A Survey of Populations of Threatened Invertebrates Following Fire in the Stirling Range National Park

Mark S. Harvey & Michael G. Rix

Western Australian Museum & Queensland Museum

Cryptic open burrow of *Bertmainius colonus* (Migidae). Image by M. Rix.

A report submitted to the Department of Biodiversity, Conservation & Attractions
Albany Field Office

May 2019

EXECUTIVE SUMMARY

Following a significant wildfire event in the eastern Stirling Range National Park in May 2018, a visual survey of threatened, priority and potentially threatened invertebrates (spiders, snails, millipedes and onychophorans) was undertaken by staff from the Western Australian Museum and Queensland Museum between **25 and 29 March 2019**. The aim of this survey was to ascertain if threatened invertebrate taxa were still active in the post-fire zone, with a focus on the southern slopes of the Eastern Massif, between Coyanurup Peak and Pyungoorup Peak.

Taxa targeted during the survey were the trapdoor spiders ***Bertmainius colonus*** (family Migidae; status Vulnerable), ***Cataxia stirlingi*** and ***C. sandsorum*** (both family Idiopidae; potentially threatened), the millipede ***Atelomastix tigrina*** (family Iulomorphidae; status Vulnerable), the **Stirling Range carnivorous snail** (family Rhytididae; status Critically Endangered), and **onychophorans** of the genus *Kumbadjena* (family Peripatopsidae; potentially threatened).

Of the three species targeted and formally listed under the Western *Australian Wildlife Conservation Act 1950 – Bertmainius colonus*, the Stirling Range rhytidid snail and *Atelomastix tigrina* – all were still present at sites formerly recorded as having active populations. Surveyed populations of *B. colonus* south of Coyanurup and Isongerup did seem to have been negatively affected by the fire, with very few active burrows, however local extinction seems unlikely given the continued persistence of some individuals. At the only known extant population of the Stirling Range rhytidid snail south of Pyungoorup Peak, two live juvenile individuals were observed. Numerous specimens of *A. tigrina* was similarly observed south of Pyungoorup Peak, co-existing with the sympatric species *A. montana*.

Non-listed but potentially threatened species of *Cataxia* and *Kumbadjena* seemed to have fared particularly well post-fire, with populations of *Cataxia* still thriving at surveyed sites, and *Kumbadjena* recorded at two sites, including at a new locality south of Isongerup Peak.

Overall, threatened and potentially threatened invertebrate species surveyed as part of this work appear to have survived the 2018 fire event, with some populations impacted but not extirpated, and other populations seemingly unaffected. Deeply incised gullies on the southern flanks of the Eastern Massif appear to have provided critical microhabitats and a refugial microclimate conducive to the survival of these highly restricted species.

The Stirling Range's Eastern Massif

The Eastern Massif of the Stirling Range National Park is one of three major upland subregions situated within the park, and by far the largest and highest. It is recognised as an evolutionary refugium with high levels of invertebrate and plant endemism, and a suite of habitats which are highly restricted in Western Australia, including expansive montane heathlands and seasonal waterfalls. Numerous invertebrate species are wholly endemic to the Eastern Massif, including several formally listed as threatened under the *Western Australian Wildlife Conservation Act 1950* (Table 1). A number of other potentially threatened but not yet listed invertebrate species, including other mygalomorph spiders (genus *Cataxia*), snails (genus *Bothriembryon*) and onychophorans (genus *Kumbadjena*), are also endemic to the Eastern Massif.

Table 1. Listed threatened invertebrate species endemic to the Stirling Range's Eastern Massif. Taxa targeted during the current survey are highlighted (*).

Species	Order	Family	Status
*Rhytidid sp. (WAM 2295-69)	Eupulmonata	Rhytididae	Critically Endangered
Maratus sarahae	Araneae	Salticidae	Critically Endangered
Pseudococcus markharveyi	Hemiptera	Pseudococcidae	Critically Endangered
**Atelomastix tigrina*	Spirostreptida	Iulomorphidae	Vulnerable
Atelomastix tumula	Spirostreptida	Iulomorphidae	Vulnerable
**Bertmainius colonus*	Araneae	Migidae	Vulnerable
Zephyrarchaea robinsi	Araneae	Archaeidae	Vulnerable

The May 2018 wildfire

In late May 2018, a large wildfire swept through the south-eastern side of Stirling Range National Park, severely burning much of the lowland mallee country and also burning a significant portion of the upland zone east of Bluff Knoll (Fig. 1). Affected areas included a number of the south-facing slopes, gullies and montane peaks known to be home to threatened invertebrate taxa.

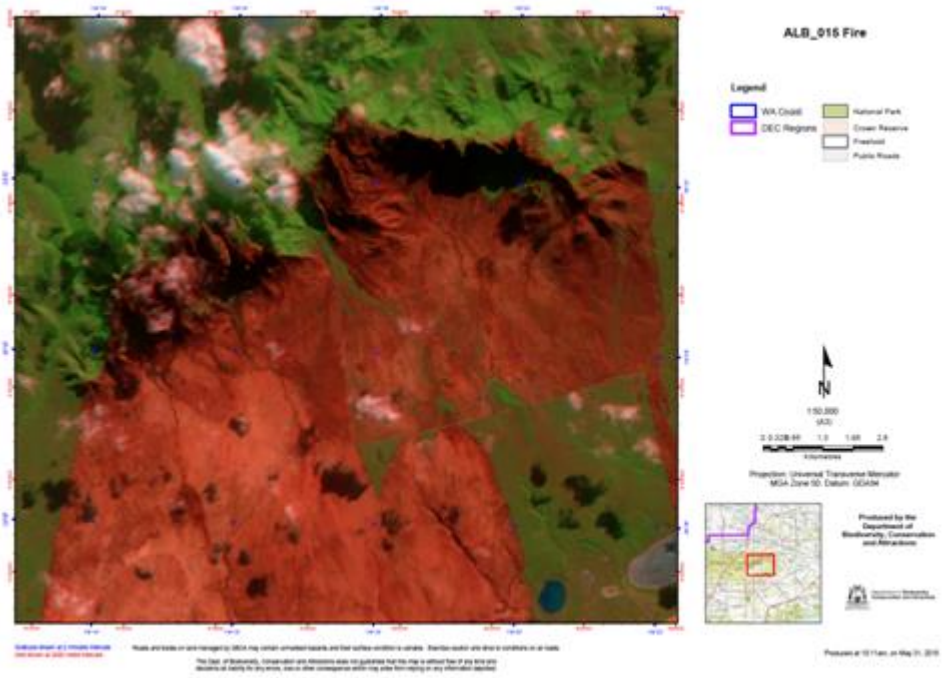

Figure 1. Map showing the extent of the May 2018 fire zone in the eastern Stirling Range National Park. Image supplied by the Department of Biodiversity, Conservation & Attractions.

Survey methodology

Surveys were conducted by Mark Harvey (Western Australian Museum) and Michael Rix (Queensland Museum) between 25 and 29 March 2019, by accessing affected habitats on the southern side of the Eastern Massif, and targeting sites known to have had viable populations of threatened species prior to the fire. All surveys were visual and not intended to be quantitative, but rather designed to allow qualitative presence or absence information to be recorded and geo-located. In this way, no populations of listed threatened species were negatively impacted by collecting, and only non-listed taxa from key sites were collected as required (e.g. to record new locality data).

The synopsis below summarises recorded information for each of the target species.

Species account:

Stirling Range carnivorous snail (rhytidid sp. WAM 2295-69)

The undescribed carnivorous rhytidid snail is currently listed as Critically Endangered, and has only been collected from two sites on the Eastern Massif (at 'The Cascades' [Bluff Knoll] and on the south face of Pyungoorup Peak). The Bluff Knoll population has not been re-located in recent years, however the Pyungoorup population was active and seemingly healthy prior to the fire. During the survey, two juvenile specimens were found alive under rocks on the south face of Pyungoorup Peak (Table 2), with relatively little survey effort. While the gully in which they were found was impacted by the fire, the habitat was recovering well, and the site did not seem to have been as badly affected as more exposed lowland areas. We therefore surmise that the population remains viable.

Table 2. Geo-located observations of the Critically Endangered rhytidid snail.

Species	Latitude	Longitude	Site	Number
Rhytidid sp. (WAM 2295-69)	34°22'00"S	118°19'43"E	Pyungoorup	2 (juv.)

Species account:

Eastern Massif tiger millipede (*Atelomastix tigrina*)

The Eastern Massif tiger millipede, *Atelomastix tigrina* (Fig. 2), was first described by Edward & Harvey (2010), and is currently listed as Vulnerable. It is found patchily throughout the Eastern Massif, in both upland habitats and protected gullies on the lower southern slopes, and during winter can be found relatively commonly under rocks and logs. During the survey, numerous specimens were found alive under rocks and logs on the south face of Pyungoorup Peak (Table 3), with little survey effort. While the gully in which they were found was impacted by the fire, the habitat was recovering well, and the site did not seem to have been as badly affected as more exposed lowland areas. Millipedes are also assumed to retreat underground during adverse summer conditions, and only re-surface once cooler temperatures and rainfall return. We therefore surmise that populations of this species are likely to remain viable, especially in protected gullies with plenty of rocky cover.

Figure 2. *Atelomastix tigrina* (family Iulomorphidae). Image by M. Rix.

Table 3. Geo-located observations of the Vulnerable millipede *Atelomastix tigrina*.

Species	Latitude	Longitude	Site	Number
Atelomastix tigrina	34°22’00”S	118°19’43”E	Pyungoorup	Many

Species account:

Eastern Stirling Range pygmy trapdoor spider (*Bertmainius colonus*)

The Eastern Stirling Range pygmy trapdoor spider, *Bertmainius colonus*, was first described by Harvey, Main, Rix & Cooper (2015), and is currently listed as Vulnerable. It is one of three species of *Bertmainius* endemic to the Stirling Range National Park, and is known only from the Eastern Massif, between Wedge Hill and Pyungoorup Peak. The spiders are very small for a mygalomorph, around 6–10 mm in body length, and build highly cryptic burrows in soil banks, normally adjacent to ephemeral streams in gullies or riparian zones (Fig. 3).

Figure 3. Closed (left) and open (right) active burrow of *Bertmainius colonus*. Image by M. Rix.

During the survey, targeting known populations of *B. colonus* was seen as a strategic priority, given the occurrence of most populations in the fire zone and the known susceptibility of the spiders to fire. Based on records in the Western Australian Museum, MSH and MGR visited sites in the major gullies south of Coyanurup Peak and Isongerup Peak. At both of these sites, the fire did seem to have had an impact on populations, with large numbers of defunct burrows and only small numbers of active burrows present at any one location (Table 4). We therefore surmise that surveyed populations of *B. colonus* south of Coyanurup and Pyungoorup did seem to have been negatively affected by the fire, however local extinction seems unlikely given the continued persistence of some individuals.

Table 4. Geo-located observations of the Vulnerable pygmy trapdoor spider *Bertmainius colonus*.

Species	Latitude	Longitude	Site	Number
Bertmainius colonus	34°23’33”S	118°16’04”E	Coyanurup	3 active
Bertmainius colonus	34°22’52”S	118°17’20”E	Isongerup	2 active
Bertmainius colonus	34°22’51”S	118°17’21”E	Isongerup	Defunct only
Bertmainius colonus	34°22’52”S	118°17’19”E	Isongerup	Defunct only

Species account:

Open-holed spiny trapdoor spider (*Cataxia sandsorum*)

The open-holed spiny trapdoor spider, *Cataxia sandsorum* (Fig. 4), was first described by Rix, Bain, Main & Harvey (2017), and while not currently listed under Western Australian State legislation, is endemic to the Eastern Massif. Unusual among idiopid trapdoor spiders for building an open-holed burrow with no lid (Fig. 4), Western Australian species of *Cataxia* have a highly relictual distribution in the Stirling Range, Porongurup Range and on Mount Manypeaks. *Cataxia sandsorum* was previously known from only a few sites on the eastern side of the Eastern Massif, with the major population occurring on the south face of Pyungoorup Peak. During the survey, numerous specimens were found alive throughout the study region south of Pyungoorup Peak, including in areas not previously known to have had active burrows (Table 5). We therefore surmise that populations of this species are likely to remain viable, irrespective of the fire.

Figure 4. Female (left) and distinctive open 'skirted' burrow (right) of *Cataxia sandsorum*. Images by M. Harvey and M. Rix.

Table 5. Geo-located observations of the open-holed spiny trapdoor spider *Cataxia sandsorum*.

Species	Latitude	Longitude	Site	Number
Cataxia sandsorum	34°22'08"S	118°19'40"E	Pyungoorup	Few
Cataxia sandsorum	34°22'03"S	118°19'42"E	Pyungoorup	Few

Species account:

Open-holed spiny trapdoor spider (*Cataxia stirlingi*)

The open-holed spiny trapdoor spider, *Cataxia stirlingi* (Fig. 5), was first described by Main (1985) (as *Neohomogona stirlingi*), and while not currently listed under Western Australian State legislation, is endemic to the Eastern Massif. Unusual among idiopid trapdoor spiders for building an open-holed burrow with no lid (Fig. 5), Western Australian species of *Cataxia* have a highly relictual distribution in the Stirling Range, Porongurup Range and on Mount Manypeaks. *Cataxia stirlingi* was previously known from only a few sites on the western side of the Eastern Massif, with the major population occurring on and around Bluff Knoll. During the survey, numerous specimens were found alive throughout the study region south of Coyanurup and Isongerup Peaks, including in areas not previously known to have had active burrows (Table 6). We therefore surmise that populations of this species are likely to remain viable, irrespective of the fire. One collected individual from adjacent to the Isongerup Track was further DNA sequenced for cytochrome *c* oxidase subunit 1 (*COI*), to confirm the species identification (see Fig. 6). The Isongerup sequence did show population-level divergence from the upper Bluff Knoll populations, but was otherwise consistent with expected genetic variation within a species of *Cataxia*.

Figure 5. Female (left) and distinctive open 'skirted' burrow (right) of *Cataxia stirlingi*. Images by M. Harvey and M. Rix.

Table 6. Geo-located observations of the open-holed spiny trapdoor spider *Cataxia stirlingi*.

Species	Latitude	Longitude	Site	Number
Cataxia stirlingi	34°23'48"S	118°16'07"E	Coyanurup	Numerous
Cataxia stirlingi	34°23'34"S	118°16'03"E	Coyanurup	Numerous
Cataxia stirlingi	34°23'33"S	118°16'04"E	Coyanurup	Numerous
Cataxia stirlingi	34°22'52"S	118°17'20"E	Isongerup	Numerous
Cataxia stirlingi	34°22'51"S	118°17'21"E	Isongerup	Few
Cataxia stirlingi	34°22'48"S	118°17'12"E	Isongerup	Numerous
Cataxia stirlingi	34°22'37"S	118°17'07"E	Isongerup	Numerous
Cataxia stirlingi	34°22'36"S	118°17'08"E	Isongerup	Numerous
Cataxia stirlingi	34°22'52"S	118°17'19"E	Isongerup	Numerous

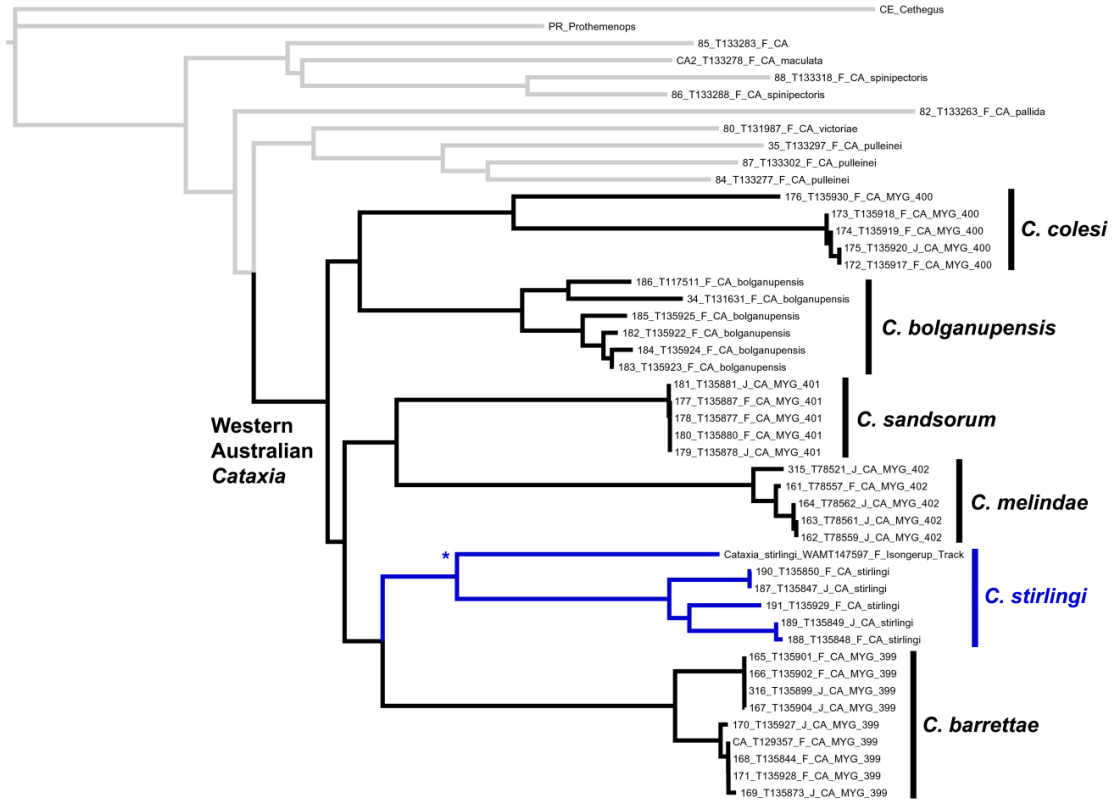

Figure 6. Neighbour-joining tree of the *COI* sequence data, showing *C. stirlingi* in blue and the new specimen from south of Isongerup (WAM T147597) highlighted (*). Legacy data are from Rix et al. (2017).

Species account:

Onychophorans (*Kumbadjena* spp.)

Onychophorans of the genus *Kumbadjena* are extremely rare in the Stirling Range National Park, with only a handful of previous records. During the survey, a population was discovered south of Isongerup for the first time, and additional specimens were collected from south of Pyungoorup Peak, in the same habitat as the rhytidid snail (Table 7).

Table 7. Geo-located observations of onychophorans of the genus *Kumbadjena*.

Species	Latitude	Longitude	Site	Number
Kumbadjena sp.	34°22’52”S	118°17’20”E	Isongerup	1
Kumbadjena sp.	34°22’00”S	118°19’43”E	Pyungoorup	3

Threatened species not accounted for

A number of listed threatened invertebrates endemic to the Eastern Massif were not targeted during this survey (Table 1), especially extremely rare upland-endemic taxa known from only a relatively few specimens. These species are difficult to search for and detect at the best of times, and will require other forms of assessment (e.g. microhabitat mapping) to ascertain the impact of the fire on the highest elevation invertebrate communities.

Licensing and lodgement of specimens

Specimens were collected under a permit issued by the Department of Biodiversity, Conservation & Attractions: Fauna Taking (for Scientific or Other Purposes) Licence (FO25000006) and "Lawful Authority" to take Fauna from CALM Act Lands (issued 22 March 2019). All specimens collected during this survey are lodged in the collections of the Western Australian Museum and Queensland Museum.

References cited

Edward KL, Harvey MS. 2010. A review of the Australian millipede genus *Atelomastix* (Diplopoda: Spirostreptida: Iulomorphidae). *Zootaxa* **2371**: 1–63.

Harvey MS, Main BY, Rix MG, Cooper SJB. 2015. Refugia within refugia: *in situ* speciation and conservation of threatened *Bertmainius* (Araneae: Migidae), a new genus of relictual trapdoor spiders endemic to the mesic zone of south-western Australia. *Invertebrate Systematics* **29**: 511–553.

Main BY. 1985. Further studies on the systematics of ctenizid trapdoor spiders: a review of the Australian genera (Araneae: Mygalomorphae: Ctenizidae). *Australian Journal of Zoology Supplementary Series* **108**: 1–84.

Rix MG, Bain K, Main BY, Raven RJ, Austin AD, Cooper SJB, Harvey MS. 2017. Systematics of the spiny trapdoor spiders of the genus *Cataxia* (Mygalomorphae: Idiopidae) from south-western Australia: documenting a threatened fauna in a sky-island landscape. *Journal of Arachnology* **45**: 395–423.