Spiders (Arachnida: Araneae) of the vegetation layer of the Mkambati Nature Reserve, Eastern Cape, South Africa

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The Pondoland region of the Eastern Cape province, South Africa is very poorly studied with regard to invertebrate diversity, particularly in the case of arachnids. Accordingly, and in view of proposed infrastructural and mining developments in this ecologically sensitive area of high plant endemism, baseline data are provided on spiders (Araneae) of the vegetation layer (i.e. excluding the ground-dwelling fauna) of the Mkambati Nature Reserve (MNR). Spiders were collected at 26 sites (six forest and 20 grassland sites) in the MNR over an eight-day period, using sweep sampling and active searching of flowers in grassland and tree beating in forests, as part of a broader biodiversity survey. Additional specimens were collected with Malaise and pan traps. A total of 1275 specimens were sampled, representing 132 species (6.6% of the total number recorded in South Africa) in 103 genera and 29 families. Theridiidae and Araneidae were the most diverse spider families in the reserve, represented by 22 species each (16.7% of the total), followed by Thomisidae with 19 species (14.4%) and Salticidae with 18 species (13.6%). Grassland and forest had distinct spider faunas, with only 24.2% of species being recorded from both biomes. The average number of species sampled per site in grassland and forest was 26 species for both habitats, although values for the two biomes are not directly comparable because different sampling methods were used. All 132 species are new records for the reserve, of which 20 were new records for the Eastern Cape and at least eight spider species may be new to science. The spider diversity captured despite temporal and methodological limits indicates that many additional species are likely to occur in the reserve.

Conservation implications: If the MNR is not adequately conserved at least five new species, which may be confined to the area, would be at high risk of extinction and 15 other species endemic to the Pondoland and KwaZulu-Natal region would have their risk of extinction increased.

Introduction

The conservation of biodiversity is critical to the well-being of humans owing to its provision of ecosystem services (Millennium Ecosystem Assessment 2005). In addition, biodiversity, especially where unique and rich, can also contribute to economic development through ecotourism (Kepe 2001). However, to identify key areas for conservation and ecotourism and to monitor the effects of protection, management and/or threats, biodiversity inventories are essential and are considered by conservationists as being good investments (Balmford & Gaston 1999; Rohr, Mahan & Kim 2007; Ward & Larivière 2004).

Invertebrates have become recognised as an important component of biodiversity. They are important in all ecosystems with regard to species richness (an estimated 95% of all species are invertebrates), abundance and biomass, and they play vital roles in ecosystem functioning (see, for example, Black, Shepard & Allen 2001; Janzen 1987; Luck, Daily & Ehrlich 2003). Spiders (Araneae) are one of the largest orders of terrestrial invertebrates, with more than 40 000 described species (Platnick 2010), and are predacious in all of their life stages. They therefore play an important role in terrestrial food webs as arthropod population regulators, whilst also providing food for other predators (Gruner 2004; Schmitz 2003).

The South African National Survey of Arachnida was initiated in 1997 to document the diversity and distribution of arachnids in the country (Dippenaar-Schoeman & Craemer 2000). Surveys have been carried out across many of the provinces, biomes, agro-ecosystems and protected areas of South Africa (Dippenaar *et al.* 2008; Dippenaar-Schoeman 2006; Dippenaar-Schoeman & Leroy 2003; Dippenaar-Schoeman *et al.* 1999, 2005; Dippenaar-Schoeman, Van den Berg & Prendini 2009; Foord *et al.* 2008; Haddad & Dippenaar-Schoeman 2009; Haddad, Dippenaar-Schoeman & Wesolowska 2006), thereby generating the data that are critical for a conservation assessment of species and for understanding habitats and vegetation types of conservation concern for arachnids.

Whilst the Pondoland region of the Eastern Cape, South Africa is recognised as a centre of high plant diversity and endemism (Van Wyk & Smith 2001), the spider fauna of the region is still poorly known and no structured surveys or sampling using standard methods and a consistent number of samples across sites (i.e. quantified surveys) have previously been carried out in the region. The environmental impact assessment report for a proposed national toll road through the region acknowledged the poor state of knowledge regarding invertebrates of the area (Branch 2002). Quantified surveys are critical for comparisons of areas and for providing future baseline data for monitoring (Rohr *et al.* 2007).

The Mkambati Nature Reserve (MNR) was selected for the survey of invertebrates in 2008 because of possible tourism development in the reserve (Kepe 2001), the proposed construction of a toll road adjacent to the reserve (Branch 2002; Farrington & Davies 2004), the threat of controversial open cast dune mining in the region and the lack of invertebrate data to support planning and decision-making. The survey targeted a range of invertebrates, including spiders. The objectives of this particular paper are (1) to provide an annotated species list of spiders sampled from the vegetation layer at the MNR, (2) to provide an analysis of the spider faunal composition with regard to taxonomic breakdown and guilds, and (3) to assess the fauna with regard to species abundance or rarity, levels of endemism and the habitats used by species.

Spider guilds can be broadly divided into ground dwellers, plant dwellers and web dwellers. Sampling in the MNR focused mainly on two of these guilds, namely plant dwellers and web dwellers. It should be noted that this survey is still incomplete because few ground dwellers, usually sampled with pitfall traps and litter sampling methods, were collected. Community and detailed habitat analyses will be presented as part of a broader invertebrate publication (Hamer *et al.* in prep.).

Materials and methods

Study area and period

The MNR (31°15′S, 29°56′E) is situated in north-eastern Pondoland, 30 km south of Port Edward in the Eastern Cape, South Africa (Figure 1). This coastal reserve is 7720 ha in size, and comprises mainly open grasslands with patches of coastal, dune and swamp forest (Figure 2). The climate is subtropical, with summer rainfall (annual average = 1200 mm).

We surveyed the MNR between 24 January and 3 February 2008 and sampled a total of 26 sites, which included six forest (coastal forest, swamp forest and dune forest) and 20 grassland sites. The sample sites covered localities from the coast at 16 m.a.s.l., those near wetlands, on rocky hills or slopes, and inland sites at 311 m.a.s.l. (Figure 2; Table 1). Sampling was undertaken primarily by seven Earthwatch Institute volunteers, who had no previous biodiversity survey experience, and seven experienced technicians or scientists under the supervision of the second author. The volunteers attended an introductory presentation on the project and sampling methods and were then trained on site. They received close guidance from the experienced project staff during the actual sampling. Previous studies have shown that volunteers are capable of producing similar diversity results when compared with experienced researchers (Lovell

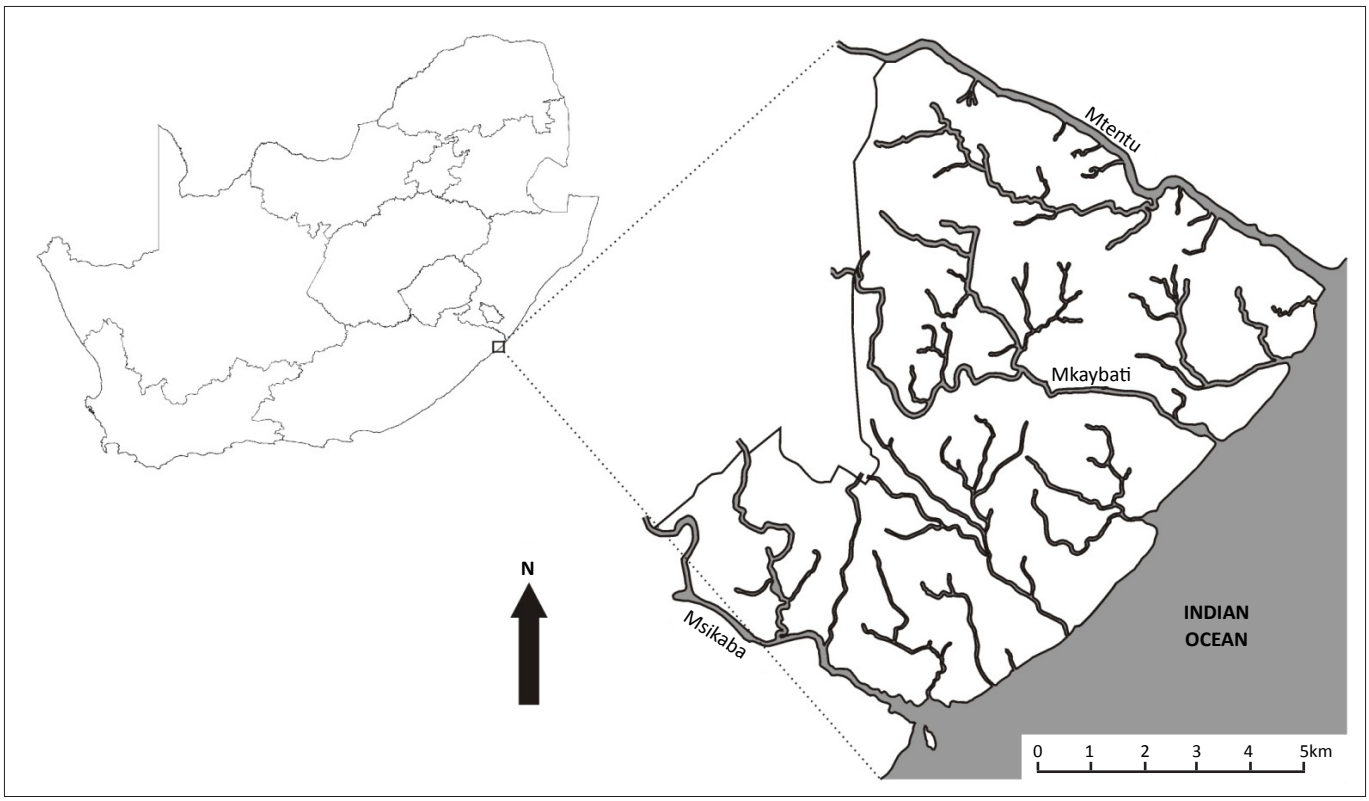

FIGURE 1: Location and extent of the Mkambati Nature Reserve, South Africa and its main river systems.

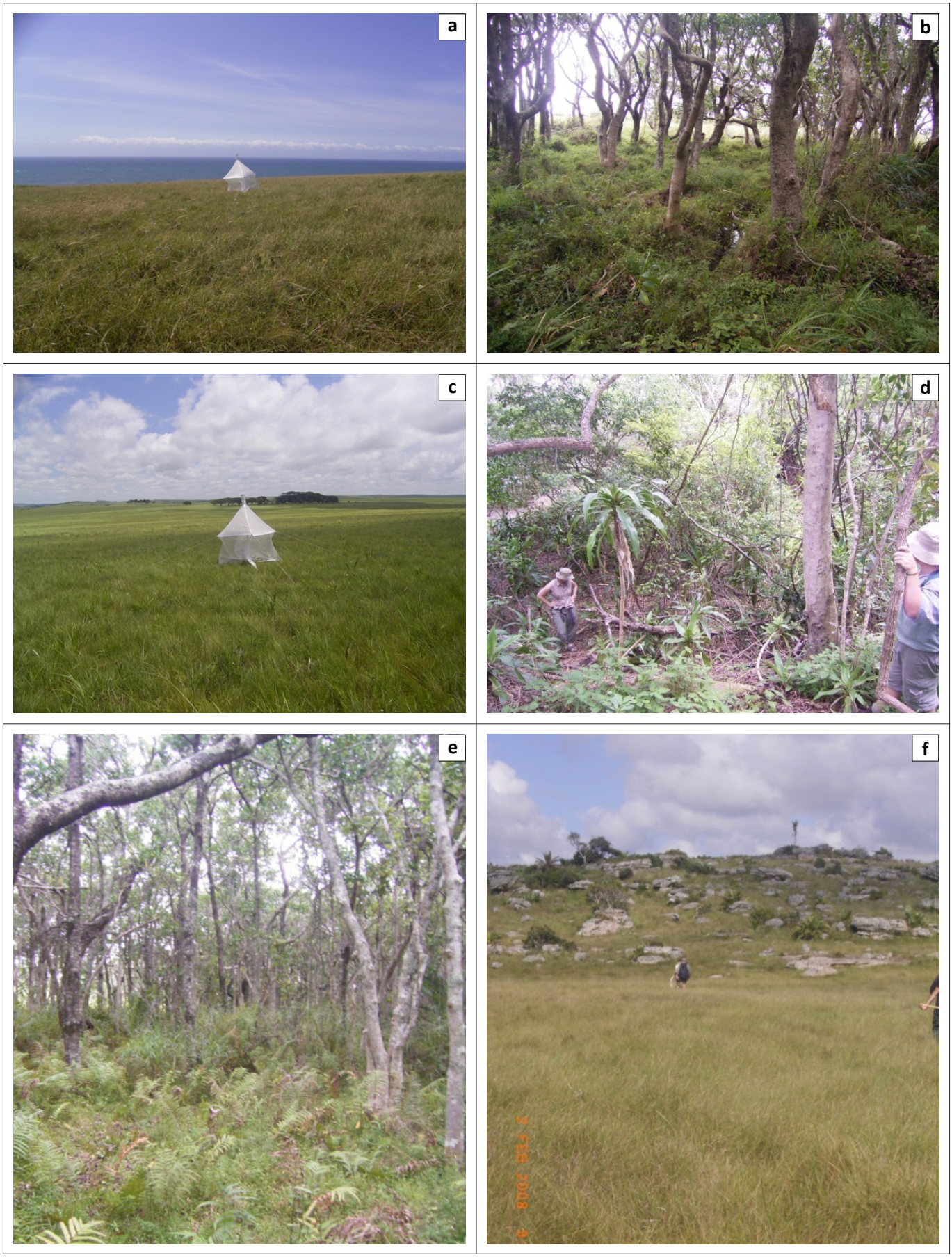

FIGURE 2: Habitats sampled at the Mkambati Nature Reserve: a) Site 1 (grassland), b) Site 11 (forest), c) Site 19 (grassland), d) Site 12 (forest), e) Site 15 (forest), f) Site 10 (grassland), g) Site 25 (grassland) and h) Site 26 (forest).

Figure 2 continues on the next page →

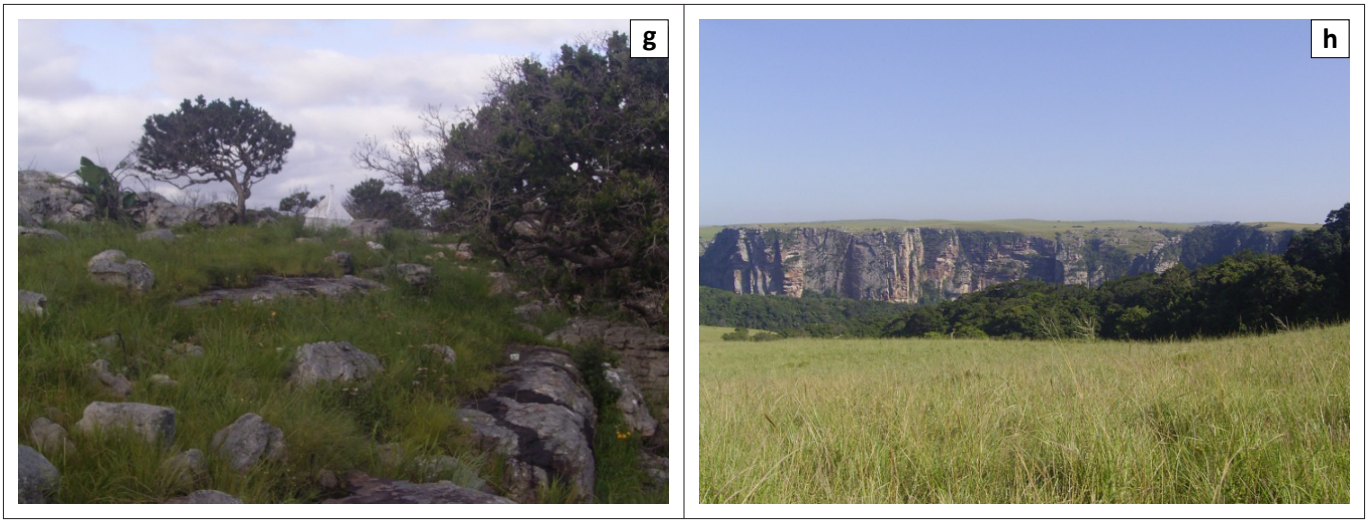

FIGURE 2 (Continues...): Habitats sampled at the Mkambati Nature Reserve: a) Site 1 (grassland), b) Site 11 (forest), c) Site 19 (grassland), d) Site 12 (forest), e) Site 15 (forest), f) Site 10 (grassland), g) Site 25 (grassland) and h) Site 26 (forest).

et al. 2009) and their contribution to the current biodiversity survey was thus considered adequate to get a representation of the spider fauna of the area. Considering the size of the survey team, the sampling effort was 112 'person-days'.

Sampling methods

Details of sampling methods used at each site are provided in Table 1.

Grassland sampling

Grassland sampling included setting one Malaise trap and five each of yellow, blue and white pan traps, which were collected after five days, at each site (approximately 1 ha). Six sweep samples, each comprising 40 sweeps (approximately 1 m apart) with a 50-cm diameter net, were taken from selected sites. Active searching for spiders on 40 flowers was carried out at 10 of the grassland sites. This sampling involved examination of the upper and lower surfaces of each flower and the capture of any spiders observed using a vial. There was no time limit set for examination of flowers.

Forest sampling

Ten trees in each forest site were beaten to sample selected invertebrates, including spiders. For this method each tree was struck 10 times with a beating stick and a white tray (80 cm x 80 cm) was held underneath to collect specimens that dropped from the tree. An aspirator was used to capture small specimens.

Specimens were preserved in 80% ethanol and later sorted in the laboratory according to sample and morphospecies. The first and third authors subsequently identified the specimens to species level, where possible. Voucher specimens are housed at the National Collection of Arachnida of the ARC–Plant Protection Research Institute in Pretoria, South Africa.

Results

Species inventory and faunal composition

A total of 1275 specimens were sampled, representing 132 species (6.6% of the total recorded in South Africa) in 103 genera (95 identified) and 29 families (Appendix and Table 2). Theridiidae and Araneidae were the most diverse spider families sampled in the reserve, represented by 22 species each (16.7% of the total number of species), followed by Thomisidae (19 species; 14.4%) and Salticidae (18 species; 13.6%). *Neoscona blondeli* (Simon, 1885) (Araneidae) represented 13.0% of the spider specimens sampled, followed by *Heliophanus proszynskii* Wesołowska, 2003 (Salticidae) at 7.8% (Table 2). Of the sampled species, 38 (28.8%) could not be identified beyond genus level and a further eight species (6.1%) could not be assigned to a genus. An equal number (66) of web-dwelling and wandering species were sampled (Appendix).

The highest number of individuals (n = 635, 49.8%) was sampled using sweep-netting, followed by tree beating, with which 342 individuals (26.8%) were sampled. Pantraps sampled 206 individuals (16.2%) and other methods provided 92 specimens (7.2%).

Species prevalence, rarity, endemism and habitats

Of the total number of species sampled, 35 (26.5%) occurred only in forest and 65 (49.2%) were confined to grassland. Only 32 species (24.2%) occurred in both habitat types. At one site 45 species (34.1%) were recorded, whilst 40 species (30.3%) were represented by only a single individual (singletons).

No species was sampled at all the sites and only seven species (5%) were recorded from more than 50% of the sampled sites (both forest and grassland). The most regularly collected species across sites were *N. blondeli* and *Copa flavoplumosa* Simon, 1885 (Corinnidae), which were sampled at 20 sites, *Theridion* sp. 1 (Theridiidae) and *Clubiona* sp. 3 (Clubionidae), which were collected from 17 sites, and *H. proszynskii*, which was collected at 16 sites. These were also the most abundant species.

All 132 species are new records for the reserve and eight species (6.1% of the total) may be new to science. These species belong to the genera *Chresiona* Simon, 1903 (Amaurobiidae),

TABLE 1: Details of sites and sampling methods used during the survey at Mkambati Nature Reserve (January–February 2008).

Site	Habitat	Coordinates		Altitude (m)	Sampling method					Number of species
		South	East		FL	MT	PT	SW	TB	
1†	Coastal grassland with forbs	31.2905	30.0112	16	X	X	X	X	-	27
2†	Thick unburnt grass	31.2894	30.0047	52	X	X	X	X	-	29
3	Ridge; burnt grass, short, green, many flowers	31.2950	29.9958	71	-	X	X	-	-	6
4	Wetland area in depression surrounded by low ridges	31.2931	29.9952	64	-	X	X	-	-	15
5	East-facing rocky ridge	31.2756	29.9898	152	-	X	X	-	-	8
6†	Coastal strip; grass mixed with dense forbs	31.2635	30.0379	16	X	X	X	X	-	28
7†	Thick grass with scattered flowers	31.2636	30.0350	28	X	X	X	X	-	27
8†	Thick grass with scattered flowers	31.2680	30.0268	57	X	X	X	X	-	23
9	Wetland, along narrow stream	31.2644	30.0283	32	-	X	X	-	-	9
10	Rocky ledge above river and site 09	31.2643	30.0263	56	-	X	X	-	-	10
F11‡	Forest: coastal forest, with swamp forest in lower area	31.2903	29.9903	-	-	-	-	-	X	28
F12‡	Dune forest	31.3181	29.9672	28	-	-	-	-	X	19
F13‡	Coastal forest	31.2733	30.0229	10	-	-	-	-	X	23
F14‡	Forest along stream	31.2906	29.9767	70	-	-	-	-	X	17
F15‡	Swamp forest	31.3026	29.9766	36	-	-	-	-	X	24
16†	Rocky ledge, burnt grass	31.2309	29.9775	297	X	X	X	X	-	23
17†	Flat, open grassland; frequently burnt	31.2313	29.9752	304	X	X	X	X	-	43
18†	Small rocky ledge; east-facing with short burnt grass	31.2332	29.9696	310	X	X	X	X	-	27
19†	Open grassland; frequently burnt	31.2321	29.9626	311	X	X	X	X	-	31
20†	Rocky ledge along river	31.2536	29.9597	264	X	X	X	X	-	24
21†	Rocky cliff leading down to river; mostly grass with large slabs of rock	31.2641	29.9578	235	X	X	X	X	-	15
22	Grassland, with large rocks; burnt but long, coarse grass	31.3170	29.9674	33	-	X	X	X	-	21
23†	Rocky ledge; frequently burnt grass	31.3008	29.9548	147	X	X	X	X	-	15
24†	Slope leading down to forest; thick Moribund grass	31.3014	29.9526	143	X	X	X	X	-	26
25	Rocky ridge; steep with large rocks and heavily burnt grass	31.3051	29.9627	100	-	X	X	X	-	17
F26‡	Coastal forest; large	31.2960	29.9257	156	-	-	-	-	X	45

FL, flower sampling; MT, Malaise traps; PT, pan traps; SW, sweep-netting; TB, tree beating.
†, Grassland sites at which the full suite of sampling methods targeting spiders was carried out.
‡, Forest sites at which the full suite of sampling methods targeting spiders was carried out.

Araniella Chamberlin & Ivie, 1942, *Cyrtophora* Simon, 1864, *Hypsosinga* Ausserer, 1871 and *Poltys* C.L. Koch, 1843 (Araneidae), *Typhistes* Simon, 1894 (Linyphiidae), *Cheiramiona* Lotz & Dippenaar-Schoeman, 1999 (Miturgidae) and *Tibitanus* Simon, 1907 (Philodromidae). Five of these species may be confined to the reserve or the Pondoland region as they have not been collected previously in surveys of other areas. A further 15 species are known only from the Eastern Cape and one other province, and another 11 species are South African endemics (Appendix).

The number of species recorded at a grassland site, where the full suite of sampling methods was used, ranged between 15 and 43, with an average number of 26 species per site. The range for forests was 17–45 species, also with an average of 26 species per forest. Site 17, a flat, open inland area with frequently burnt grass, had the highest measured richness for grassland. Site F26, a large forest in an inland gorge (known as the Superbowl), had the highest measured forest richness (Table 1).

Discussion

It should be noted that this survey produced a preliminary species list and that additional methods, sites and survey timing will produce many more species. Other spider surveys have shown that species numbers increased with increased sampling effort (e.g. Cardoso *et al.* 2008, 2009; Muelelwa *et al.* 2010). However, given the large efforts and costs required to sample, sort and identify invertebrates such as spiders, completing the inventory is unlikely to occur in the short term. Given the urgency for biodiversity data, especially with regard to invertebrates, even incomplete data sets have relevance. The identification of at least eight possibly new species over eight days of sampling illustrates just how poorly known the fauna of Pondoland is.

The 30% of singletons sampled at the MNR is close to the average of 32% calculated by Coddington *et al*. (2009) from 71 studies. The authors suggested that very high percentages of singletons indicate undersampling, but they also recognised that undersampling is virtually inevitable in most tropical regions when dealing with arthropods. Many other published studies on spider diversity included specimen numbers similar to the total sampled at the MNR, ranging between 75 and 9375 individuals (see Coddington *et al*. 2009). This suggests that the data collected in the current study are not unacceptably incomplete.

Almost half the species recorded could not be identified beyond genus or even family level, which highlights a

common problem with invertebrate surveys. In a survey of the Polokwane Nature Reserve by Dippenaar *et al.* (2008), a similar proportion (35%) of unidentifiable spider species was found. Expertise for identification is usually limited to selected families and global experts may need to be consulted, which creates delays in obtaining data; in many cases even global expertise does not exist. The large number of unidentifiable specimens is also an indication of the incomplete knowledge of the fauna and the figures include the eight species recognised as new. It is possible that additional new species may be found amongst the material not identified to species level. Some of the species could not be identified because only immature specimens were collected, which is another common problem associated with invertebrate surveys.

Comparisons of recorded species richness across spider surveys of other biomes and areas are difficult because in some of the similar spider surveys sampling was not quantified and sampling effort may be unequal. However, Haddad and Dippenaar-Schoeman (2009) provided a range of between 76 and 431 species for South African conserved areas for which published surveys exist. None of the reserves they provided data for were in the forest or grassland biome. For the Polokwane Nature Reserve, 13 821 specimens sampled over a year yielded 275 species (or a sample intensity of 50 specimens per species) (Dippenaar *et al.* 2008). In a heterogeneous area in India, Hore and Uniyal (2008) sampled 3666 individuals over a year, representing 160 species (a sample intensity of 23 specimens per species). At the MNR the sample intensity was approximately nine specimens per species. In spider surveys the ratio of individuals to species is initially low and increases as an increasing number of samples are taken and fewer new morphospecies are sampled (e.g. Cardoso *et al.* 2008). This indicates that the MNR survey (which provided a low specimens-to-species ratio) is only in the initial phase of discovery of biodiversity and supports the suggestion that much more sampling is needed to approach a complete inventory (high ratio value). Coddington *et al*. (2009) calculated sample intensities of less than 10 for some individual sampling methods, where they estimated the survey completeness to be around 60%. The low sample intensity at the MNR could also indicate higher diversity than for areas where large numbers of specimens are required to record additional species.

Forests have been shown in many studies to have high species richness across many taxa, including spiders. This is often attributed to the higher structural complexity in forests (Hore & Uniyal 2008). However, in India, Hore and Uniyal (2008) found that grassland also had high species richness and a diverse assemblage of spiders relative to forests. A similar pattern was evident at the MNR, with grassland sites showing high species richness. This would appear not to conform to the general trend of diversity being associated with obvious habitat heterogeneity (Yen 2009). Of course, the sampling methods used in the two biomes may not be directly comparable with regard to effort, but this aspect of spider diversity should be investigated further.

Hore and Uniyal (2008) found that annual burning of grassland did not seem to affect spider diversity negatively.

TABLE 2: Spider families sampled at the Mkambati Nature Reserve and diversity within each family, in order of decreasing species richness.

Family	Genera	Species	Total
Araneidae	17	22	329
Theridiidae	15	22	201
Thomisidae	12	19	80
Salticidae	14	18	224
Linyphiidae	6	6	74
Philodromidae	4	4	16
Sparassidae	2	4	13
Clubionidae	1	4	73
Dictynidae	2	2	2
Pisauridae	3	3	21
Uloboridae	3	3	12
Scytodidae	1	2	13
Lycosidae	2	2	12
Mimetidae	2	2	8
Corinnidae	2	2	70
Miturgidae	2	2	23
Tetragnathidae	2	2	23
Cyatholipidae	1	1	1
Cyrtaucheniidae	1	1	1
Deinopidae	1	1	6
Gnaphosidae	1	1	1
Anapidae	1	1	1
Oxyopidae	1	1	1
Pholcidae	2	2	39
Amaurobiidae	1	1	1
Selenopidae	1	1	11
Zodariidae	1	1	3
Zoridae	1	1	12
Zoropsidae	1	1	4
Total	**103**	**132**	**1275**

Total indicates the total number of individuals sampled.

This was also seen at the MNR, where two of the frequently burnt grassland sites were amongst the 10 sites of highest species density. This could be explained by higher herbivore density in newly resprouted grass and thus higher prey density, but the diversity of spider species rather than simple abundance is interesting. However, this study did not specifically investigate the effects of burning on spider diversity and conclusions cannot be drawn for the small number of sites sampled.

The site with the highest species density was the largest forest site (F26, the 'Superbowl forest'). This might be explained by higher sampling effort exercised than for the other forests (tree beating was performed in 20 rather than 10 trees), but even so, this forest does house at least one new species that may be a narrow endemic, seven species that are near endemics for the Eastern Cape, and 26 species that were not identified to species level. Additional sampling will be required to validate this preliminary assessment of the sites, but the Superbowl forest appears to be a high priority for the spider fauna. The survey suggests that additional sampling of the spider fauna would be productive, especially in view of the threats to the region. Other aspects that require investigation are the comparison of the grassland and forest habitats with regard to their invertebrate fauna using comparative sampling methods and efforts, and further investigation of fire impacts in the grassland areas.

Conclusion

Baseline data on spiders are provided for the first time for a conserved area in Pondoland, Eastern Cape. A total of 132 species, including at least eight new species, were recorded from the MNR. Grassland and forest sites had a similar average number of species and each had a distinct fauna, indicating that both biomes require conservation measures. A single site yielded 34% of the total number of species recorded, whilst only seven species (5%) were sampled from more than 50% of the sites. Although the survey was not comprehensive, preliminary data suggest a high turnover of species even at the small scale at which the survey was carried out, which means that a large area is likely to be required to conserve the spider fauna. This finding should be considered in setting conservation targets for Pondoland grassland and forest. In addition, any loss of area in the MNR may result in the loss of species in the reserve because most areas have unique species. Of the eight new species recorded, five may be confined to the MNR or the Pondoland area. This means that these species would be at high risk of extinction without the conservation area, and 15 other species endemic to the Pondoland and KwaZulu-Natal region would have their risk of extinction increased if the MNR is not adequately conserved.

The results from this study provide a platform for much needed future spider research in Pondoland, Eastern Cape, and the species data can be used in future conservation and environmental impact assessments.

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Author's contributions

A.S.D. identified most of the material and presented statistical data. M.H. was the project leader, supervised the fieldwork and sorting of material, drafted the manuscript and took habitat photographs. C.H. identified Corinnidae and Salticidae, designed the map, and prepared the manuscript for submission. A.S.D., M.H. and C.H. all contributed to writing the manuscript.

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Appendix

APPENDIX: List of spider species sampled at the Mkambati Nature Reserve (January–February 2008).

Family	Genus/species	GU	DI	Sampling method				Total	HB	Sites
				SN	PT	TB	OM			
Amaurobiidae	*Chresiona* sp. 1†	RWB	5	-	-	1	-	1	F	1
Anapidae	undetermined sp. 1	OWB	?	1	-	-	-	1	G	1
Araneidae	*Araniella* sp. 1	OWB	3	1	-	-	-	1	G	1
	Araneus nigroquadratus Lawrence, 1937	OWB	2	-	-	1	-	1	F	2
	Caerostris sexcuspidata (Fabricius, 1793)	OWB	1	-	-	1	-	1	F	1
	Cyclosa insulana (Costa, 1834)	OWB	1	-	-	1	-	1	F	1
	Cyclosa sp. 2 (immature)	OWB	?	-	-	1	-	1	F	1
	Cyrtophora citricola (Forsskål, 1775)	OWB	1	-	-	2	-	2	F	1
	Cyrtophora sp. 2†	OWB	4	-	-	5	-	5	F	3
	Gea infuscata Tullgren, 1910	OWB	2	15	1	-	-	16	G	8
	Hypsosinga lithyphantoides Caporiacco, 1947	OWB	1	28	-	-	-	28	G	8
	Hypsosinga sp. 2†	OWB	3	20	-	-	-	20	G	8
	Ideocaira transversa Simon, 1903	OWB	3	1	-	3	-	4	F	3
	Isoxya tabulata (Thorell, 1859)	OWB	1	-	-	1	-	1	F	1
	Kilima decens (Blackwall, 1866)	OWB	1	6	-	-	-	6	G	4
	Lipocrea longissima (Simon, 1881)	OWB	1	-	-	1	-	1	F	1
	Neoscona blondeli (Simon, 1885)	OWB	1	122	1	25	18	166	F/G	20
	Neoscona moreli (Vinson, 1863)	OWB	1	1	-	-	2	3	G	2
	Neoscona subfusca (C.L. Koch, 1837)	OWB	1	19	2	1	3	25	F/G	9
	Pararaneus cyrtoscapus (Pocock, 1898)	OWB	1	-	5	1	-	6	F/G	6
	Poltys sp. 1†	OWB	6	-	-	1	-	1	F	1
	Pycnacantha tribulus (Fabricius, 1781)	OWB	2	1	-	-	-	1	G	1
	Singa albodorsata Kauri, 1950	OWB	4	1	-	-	-	1	G	1
	undetermined sp. 1	OWB	?	38	-	-	-	38	G	11
Clubionidae	*Clubiona abbajensis* Strand, 1906	PWA	1	1	2	-	6	9	G	4
	Clubiona pupillaris Lawrence, 1938	PWA	3	3	1	2	1	7	F/G	6
	Clubiona sp. 3	PWA	?	27	7	12	7	53	F/G	17
	Clubiona sp. 4	PWA	?	1	3	-	-	4	F/G	3
Corinnidae	*Afroceto martini* (Simon, 1897)	PWA	1	-	-	-	1	1	G	1
	Copa flavoplumosa Simon, 1885	GWA	1	3	66	-	-	69	G	20
Cyatholipidae	*Cyatholipus quadrimaculatus* Simon, 1894	SWB	4	1	-	-	-	1	G	1
Cyrtaucheniidae	*Homostola abernethyi* (Purcell, 1903)	GWA	5	-	1	-	-	1	G	1
Deinopidae	*Menneus camelus* Pocock, 1902	OWB	3	1	-	5	-	6	F/G	5
Dictynidae	*Dictyna* sp. 1	RWB	?	1	-	-	-	1	G	2
	Mashimo leleupi Lehtinen, 1967	RWB	1	-	-	1	-	1	F	1
Gnaphosidae	*Zelotes* sp. 1 (immature)	GWA	?	-	1	-	-	1	G	1
Linyphiidae	*Mecynidis dentipalpis* Simon, 1894	SWB	4	-	-	5	-	5	F	4
	Microlinphia sterilis (Pavesi, 1883)	SWB	1	-	-	1	-	1	F	1
	Typhistes sp. 1†	SWB	6	1	3	22	1	27	F/G	9
	undetermined sp. 1	SWB	?	6	3	-	-	9	G	10
	undetermined sp. 2	SWB	?	8	4	-	-	12	G	8
	undetermined sp. 3	SWB	?	10	8	1	1	20	F/G	11
Lycosidae	*Hippasa australis* Lawrence, 1927	FWB	1	-	9	-	1	10	G	2
	Pardosa sp. 1 (immature)	GWA	?	1	1	-	-	2	G	2
Mimetidae	*Ero capensis* Simon, 1895	PWA	4	-	-	7	-	7	G	3
	Mimetus natalensis Lawrence, 1938	PWA	3	-	1	-	-	1	G	1
Miturgidae	*Cheiracanthium* sp. 1 (immature)	PWA	?	8	-	-	9	17	G	12
	Cheiramiona sp. 1†	PWA	6	-	-	6	-	6	F	4
Oxyopidae	*Oxyopes* sp. 1 (immature)	PWA	?	1	-	-	-	1	G	1
Philodromidae	*Philodromus* sp. 1 (immature)	PWA	?	2	-	-	-	2	G	2
	Thanatus dorsilineatus Jezequel, 1964	PWA	1	8	-	-	-	8	G	5
	Tibellus seriepunctatus Simon, 1907	PWA	1	4	-	-	-	4	G	3
	Tibitanus sp. 1†	PWA	6	1	1	-	-	2	G	2

GU, guild (FWB, funnel web; GWA, ground wanderer; CWB, cob web; PWA, plant wanderer; RWB, retreat web; SWB, sheet web; SPWB, space web; OWB, orb web).
DI, distribution (6, endemic to reserve; 5, endemic to the Eastern Cape; 4, near endemic to the Eastern Cape (occurs in two provinces); 3, endemic to South Africa; 2, endemic to southern Africa; 1, endemic to the Afrotropical Region; 0, cosmopolitan, occurs outside the Afrotropical Region; ?, data deficient).
Entries in sampling method columns (SN, sweep netting; PT, pan traps; TB, tree beating; OM, other methods) represent the number of individuals sampled by each method; Total, number of individuals sampled.
HB, habitat (G, grassland only; G/F, grassland and forest; F, forest only).
Sites, number of sites at which each species was sampled.
†, Possible new species.

Appendix continues on the next page →

APPENDIX (Continues...): List of spider species sampled at the Mkambati Nature Reserve (January–February 2008).

Family	Genus/species	GU	DI	Sampling method				Total	HB	Sites
				SN	PT	TB	OM			
Pholcidae	*Smeringopus* sp. 1 (immature)	SPWB	?	-	-	1	-	1	F	1
	Spermophora sp. 1	SPWB	?	1	-	37	-	38	F	5
Pisauridae	*Afropisaura rothiformis* (Strand, 1908)	PWA	1	17	-	1	-	18	F/G	8
	Euprosthenopsis vuattouxi Blandin, 1977	SWB	1	-	1	-	-	1	G	1
	Maypacius bilineatus (Pavesi, 1895)	SWB	1	1	1	-	-	2	G	2
Salticidae	*Asemonea stella* Wanless, 1980	PWA	1	2	-	-	-	2	F/G	2
	Evarcha dotata (Peckham & Peckham, 1903)	GWA	1	2	13	-	1	16	G	10
	Heliophanus proszynskii Wesolowska, 2003	PWA	3	85	6	1	7	99	F/G	16
	Heliophanus sp. 2	PWA	?	13	-	-	-	13	G	7
	Icius sp. 1	PWA	?	8	-	-	-	8	G	5
	Klamantia flava Peckham & Peckham, 1903	PWA	4	-	-	5	-	5	F	4
	Langaelurillus sp. 1	GWA	?	1	4	-	-	5	G	4
	Myrmarachne foreli Lessert, 1925	PWA	1	2	-	-	2	4	G	2
	Myrmarachne solitaria Peckham & Peckham, 1903	PWA	3	2	4	-	-	6	G	6
	Nigorella hirsuta Wesołowska, 2009	PWA	2	-	1	-	-	1	G	1
	Pellenes sp. 1 (immature)	GWA	?	1	-	-	-	1	G	3
	Phintella aequipes (Peckham & Peckham, 1903)	PWA	1	-	-	2	-	2	F	2
	Phlegra sp. 1	PWA	?	-	9	2	-	11	F/G	7
	Saitis leighi Peckham & Peckham, 1903	PWA	4	-	1	-	-	1	G	1
	Thyene aperta (Peckham & Peckham, 1903)	PWA	1	2	-	-	-	2	G	2
	Thyene semiargentata (Simon, 1884)	PWA	1	15	2	7	1	25	F/G	13
	Thyenula aurantiaca (Simon, 1902)	PWA	2	-	-	13	2	15	F/G	5
	Thyenula sp. 2	GWA	?	1	5	2	-	8	F/G	8
Scytodidae	*Scytodes caffra* Purcell, 1904	GWA	1	-	1	1	-	2	F/G	2
	Scytodes constellata Lawrence, 1938	PWA	3	-	4	7	-	11	F/G	6
Selenopidae	*Anyphops purcelli* (Lawrence, 1940)	PWA	3	-	1	7	3	11	F/G	6
Sparassidae	*Olios biarmatus* Lessert, 1925	PWA	4	-	-	-	1	1	F	1
	Olios correvoni Lessert, 1921	PWA	2	-	-	-	3	3	G	3
	Olios machadoi Lawrence, 1952	PWA	3	-	1	1	5	7	F/G	6
	Palystes superciliosus L. Koch, 1875	PWA	2	-	-	-	2	2	G	1
Tetragnathidae	*Leucauge festiva* (Blackwall, 1866)	OWB	1	8	-	1	-	9	F/G	6
	Tetragnatha boydi O.P.-Cambridge, 1898	OWB	1	6	-	8	-	14	F/G	8
Theridiidae	*Achaearanea* sp. 1	CWB	?	-	-	7	-	7	F	4
	Anelosimus nelsoni Agnarsson, 2006	CWB	4	-	-	2	-	2	F	1
	Argyrodes convivans Lawrence, 1937	CWB	3	-	-	1	-	1	F	1
	Dipoena sp. 1	CWB	?	2	-	7	-	9	F/G	6
	Dipoenura sp. 1	CWB	?	1	-	35	-	36	F/G	6
	Enoplognatha sp. 1	CWB	?	-	1	-	-	1	G	1
	Euryopis funebris (Hentz, 1850)	CWB	0	-	-	7	-	7	F	4
	Euryopis sp. 2	CWB	?	5	1	-	3	9	G	8
	Euryopis sp. 3	CWB	?	4	2	3	1	10	F/G	6
	Latrodectus geometricus C.L. Koch, 1841	CWB	0	1	-	-	-	1	G	1
	Phoroncidia eburnea (Simon, 1895)	CWB	3	4	-	-	-	4	G	2
	Steatoda capensis Hann, 1990	CWB	0	-	1	-	-	1	G	1
	Theridion piliphilum Strand, 1907	CWB	4	-	-	2	-	2	F	1
	Theridion sp. 2	CWB	?	14	2	22	-	38	F/G	17
	Theridion sp. 3	CWB	?	2	3	11	-	16	F/G	6
	Theridion sp. 4	CWB	?	18	3	11	2	34	F/G	15
	Theridion sp. 5	CWB	?	8	-	2	-	10	F/G	7
	Theridion sp. 6	CWB	?	3	-	2	-	5	F	1
	Tidarren sp. 1 (immature)	CWB	?	1	-	-	-	1	G	1
	undetermined sp. 1	CWB	?	2	-	2	-	4	F	1
	undetermined sp. 2	CWB	?	2	-	-	-	2	G	2
	undetermined sp. 3	CWB	?	1	-	-	-	1	G	1

GU, guild (FWB, funnel web; GWA, ground wanderer; CWB, cob web; PWA, plant wanderer; RWB, retreat web; SWB, sheet web; SPWB, space web; OWB, orb web).
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†, Possible new species.

Appendix continues on the next page →

APPENDIX (Continues...): List of spider species sampled at the Mkambati Nature Reserve (January–February 2008).

Family	Genus/species	GU	DI	Sampling method				Total	HB	Sites
				SN	PT	TB	OM			
Thomisidae	*Ansiae tuckeri* (Lessert, 1919)	PWA	1	1	-	1	-	2	F/G	2
	Avelis hystriculus Simon, 1895	PWA	4	-	-	3	-	3	F	3
	Borboropactus silvicola (Lawrence, 1938)	PWA	4	-	-	1	-	1	F	1
	Monaeses austrinus Simon, 1910	PWA	1	13	-	-	-	13	G	7
	Monaeses pustulosus Pavesi, 1895	PWA	1	3	-	-	-	3	G	3
	Monaeses sp. 3†	PWA	6	6	-	-	-	6	G	4
	Oxytate concolor (Caporiacco, 1947)	PWA	1	-	-	-	1	1	F	1
	Pactates trimaculatus Simon, 1895	PWA	1	1	-	-	-	1	G	2
	Paramystaria variabilis Lessert, 1919	PWA	1	-	-	-	1	1	F	1
	Runcinia flavida (Simon, 1881)	PWA	1	-	-	-	1	1	G	1
	Runcinia grammica (L. Koch, 1937)	PWA	1	8	-	-	-	8	G	3
	Synema imitator (Pavesi, 1883)	PWA	1	3	-	-	-	3	G	2
	Thomisops sulcatus Simon, 1895	PWA	1	2	-	-	-	2	G	2
	Thomisus blandus Karsch, 1880	PWA	1	8	4	-	3	15	G	10
	Thomisus dalmasi Lessert, 1919	PWA	1	-	-	-	1	1	F	1
	Thomisus granulatus Karsch, 1880	PWA	2	1	-	-	-	1	G	1
	Thomisus scrupeus (Simon, 1886)	PWA	1	4	-	2	-	6	F/G	3
	Thomisus stenningi Pocock, 1900	PWA	1	3	-	-	2	5	G	4
	Tmarus comellinii Garcia-Neto, 1989	PWA	1	-	-	7	-	7	F	4
Uloboridae	*Hyptiotes akermani* Wiehle, 1964	OWB	3	-	-	1	-	1	F	1
	Miagrammopes brevicaudus O.P.-Cambridge, 1882	OWB	3	-	-	4	-	4	F	1
	Uloborus planipedius Simon, 1896	OWB	1	-	1	6	-	7	F/G	4
Zodariidae	*Chariobas lineatus* Pocock, 1900	PWA	4	3	-	-	-	3	G	1
Zoridae	*Voraptus affinis* Lessert, 1925	GWA	3	2	10	-	-	12	G	7
Zoropsidae	*Griswoldia transversa* (Griswold, 1991)	GWA	4	-	4	-	-	4	G	3
Total	-	-	-	**635**	**206**	**342**	**92**	**1275**	-	-

GU, guild (FWB, funnel web; GWA, ground wanderer; CWB, cob web; PWA, plant wanderer; RWB, retreat web; SWB, sheet web; SPWB, space web; OWB, orb web).
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