauca</i> and sand coprosma	B. & H. Patrick
Dec	Shag R. mouth south	Otago	0	Marram-dominated with <i>E. glauca</i> patch extending up cliff with <i>Pimelea urvilleana</i> and sand geranium	B. & H. Patrick
Dec	Stony Creek	Otago	0	Small dune with marram with sand coprosma	B. & H. Patrick
Dec	Pleasant River	Otago	0	Highly modified system with marram and lupin	B. & H. Patrick