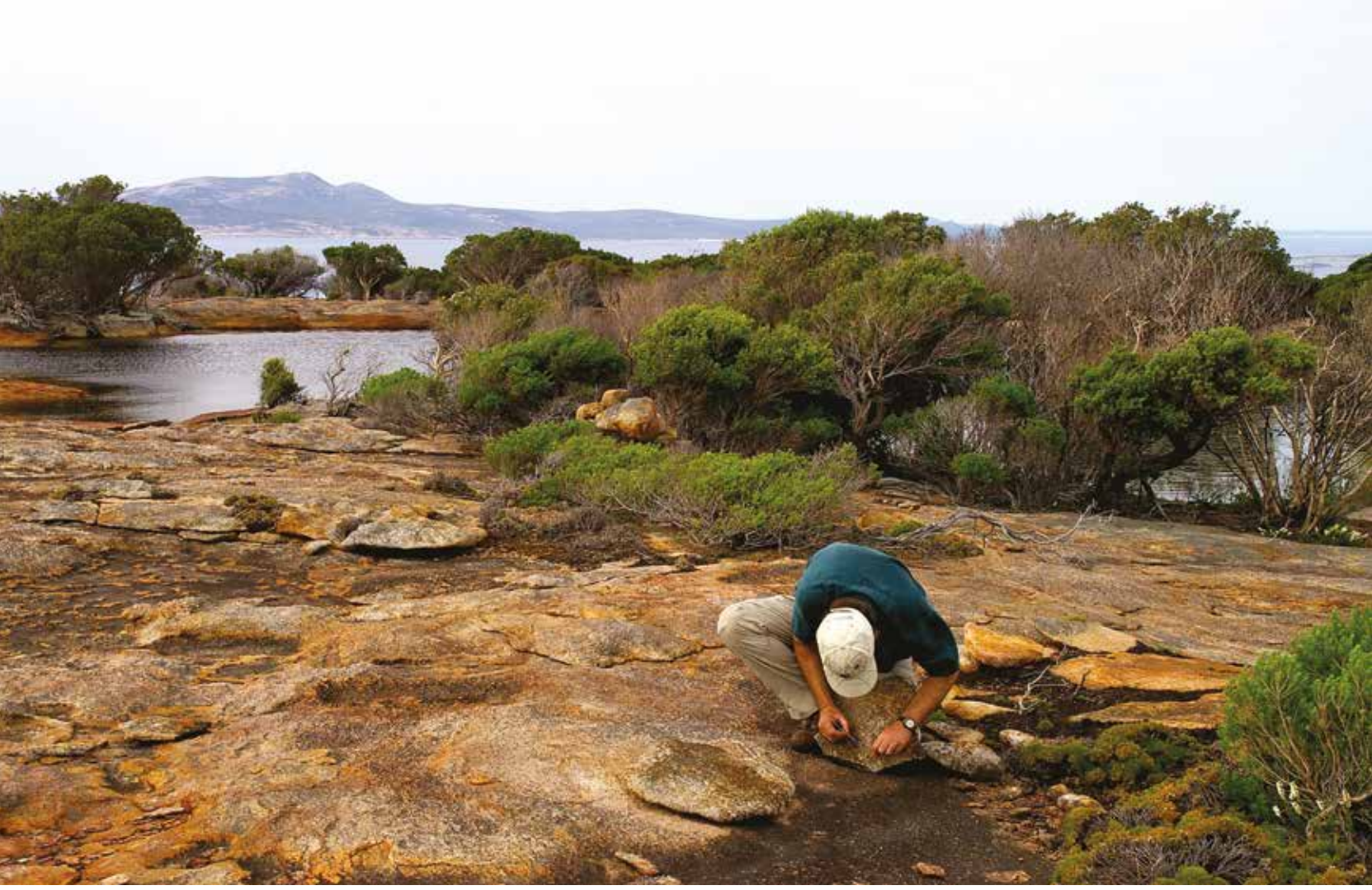


UNCOVERING
A SECRET WORLD ON THE SOUTH COAST

Hiding beneath leaf litter and under rocks on the south coast lies a hidden world of spineless animals. Thanks to the tireless work of the South Coast Threatened Invertebrate Group we are getting a better picture of these amazing animals and how best to protect them.

by Sarah Comer, Melinda Moir, Mark Harvey and Deon Utber

Previous page
Main Mark Harvey collecting invertebrates at Middle Island off the south coast.
Photo – Sarah Comer/Parks and Wildlife
Bottom The WA pill millipede (*Cynotelopus notabilis*).

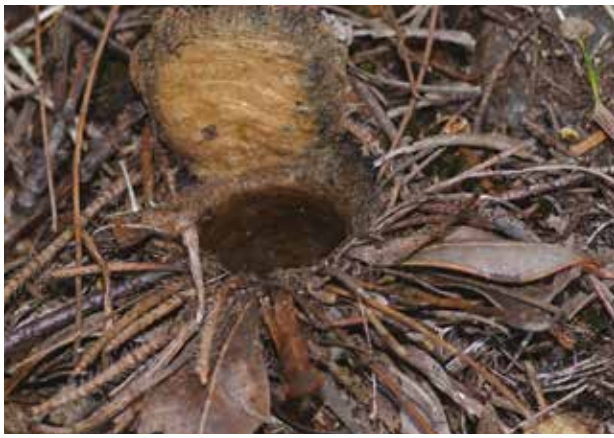
Above A female *Zephyrarchaea mainae* found at Torndirrup National Park.
Photos – Michael Rix/WA Museum

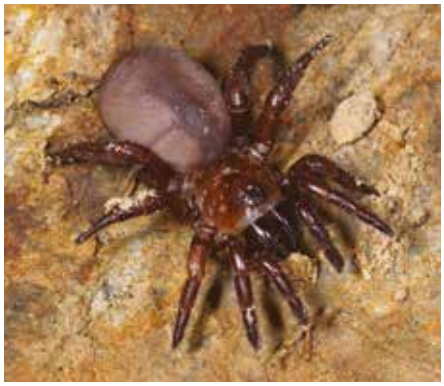
The south-west of Western Australia is recognised as one of 34 global biodiversity hotspots, and while the flora and vertebrate fauna are relatively well described, the challenge of documenting invertebrate diversity is one that has kept the South Coast Threatened Invertebrate Group (SCTIG) members busy for nearly 15 years.

UNDERSTANDING THE SPINELESS MAJORITY

To fully comprehend the challenges of invertebrate conservation it is important to understand some of the concepts that describe how little we know and what is being done. Invertebrates are 'hyperdiverse' – a term used to describe those organisms containing extremely high numbers of species – and of those that have been found, many are new to science and yet to be named. There is a bottleneck in describing these species, with only a very small percentage formally named in published scientific literature each year due to the many species requiring names and the few taxonomists available to do the job. The term 'Linnaean Shortfall' describes this bottleneck situation, but doesn't help to identify which species might require conservation. This is partly achieved by conducting surveys and examining records to determine how restricted species actually are, where they occur and, just as importantly, where they do not occur. This lack of knowledge on a species biogeography is referred to as the 'Wallacean Shortfall'. So, while the importance of taxonomy is unquestionable, conservation managers also need to have some idea of which species are likely to need special attention for management.

Addressing this issue has been the focus of the SCTIG, which first gathered in 2001. A strong collaboration between staff from the Western Australian Museum, The University of Western Australia and Parks and Wildlife sought to address the initial challenge of identifying a particular subset of potentially threatened invertebrate fauna in the South Coast Region to improve conservation outcomes for these species. The expertise of specialists from the WA Museum, and the universities of Western Australia and Melbourne have provided the backbone for these efforts, with help from a number of Parks and Wildlife staff who have assisted not only with collecting





Above left *Samichus* sp. millipedes found at Two Peoples Bay Nature Reserve.
Photo – Melinda Moir/UWA

Above An idiopid trapdoor spider burrow entrance found during SRE surveys of Fitzgerald River National Park.
Photo – Alan Danks/Parks and Wildlife

Far left South Coast Threatened Invertebrate Recovery Team meeting.
Photo – Melinda Moir/UWA

Left The idiopid trapdoor spider from the burrow above.
Photo – Alan Danks/Parks and Wildlife

"The challenge of documenting invertebrate diversity is one that has kept the SCTIG members busy for nearly 15 years."

invertebrates but also with taking up the challenge of incorporating invertebrate conservation into broader biodiversity management programs.

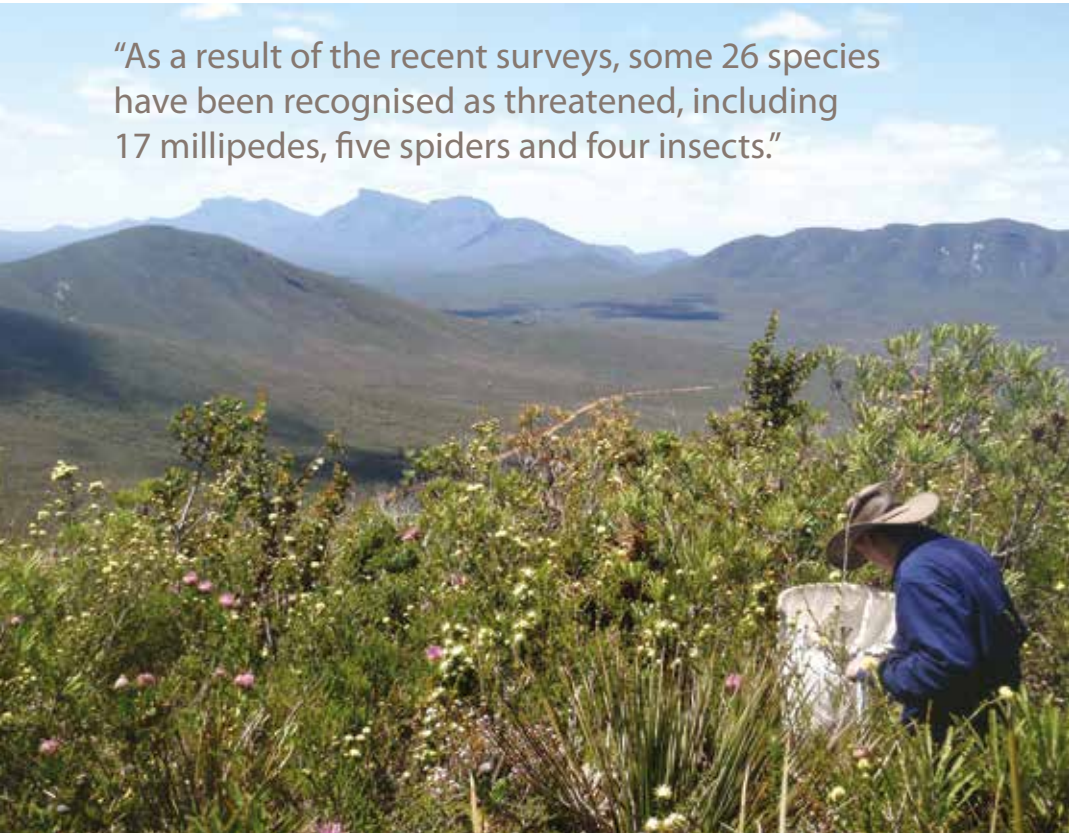
IDENTIFICATION OF REFUGES

Given the observed increase in bushfires and the drying climate through climate change in south-western WA, SCTIG initially decided to target the groups of invertebrates that were dependent on relictual Gondwanan habitats, or those long unburnt pockets of vegetation likely to remain moist and damp throughout the year. 'Relictual' habitats provide the moist conditions that many specialised invertebrate species prefer, and were deemed a good place to start looking for invertebrates that might have specialised habitat requirements with a limited ability to disperse. A modelling exercise carried out in 2002 provided a rough idea of where these habitats might occur across the south coast.

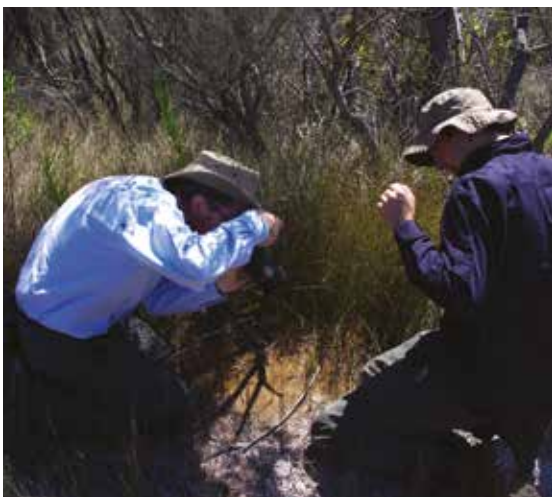
These particular habitats had already been identified as refuges for a number of species, including the Stirling Range *Moggridgea* spiders that had been studied by Barbara York Main, one of the founding members of the SCTIG. Barbara's early 1990s work on the detrimental effects of fire on the shallow burrows of these miniscule trapdoor spiders provided some insights into fire and refugial habitat for park managers. More broadly, the specialised habitats of *Moggridgea* – south-east facing moist gullies – were recognised as essential refuges for a number of species with naturally small ranges, known as short-range endemics (SREs). Examples of invertebrates that are predominantly SREs include Gastropoda (snails), Onychophora (velvet worms), Araneae (especially mygalomorph spiders) and Diplopoda (millipedes).

The ecological and life history characteristics of these groups are similar; many are hampered by their poor ability to disperse and are restricted to isolated pockets of specialised habitats. SREs are only found within areas of less than 10,000km^2 and many of these are restricted to much smaller areas. This makes them more vulnerable to the processes that impact directly on the refugial habitat, and so they require special management to avoid the risk of extinction.

One of the early inspirations illustrating the concept of SREs for Parks and Wildlife's South Coast Region staff was a pin-board in the office of WA Museum mollusc curator Shirley Slack-Smith. Shirley had placed different coloured pins on a large map of the south-west, with each colour representing what she thought were distinct species of the land snail genus *Bothriembryon*. The myriad of localised patches of vivid colours clearly illustrated the restricted range of many species. This group was difficult to study, but in recent years the work has been taken up by Corey Whisson from the



"As a result of the recent surveys, some 26 species have been recognised as threatened, including 17 millipedes, five spiders and four insects."



Above left Frances Leng hunting for invertebrates in the Stirling Range National Park.

Above right Acacia weevils (*Melanterius servalus*) on *Acacia veronica* in Stirling Range National Park.
Photos – Melinda Moir/UWA

Above Mark Harvey and Mike Rix from the WA Museum photographing trapdoor spiders at West Cape Howe National Park.
Photo – Sarah Comer/Parks and Wildlife

WA Museum, and he is collaborating with Dr Bram Breuer from the Netherlands to examine diversity of the group using molecular sequence data.

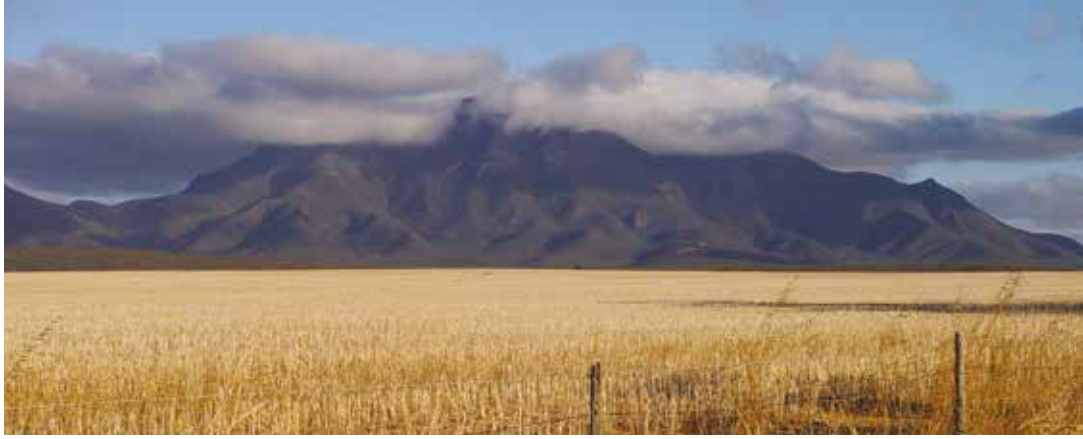
INVENTORY – PRIORITIES FOR SURVEY

Many collections of animals of interest had inadvertently already been made when the SCTIG formed, for example, through the broadscale leaf litter invertebrate collections conducted to assess the habitat of the insectivorous and endangered noisy scrub-bird (*Atrichornis clamosus*). One of the first actions of the SCTIG was to have Parks and Wildlife staff and volunteers extract potential SRE invertebrates from jars storing the noisy scrub-bird food samples for museum staff to identify. Many trapdoor spiders and millipedes were extracted from leaf litter samples collected between Mt Manypeaks and the Walpole Wilderness.

Mountain-top surveys conducted by Sarah Barrett in the 1990s provided invaluable invertebrate samples that identified species that appeared to be restricted to summit habitats. One of these was the eastern massif assassin spider (*Zephyrarchaea robinsi*), which is known only from the eastern peaks of the Stirling Range. The habitat of this species is highly vulnerable to fire, and it is one of five assassin spiders in the region now listed as threatened.

Other examples of 'opportunistic' collections were invertebrates collected from vertebrate sampling across the region. One collection, made from a pit trap in a deep gully on Mt Arid during a *LANDSCOPE* Expeditions trip to Cape Arid National Park in 2006, was of an unusual pill millipede. Sarah suspected it was different and WA Museum Senior Curator Mark Harvey and his colleagues identified that it was the first record of the *Epicyliosoma* genus (now called *Cyliosoma*) in WA. Further surveys by researcher Melinda Moir found this species, later to be named *Epicyliosoma sarahae* by Melinda and Mark, in several other refugial habitats, but to date it has still only been collected from Cape Arid and Cape Le Grand national parks.

Further documentation of SRE invertebrates across the region was made possible by support from the South Coast NRM which recognised the need to improve our understanding of poorly surveyed groups and provided funds to support some more targeted surveys. The mapped refugia from the 2002 model was an excellent starting point and in 2006 Melinda, with a number of assistants from the museum, surveyed many of the spots for SRE invertebrates. This work was supported by other targeted work by WA Museum staff and collaborators, and opportunistic collecting by staff from the then Department of Conservation and Land Management. Finally, in 2008, the



Above left Melinda Moir and threatened flora officer Sarah Barrett at *Banksia montana* translocation site.
Photo – Frances Leng

Above The clouds that cloak Stirling Range National Park create microclimates that SRE invertebrates like.
Photo – Sarah Comer/Parks and Wildlife

Left *Bothriembryon* sp. 'Thumb Peak', one of the new species of this genus collected during surveys of Fitzgerald River National Park.
Photo – Alan Danks/Parks and Wildlife

first comprehensive survey of terrestrial SRE invertebrates on the south coast was completed, and a report compiled by research scientist Volker Framenau, Melinda and Mark.

IMPROVING KNOWLEDGE

Until the SCTIG began its work in 2001, only three invertebrates were recognised as being threatened in the region and including on the WA list of threatened species. As a result of the recent surveys, some 26 species have been recognised as threatened, including 17 millipedes, five spiders and four insects. As our knowledge of this incredible group of animals increases, more will undoubtedly be identified as requiring special management consideration.

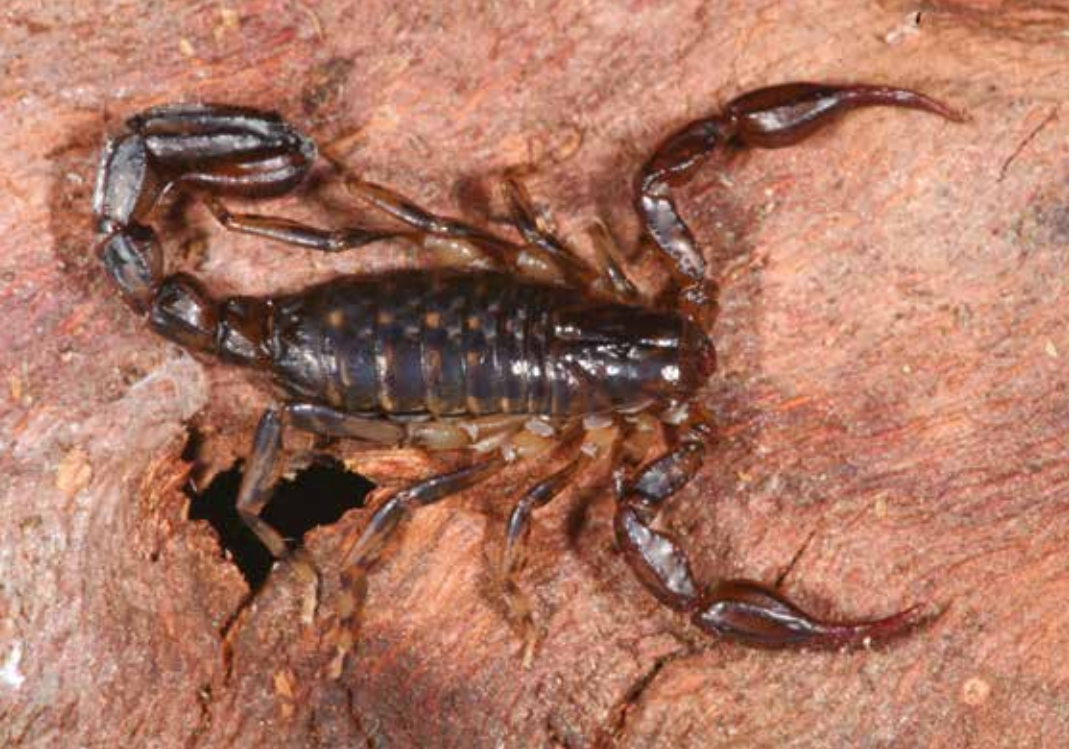
A diverse range of invertebrates have been collected and identified in recent years including species of pseudoscorpions, trapdoor spiders, millipedes, peacock spiders and velvet worms. Some groups have benefited from having students complete work on formally describing them. Karen Edward completed her Honours project looking at the millipede genus *Atelomastix* and while this group is widespread, many of the species are clearly restricted and fit the criteria of SREs. As a result of Karen's work, some 16 species of *Atelomastix* are now recognised as requiring specific conservation management and these are all now formally listed as threatened under WA legislation. Many of these species are only found on a single outcrop of granite hills, and some of their names were inspired by the hard-working members of the team who have helped to locate specimens. For example *Atelomastix julianneae* is named for WA Museum staff member Julianne Waldock, who spends hours sorting samples collected by museum staff and Parks and Wildlife staff and volunteers. Other millipede names honouring members of SCTIG include *Atelomastix danksi*, *Atelomastix mainae*, *Atelomastix melindae* and *Atelomastix sarahae*.

Another prominent millipede group that has received recent attention is *Antichiropus*. WA Museum staff recognise more than 160 species in WA and South Australia, of which only about 40 have been named. Cathy Car from the WA Museum recently reviewed the species of the Great Western Woodlands and adjacent habitats, and named 30 new species, each with relatively small distributions. Some of the samples used in this study were supplied by SCTIG members or from the then Department of Conservation and Land Management Salinity Strategy Biological Survey of the late 1990s.

Several other groups have also been examined and, while sorting out the taxonomy of some of these has been completed, many remain formally undescribed.

SPECIAL MANAGEMENT

Given that these invertebrates are so challenging to find, and that we still can't put a name to many of them, it is important we consider them when managing the areas where we know they are found. While we lack some specific knowledge, we have a basic understanding of the habitat they depend on, so can manage them appropriately, even if we aren't completely sure of which species are found where. Most refugial habitats are small, often isolated and are easily disturbed and fire is likely to have a significant impact – both its intensity and



Left One of the rare SRE psuedoscorpions *Cercophonius sulcatus* which is only known from locations near Pemberton.
Photo – Mark Harvey/WA Museum

when it occurs. Fires that occur when invertebrates are dispersing are likely to have a greater impact on SREs that are moving around, while less-intense patchy fires are likely to leave some unaffected sanctuaries within the refuge, from which SRE invertebrates can recolonise. So management that incorporates consideration of both refugia and sensitive components of the ecosystem is likely to afford them protection.

Land managers also have to look for novel ways to protect a challenging group of invertebrates that are only found on specific host plants. After delving further into the intricate world of invertebrates, Melinda found some interesting bugs associated with some of the rare plants found in small isolated patches in Stirling Range National Park and surrounds (see 'Slowing the extinction of insects,' *LANDSCOPE*, Winter 2013). One of these, the *Banksia brownii* plant-louse (*Trioza barrettae*), is found only on the leaves of the threatened feather-leaf banksia (*Banksia brownii*). Although the plant-louse does not appear to be beneficial to the plant in the way that a pollinating bee may be for example, it is also not detrimental. The risk of this invertebrate becoming extinct, with its host threatened by dieback caused by *Phytophthora cinnamomi* and too frequent fire regimes, is high. One of the more novel management interventions has been to translocate the plant-louse with its host to attempt to maintain this complex relationship of insect and host and mitigate the extinction of either species.

The efforts of the SCTIG have been instrumental in improving our capacity to manage and conserve some remarkable invertebrates on the south coast. While the contributions towards understanding the region's invertebrates clearly demonstrate the benefits of strong collaborations, this work has been enhanced and supported by students and researchers who are focussed on unravelling some of the mysteries of this amazing group of animals. The SCTIG has now written one of the first recovery plans prepared specifically for invertebrates, and will continue to foster research collaborations and knowledge-sharing to improve understanding and management of invertebrates.

A public awareness campaign is a necessary step, to highlight that shifting and relocating (or slaking) small granite rocks, which provide micro-habitats for many invertebrates can have catastrophic impacts. In many cases these refuges are so small that no level of damage can be easily seen. By sharing knowledge of this exciting group of animals as widely as we can we can capture the affection of the wider community so members of the public appreciate the value of these amazing animals and understand the need for appropriate management. Already, the dramatic colours and behaviour of the peacock spiders have rapidly become a regular feature on YouTube (see 'Ready to dance: peacock spiders', *LANDSCOPE*, Spring 2012) and it has even inspired a swimwear designer to create the 'peacock-spider print bikini' based on a restricted spider from Stirling Range National Park. Many of the other SREs are equally inspiring, and our job is to share these miniscule wonders with the wider world.

Sarah Comer is the regional ecologist for Parks and Wildlife's South Coast Region, and her work with Mark and other members of the invertebrate team over the past 15 years has inspired a love of the spineless wonders of the invertebrate world.

Melinda Moir is a research entomologist at the Department of Agriculture and Food WA and an adjunct lecturer at The University of Western Australia.

Mark Harvey loves nothing better than exploring the diverse world of terrestrial invertebrates. Mark is Head of the Department of Terrestrial Zoology and Senior Curator of Arachnids and Myriapods at the Western Australian Museum.

Deon Utber is the regional leader of nature conservation for Parks and Wildlife's South Coast Region, and the current chair of the South Coast Threatened Invertebrate Recovery Team.

Numerous people have supported the work of the South Coast Threatened Invertebrate Group, in particular Mike Rix, Corey Whisson, Volker Framenau, Julianne Waldock, the late Bert Main, Barbara York Main, Sandra Gilfillan, Janet Newell, Polly Mitchell, Sarah Barrett, Alan Danks, Karlene Bain, Alan Longbottom, Shirley Slack-Smith, Emma Massenbauer and Karen Edwards. South Coast NRM has supported the efforts of this group through funding Melinda's survey of south coast refugia.