

A CHECKLIST OF THE NON-ACARINE ARACHNIDS (CHELICERATA: ARACHNIDA) OF THE DE HOOP NATURE RESERVE, WESTERN CAPE PROVINCE, SOUTH AFRICA

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ABSTRACT

As part of the South African National Survey of Arachnida (SANSA) in conserved areas, arachnids were collected in the De Hoop Nature Reserve in the Western Cape Province, South Africa. The survey was carried out between 1999 and 2007, and consisted of five intensive surveys between two and 12 days in duration. Arachnids were sampled in five broad habitat types, namely fynbos, wetlands, i.e. De Hoop Vlei, *Eucalyptus* plantations at Potberg and Cupido's Kraal, coastal dunes near Koppie Alleen and the intertidal zone at Koppie Alleen. A total of 274 species representing five orders, 65 families and 191 determined genera were collected, of which spiders (Araneae) were the dominant taxon (252 spp., 174 genera, 53 families). The most species rich families collected were the Salticidae (32 spp.), Thomisidae (26 spp.), Gnaphosidae (21 spp.), Araneidae (18 spp.), Theridiidae (16 spp.) and Corinnidae (15 spp.). Notes are provided on the most commonly collected arachnids in each habitat.

Conservation implications: This study provides valuable baseline data on arachnids conserved in De Hoop Nature Reserve, which can be used for future assessments of habitat transformation, alien invasive species and climate change on arachnid biodiversity.

INTRODUCTION

The South African National Survey of Arachnida (SANSA) was initiated in 1997 to record the biodiversity of arachnids in South Africa (Dippenaar-Schoeman & Craemer 2000). As part of this initiative, surveys are underway in various conservancies, agroecosystems, provinces and biomes. So far, only two long-term surveys have been carried out in Western Cape Province conservancies, namely of the spiders of the Karoo National Park, falling within the Nama Karoo biome (Dippenaar-Schoeman *et al.* 1999), and the Swartberg Nature Reserve, falling within the Succulent Karoo biome (Dippenaar-Schoeman *et al.* 2005). These two surveys indicate a moderately high diversity of spiders in these conservancies, with 116 species (38 families) and 186 species (45 families) recorded from the two reserves, respectively.

The Cape Floristic Region comprises unique vegetation types such as fynbos, which are characterised by high levels of plant endemism. According to Linder (2005) some 9,000 species can be found in the region in an area of approximately 90,000 km². Although the factors influencing insect abundance and diversity in this biome have been well studied (e.g. Giliomee 2003; Procheş & Cowling 2006; Wright & Samways 1996, 1999), little is known on the diversity of arachnids in the Fynbos Biome. Coetzee *et al.* (1990) studied the spiders associated with five proteaceous plant species, Visser *et al.* (1999) studied the arachnids associated with *Protea nitida* Mill., and Sharratt (2000) included arachnids in their assessment of the conservation status of cave-dwelling arthropods of the Cape Peninsula.

The general lack of information regarding arachnid diversity, as well as that for many other invertebrate groups in the Western Cape Province, is a great hindrance to effective conservation planning. Conservation strategies should not only take into account plants and vertebrates, but also need to recognise the role that invertebrates play in ecosystem functioning. Arachnids, with the exception of some phytophagous and parasitic Acari, form an important group of predatory terrestrial arthropods that feed on a wide variety of prey using a range of capture methods, including webs and active hunting strategies. Arachnids are frequently regarded as suitable candidates for studying ecological processes, as 1) they are diverse and abundant, 2) they can be easily sampled, 3) they are functionally significant in ecosystems as predators, and as food for other predators, and 4) they interact with their abiotic and biotic environment in a manner that reflects ecological change (Churchill 1997). Therefore, arachnids can be used to monitor ecosystem stability and changes over time, making them useful organisms in long-term conservation planning. Since fynbos vegetation, which is largely endemic to the Western Cape Province, is under increasing threat from urbanisation, agriculture, alien invasive species and climate change (e.g. Picker & Samways 1996; Richardson *et al.* 1996; McNeely 2001; Midgley *et al.* 2003; Witt & Samways 2004), arachnids provide an alternative taxonomic group to monitor changes in this unique vegetation type.

The present paper aims to report on the diversity of arachnids (excluding the Acari) in the De Hoop Nature Reserve (DHNR) in the Western Cape, which consists of large areas of pristine fynbos and protected marine habitats. Apart from its value as a biodiversity and conservation tool, this checklist can thus be used as a baseline to assess impacts of the aforementioned effects on biodiversity in areas surrounding the reserve. This study forms part of the South African National Survey of Arachnida in conserved areas and the Fynbos Biome, and also contributes towards the checklists of species of the Western Cape Province.

STUDY AREA

DHNR is situated on the south coast of the Western Cape Province, South Africa, and covers an area of

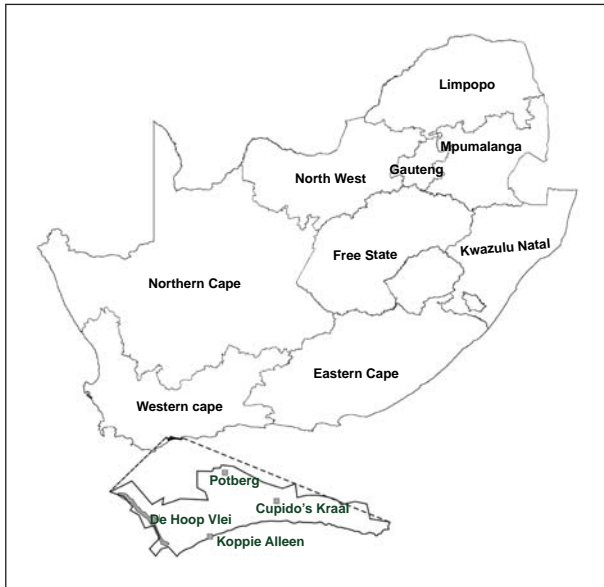


FIGURE 1

Location of the De Hoop Nature Reserve along the South Coast of South Africa. Enlarged map shows key sampling points in the reserve



FIGURES 2-7

Habitats sampled in the De Hoop Nature Reserve: 2) Fynbos (FB); 3) *Eucalyptus* plantation at Potberg (EP); 4) Wetland at De Hoop Vlei (WL); 5-6) Coastal dunes at Koppie Alleen (CD), with natural vegetation (5) and dunes covered with invasive alien *Acacia* species (6); 7) Intertidal zone at Koppie Alleen (IZ)

32,279 hectares terrestrially (Figure 1). In addition, the coastline and adjacent marine areas are also included in the reserve for the protection of the marine environment and its diversity. For the purposes of this survey the reserve was divided into five broad sampling habitats (plant classification follows Germishuizen *et al.* 2006):

1. Fynbos (FB) – the largest portion of the reserve contains typical fynbos vegetation characteristic of this particular floral biome (Figure 2). An upper vegetative layer consisting primarily of taller *Protea* spp. (*P. aurea potbergensis* Rourke, *P. obtusifolia* H.Buek ex Meisn. and *P. repens* (L.) L.) is found in certain areas, particularly near hills and mountains. The field layer comprises a high diversity of fynbos plants, including *Agathosma* spp., *Cliffortia* spp., *Leucodendron* spp., *Phyllica* spp., *Serruria fasciflora* Salisb. ex Knight and *Thamnochortus* spp..

2. *Eucalyptus* plantation (EP) – two large plantations at Potberg and Cupido's Kraal consist primarily of *Eucalyptus camaldulensis* Dehnh., with endemic low-growing shrubs (e.g. *Carissa bispinosa* (L.) Desf. ex Brenan) and other short vegetation (*Agarathus* sp., *Asparagus falcatus* L., *Bidens* sp., *Cynodon dactylon* (L.) Pers. and *Sansevieria hyacinthoides* (L.) Druce) (Figure 3).
3. Wetlands (WL) – a single inland wetland, i.e. the De Hoop Vlei, is situated in the south-west of the reserve (Figure 4). The wetland is separated from the ocean by coastal dunes, and therefore does not form a lagoon *per se*. The De Hoop Vlei is fed by water from the Zout River, the catchment of which receives most of its rainfall during the winter rainfall season. The shores of the wetland are dominated by *Sarcocornia* spp. and *Exomis microphylla* (Thunb.) Aellen., with scattered patches of the reed *Phragmites australis* (Cav.) Steud.. Beyond the shoreline the dominant vegetation includes *Sideroxylon inerme* L. trees and a variety of fynbos species.
4. Coastal dunes (CD) – coastal dune vegetation is found along the entire coastline of the reserve (Figure 5). Sea-facing dunes consist primarily of endemic shrub species, including *Carissa bispinosa*, *Cynanchum obtusifolium* L.f., *Euclea racemosa* Murray, *Passerina rigida* Wikstr., *Ptaeroxylon* spp., *Robsonodendron* sp., *Rhus glauca* Thunb. and *Secamone* spp., interspersed with shorter species such as *Arctotheca populifolia* (P.J.Bergius) Norl., *Asparagus falcatus*, *Bassia diffusa* (Thunb.) Kuntze, *Chironia baccifera* L., *Dasispermum suffruticosum* (P.J.Bergius) B.L.Burt, *Gazania krebsiana* Less., *Limonium scabrum* (Thunb.) Kuntze, *Plantago crassifolia* Forssk., *Silene primuliflora* Eckl. & Zeyh., *Spirobolus* sp., *Trachyandra ciliata* (L.f) Kunth and fynbos vegetation. Many dunes are strongly overgrown with invasive alien plant species such as *Acacia cyclops* A.Cunn ex G.Don and *A. saligna* (Labill.) H.L.Wendl. (Figure 6), occasionally interspersed with fynbos elements.
5. Intertidal zone (IZ) – this habitat includes all rocky shores along the coastline and the vegetation immediately associated with the high tide breaker line (Figure 7). On the rocky shores themselves, various marine algae dominate, while plants associated with the high tide mark include scattered fynbos insertions and coastal dune shrubs.

SAMPLING PERIOD AND METHODS

Intensive sampling for arachnids was carried out during five visits to the reserve. Three of the trips were carried out during early autumn (March 1999 – April 1999, 2004 and 2005) and lasted 10 – 12 days each, the fourth trip was undertaken during the middle of winter (July 2005) and lasted four days, and the last trip took place in spring (September 2007) for two days.

Sampling was undertaken *ad hoc* in each of the habitats by active searching under rocks, logs and in leaf litter, beating foliage, sifting leaf litter and sweeping low-growing vegetation. Additional sampling was conducted by searching under bark in the EP, as this was the only habitat in which loose bark was available. Material was preserved in 70% ethanol for sorting and identification. Due to time and logistical constraints during the sampling trips, material was not collected quantitatively (i.e. according to a set sampling protocol). Thus, the sampling intensity varied considerably between habitats with a bias towards collecting in FB and EP, as these were the easiest habitats to access. However, adequate sampling was conducted in the other three habitats using various methods to give a good indication of the arachnid diversity of each.

Guilds observed

All arachnids were grouped into guilds based on the typical habits known for each family or genus, but also took into consideration the strata in which each species was sampled.



All arachnid orders collected, with the exception of spiders, can be classified as wanderers. Spiders can be separated into wandering and web-building guilds. The wandering arachnids can be broadly separated into ground wanderers (GW) and plant wanderers (PW). For the latter group, distinction was made between spiders associated with foliage (PWF) of plants and those associated with the bark of trees (PWB). Web-building spiders can be separated into various guilds based on the types of webs they construct, namely orb-web builders (OWB), funnel-web builders (FWB), sheet-web builders (SWB), space-web builders (SpWB), hackle-web builders (HWB) and gum-foot-web builders (GWB).

Representative specimens of each species are deposited in the institutions of the various specialists listed in the Acknowledgements, who provided identifications for their respective groups. Material of all the remaining taxa is deposited in the National Collection of Arachnida at the Plant Protection Research Institute, Pretoria, South Africa.

RESULTS & DISCUSSION

Diversity

A total of 274 species of arachnids were collected in DHNR, representing five orders, 65 families and 191 determined genera (Table 1, Appendix 1). The most species rich order was the Araneae, with 252 species in 54 families. This includes one published record of a species that was not collected in the current survey, *Nephila fenestrata* Thorell (Nephilidae) (Fromhage *et al.* 2007). The spider family diversity represents the highest from South Africa, exceeding the 46 families collected in the Western Soutpansberg in Limpopo Province (Foord *et al.* 2002) and Ndumo Game Reserve in KwaZulu-Natal (Haddad *et al.* 2006). The relatively high spider diversity from fynbos is impressive when compared to more structurally complex habitats such as savanna, where greater species diversity could be expected (see Table 2).

The remaining arachnid orders were relatively poorly represented, the most species rich being the Pseudoscorpiones (nine species, five families), followed by Opiliones (eight species,

three families), Scorpiones (four species, three families), and Solifugae (one species, one family). One published record of Scorpiones, of *Parabuthus planicauda* (Pocock) (Buthidae), was found in the literature (Prendini 2004).

As in several other South Africa surveys, Salticidae were the most species rich family (32 spp., 12.7% of spiders), followed by the Thomisidae (26 spp., 10.3%) and Gnaphosidae (21 spp., 8.3%). Several other families contributed 5% or more of the spider species: Araneidae (18 spp., 7.1%), Theridiidae (16 spp., 6.3%) and Corinnidae (15 spp., 6.0%). In contrast to some other reserves previously sampled in South Africa, such as the Ndumo Game Reserve in KwaZulu-Natal, the family composition of spiders was considerably less skewed in the current study (Figure 8). At Ndumo, the five dominant spider families contributed 52% of the species, with the Salticidae dominant (82 spp., 19.0%) (Haddad *et al.* 2006). In contrast, the five families dominating the current study contributed 44.7% of the total spiders, with the dominant Salticidae only contributing 12.7% of the total.

Guilds

The majority of the arachnid species collected in DHNR are wanderers (73.0%), while web-builders comprise 27.0%. When spiders alone are considered, 70.6% are wanderers while 29.4% are web-builders. This compares well with several surveys completed in South Africa (Table 2). This indicates that fynbos and associated habitats sampled in this study are sufficiently heterogeneous to support a fauna similar to that found in more structurally complex habitat types, such as savanna.

Common taxa by stratum

This study was qualitative in its entirety and thus there is no data available on the relative abundance of arachnids. However, based on the frequency of collection and observations made during the study the following species can be recognised as representative of each stratum and guild:

Ground wanderers: A large proportion of the species collected are wandering arachnids on the soil surface (Appendix 1). The coastal dune (CD) fauna was largely dominated by *Pardosa* and *Trabea* spp. (Lycosidae), *Griswoldia robusta* (Simon) (Zoropsidae), *Opopaea speciosa* (Lawrence) (Oonopidae), *Zelotes anchora* Tucker (Gnaphosidae), *Natta* spp. (Salticidae), *Diores simoni* O. P.-Cambridge (Zodariidae) and *Orthobula infima* Simon (Corinnidae).

In the *Eucalyptus* plantation (EP), various gnaphosids (especially *Zelotes*, *Camillina* and *Xerophaeus* spp.), *Caponia capensis* Purcell (Caponiidae), *Opopaea speciosa*, *Xysticus lucifugus* Lawrence (Thomisidae), *Griswoldia robusta* and *Phanotea digitata* Griswold (Zoropsidae), *Lepthercus ratrayi* Hewitt (Nemesiidae), various lycosids, *Fuchiba* and *Fuchibotulus* spp. (Corinnidae) and *Drassodella vasivulva* Tucker (Gallieniellidae) were common.

TABLE 1

Order composition of the non-acarine arachnids of the De Hoop Nature Reserve, Western Cape Province, South Africa

ORDER	COMMON NAME	FAMILIES	GENERA	SPECIES
Araneae	Spiders	53	174	252
Opiliones	Harvestmen	3	5	8
Pseudoscorpiones	False scorpions	5	7	9
Scorpiones	Scorpions	3	4	4
Solifugae	Sun spiders	1	1	1
Total		65	191	274

TABLE 2

Guild composition of spiders collected in the De Hoop Nature Reserve, compared to other surveys carried out in South African conservation areas. Abbreviations: WA – wanderers; WB – web-builders

CONSERVANCY	BIOME	SPP.	%WA	%WB	REFERENCE
De Hoop Nature Res.	Fynbos	252	70.6	29.4	Current study
Karoo Nat. Park	Nama Karoo	116	66.4	33.6	Dippenaar-Schoeman <i>et al.</i> (1999)
Kruger Nat. Park	Savanna	152	79.0	21.0	Dippenaar-Schoeman & Leroy (2003)
Makalali Game Res.	Savanna	268	69.4	30.6	Whitmore <i>et al.</i> (2002)
Mountain Zebra Nat. Park	Nama Karoo	76	53.9	46.1	Dippenaar-Schoeman (2006)
Ndumo Game Res.	Savanna	431	74.2	25.8	Haddad <i>et al.</i> (2006)
Polokwane Nature Res.	Savanna	275	69.5	30.5	Dippenaar <i>et al.</i> (2008)
Roodeplaat Dam Nature Res.	Savanna	110	65.5	34.5	Dippenaar-Schoeman <i>et al.</i> (1989)
Sovenga Hill	Savanna	76	83.9	16.1	Modiba <i>et al.</i> (2005)
Swartberg Nature Res.	Succulent Karoo	186	76.5	23.5	Dippenaar-Schoeman <i>et al.</i> (2005)
Western Soutpansberg	Savanna	127	63.8	36.2	Foord <i>et al.</i> (2002)

Opistacanthus capensis Thorell (Liochelidae) and *Uroplectes lineatus* (C. L. Koch) (Buthidae) were often collected under logs and rocks.

The fynbos (FB) fauna was dominated primarily by lycosids (particularly *Pardosa*, *Trabea* and *Zenonina* spp.), *Drassodella vasiulova*, various gnaphosids (*Camillina*, *Xerophaeus* and *Zelotes* spp.), *Philodromus guineensis* Millot and *Suemus punctatus* Lawrence (Philodromidae) and *Afrilobus* sp. (Orsolobidae). Large numbers of Pseudoscorpiones were collected by sifting leaf litter of *Protea* spp..

The fauna at De Hoop Vlei (WL) was strongly dominated by gnaphosids (*Zelotes* and *Xerophaeus* spp., and *Drassodes ereptor* Purcell), lycosids (*Geolycosa* and *Pardosa* spp.), and *Heliophanus* spp. (Salticidae). Various gnaphosids, corinnids and pseudoscorpions were common in sifted leaf litter of *Sideroxylon inrme* (milkwood) trees near to the wetland.

In the intertidal zone (IZ), only two species were particularly common. *Amaurobioides africanus* Hewitt (Anyphaenidae) was commonly found in retreats constructed in sandstone formations at the back end of the intertidal zone, while *Desis formidabilis* (O.P.-Cambridge) (Desidae) was occasionally collected from beneath limpet shells and between algae on the rocky shores. These two species are regarded as marine specialists, occurring only in association with the intertidal zone along rocky shores (Lamoral 1968).

Ground web-builders: Web-builders were generally uncommon on the ground surface, but several species can be singled out. In CD leaf litter, *Hahnia* spp. (Hahniidae) were frequently found in their sheet-webs, while in FB leaf litter, *Benoitia ocellata* (Pocock) (Agelenidae) and various linyphiids were common. *Lamaika* sp. and *Vidole capensis* (Pocock) (Phyxelididae) were frequently collected in leaf litter and under logs in the EP. The most common web-builders in the WL were *Steatoda capensis* Hann and *Euryopis* sp. 1 (Theridiidae), while very few web-builders were collected from the ground level in IZ.

Arachnids associated with bark: Due to the vegetative structure of fynbos, very few large shrubs and trees are found in most of the habitats sampled. Only the EP contained *Eucalyptus* trees that were large enough to sample arachnids from under bark. Common wandering arachnids collected include *Clubiona* spp. (Clubionidae), *Aneplasa sculpturata* Tucker, *Poecilochroa anomala* (Hewitt) and *Upognampa aplanita* Tucker (Gnaphosidae), *Pseudicius* spp. and *Menemerus bivittatus* (Dufour) (Salticidae), *Platyoides quinquedentatus* Purcell (Trochanteriidae), *Cetonana martini* (Simon) (Corinnidae) and *Uroplectes lineatus* (Buthidae). Dominant web-dwelling spiders include *Theridion* spp. (Theridiidae) and *Neoscona subfusca* (C.L. Koch) (Araneidae). Interestingly, several specimens of the tree trapdoor spider *Moggridgea peringueyi* Simon (Migidae) were collected from their silken burrows under bark.

Foliage wanderers: The fauna of CD was dominated by *Massagris regina* Wesolowska and *Heliophanus* sp. (Salticidae) and predominantly immature *Palystes superciliosus* L. Koch (Sparassidae). Wandering spiders were quite rare in WL, comprising primarily of *Heliophanus* spp., various philodromids, and ground-dwelling lycosids (particularly *Pardosa* spp.) that had wandered onto short vegetation.

In EP, various salticids (*Massagris regina*, *Thyene* and *Heliophanus* spp.), *Oxyopes* and *Hamataliwa* spp. (Oxyopidae), *Synema* spp. (Thomisidae), immature *Tibellus minor* Lessert (Philodromidae) and *Clubiona* spp. (Clubionidae) were collected from short shrubs and creepers. The FB plant-dwellers were considerably more diverse. The most common species collected include *Chariobas* spp. (Zodariidae), various thomisids (*Tmarus*, *Thomisus* and *Misumena* spp.), and salticids (*Thyene* and *Menemerus* spp.).

Foliage web-dwellers: Web-dwellers in the CD and FB were particularly dominated by *Neoscona* and *Cyclosa* spp. (Araneidae), *Theridion* spp. and various linyphiids. Several rare species were also collected in the FB and EP, particularly. The only common web-dweller near the

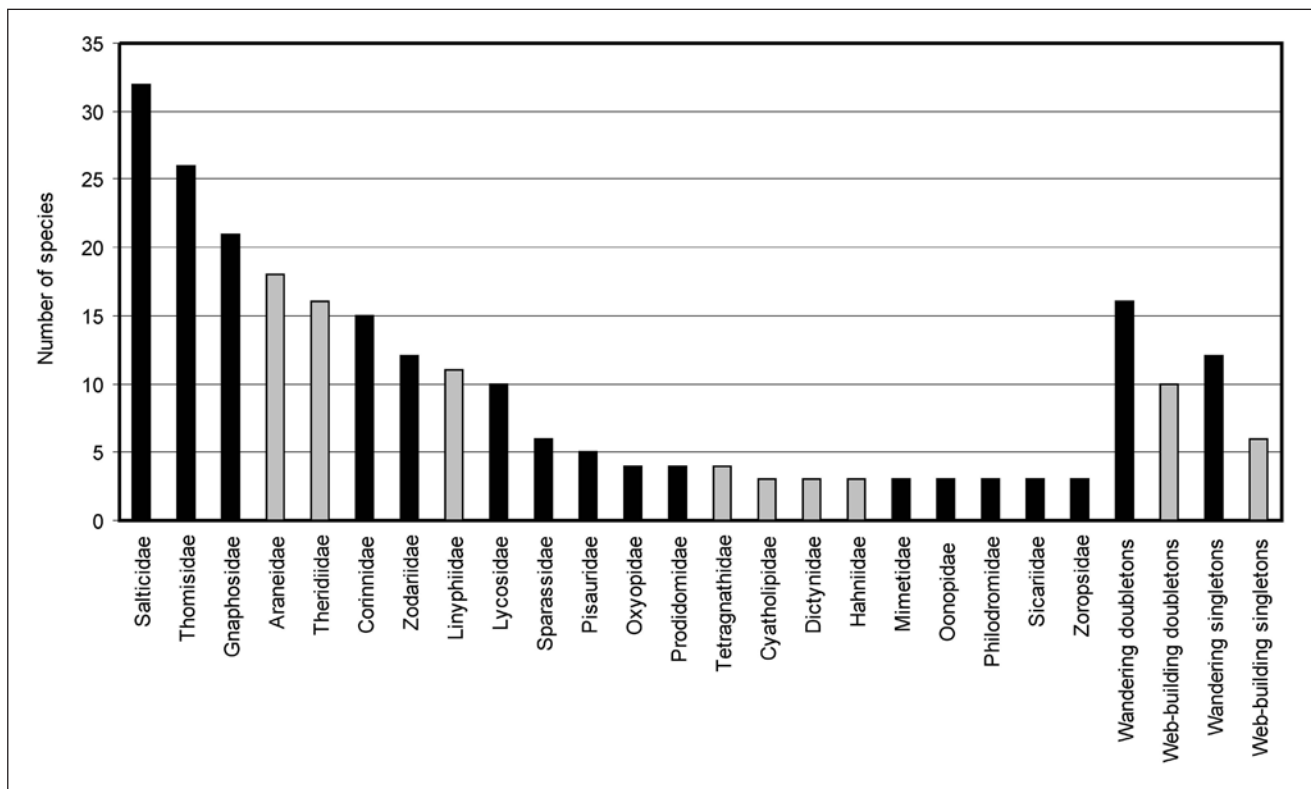


FIGURE 8 Species diversity of spider families collected in the De Hoop Nature Reserve as ranked from highest to lowest. Black bars indicate wandering spiders and grey bars indicate web-builders



IZ was *Larinia natalensis* (Grasshoff) (Araneidae), which constructs its orb-web in creepers and other vegetation between rocky outcrops surrounding the intertidal zone.

CONCLUSION

This study provides the first intensive data on spider diversity in the Fynbos Biome, although two studies have previously been conducted in this vegetation type (Coetzee *et al.* 1990; Visser *et al.* 1999). In total, 274 species of arachnids were collected, with spiders the dominant group (252 species). This diversity represents approximately 12.5% of the currently known South African fauna of approximately 2000 species (Dippenaar-Schoeman & Haddad, unpubl.). While the species diversity is slightly lower than surveys conducted in the Savanna Biome, it compares favourably with studies conducted in the Succulent and Nama Karoo Biomes. The relatively high number of arachnid species collected, and the presence of several fynbos endemics (e.g. 10 of the 15 Corinnidae species), supports the generalised perception that fynbos contains a unique fauna and flora.

The only spiders currently considered to be of conservation importance are the baboon spiders, *Harpactira cafriana* (Walkenaer) and *Harpactirella* sp. Both species are relatively common under rocks and within tussocks of *Thamnochortis* grasses and populations are unlikely to be threatened by occasional collecting. Perhaps also worth noting was the unusual *Stasimopes* sp. (trapdoor spider), of which only males were collected. These have unusual spine-like tubercles in the eye region, something which could not be traced to any described species in the literature. Consequently, this species may possibly be new or an undescribed male of a described species.

The scorpions collected all have a relatively broad distribution within the Western Cape Province (Prendini pers. comm.). For example, *Parabuthus planicauda* (Pocock) was recorded from DHNR by Prendini (2004), but is widespread throughout the Western and Eastern Cape Provinces. The occurrence of these scorpions within a protected area such as DHNR can be considered important for the conservation of the species, particularly when the growing threats to the Fynbos Biome are considered.

In this study several new species and three new genera were collected, some of which have recently been described (Haddad 2006; Haddad & Lyle 2008). This study expanded the distribution ranges known for many species, and provided valuable material for future taxonomic studies. This emphasises the need to expand efforts to survey the arachnid faunas of conservancies throughout South Africa, but particularly within the Western Cape Province, where invertebrate endemism may be relatively high compared to other areas.

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CapeNature invertebrate species database for DHNR, are also acknowledged.

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APPENDIX 1

A checklist of the non-acarine arachnids of the De Hoop Nature Reserve.

Guild abbreviations are provided in the text. Habitat abbreviations: CD – coastal dunes; EP – *Eucalyptus* plantation; FB – fynbos; IZ – intertidal zone; WL – wetlands. Symbols: ☼, † indicates a new species, ‡ indicates a possible new species, and ? indicates a dubious identification.

FAMILY/GENUS/SPECIES	GUILDS	HABITATS
ORDER: ARANEAE (SPIDERS)		
Family: Agelenidae		
<i>Benoitia ocellata</i> (Pocock, 1900)	FWB	FB
Family: Anapidae		
<i>Crozetulus rhodesiensis</i> Brignoli, 1981	OWB	FB
Family: Anyphaenidae		
<i>Amaurobioides africana</i> Hewitt, 1917	GW	IZ

APPENDIX 1 (CONT...)

FAMILY/GENUS/SPECIES	GUILDS	HABITATS
Family: Araneidae		
<i>Araneus apricus</i> (Karsch, 1884)	OWB	EP
<i>A. nigroquadratus</i> Lawrence, 1937	OWB	EP
<i>Argiope trifasciata</i> (Forskål, 1775)	OWB	WL
<i>Caerostris sexcuspidata</i> (Fabricius, 1793)	OWB	EP, WL
<i>Cyclosa insulana</i> (Costa, 1834)	OWB	CD, EP, FB
<i>C. oculata</i> (Walckenaer, 1802)	OWB	FB
<i>Cyrtophora citricola</i> (Forskål, 1775)	OWB	FB
<i>Gea infusca</i> Tullgren, 1910	OWB	WL
<i>Ideocaira transversa</i> Simon, 1903	OWB	EP
<i>Isoxya cicatricosa</i> (C.L. Koch, 1844)	OWB	FB
<i>Kilima</i> sp. ‡	OWB	WL
<i>Larinia natalensis</i> (Grasshoff, 1971)	OWB	FB, IZ
<i>Lipocrea longissima</i> (Simon, 1881)	OWB	FB, WL
<i>Nemoscolus tubicola</i> (Simon, 1887)	OWB	WL
<i>Neoscona rufipalpis</i> (Lucas, 1858)	OWB	WL
<i>N. subfusca</i> (C.L. Koch, 1837)	OWB	CD, EP, FB
<i>Paralarinia bartelsi</i> (Lessert, 1933)	OWB	FB
<i>Prasonica</i> sp. ?	OWB	FB
Family: Caponiidae		
<i>Caponia capensis</i> Purcell, 1904	GW/PWB	CD, EP, FB, WL
Family: Clubionidae		
<i>Clubiona abbajensis</i> Strand, 1906	GW/PWB	EP, FB, WL
<i>Clubiona</i> sp. 2	PWB	EP, FB
Family: Corinnidae		
<i>Apochinomma</i> sp. †	GW	FB
<i>Castianeira fulvipes</i> Simon, 1896	GW	CD, EP, FB
<i>Cetonana martini</i> (Simon, 1896)	GW/PWB	EP, FB
<i>Cetonana</i> sp. 2 †	GW	EP
<i>Cetonana</i> sp. 3 †	GW	FB
<i>Cetonana</i> sp. 4 †	GW	FB
<i>Copa flavoplumosa</i> Simon, 1885	GW	CD, EP, FB
<i>Fuchiba capensis</i> Haddad & Lyle, 2008	GW	EP, FB, WL
<i>Fuchibotulus bicornis</i> Haddad & Lyle, 2008	GW	EP, FB, WL
<i>Graptartia tropicalis</i> Haddad, 2004	GW	CD, EP, FB
<i>Orthobula infirma</i> Simon, 1897	GW	CD, EP, FB, WL
<i>Pronophaea natalica</i> Simon, 1897	GW	EP
<i>Spinotrachelas capensis</i> Haddad, 2006	GW	EP, FB, WL
<i>Trachelas</i> sp. 1 †	PWF	FB
<i>Trachelas</i> sp. 2 †	PWF	FB
Family: Ctenidae		
<i>Thoriosa</i> sp. ‡	GW	EP, FB
Family: Ctenizidae		
<i>Stasimopus</i> sp. ‡	GW	EP, FB
Family: Cyatholipidae		
<i>Cyatholipus quadrimaculatus</i> Simon, 1894	GWB	EP
<i>Cyatholipus</i> sp. 2 †	GWB	EP, FB
<i>Ulwembua denticulata</i> Griswold, 1987	OWB	EP
Family: Cyrtauchenidae		
<i>Homostola reticulata</i> (Purcell, 1902)	GW	EP
Family: Deinopidae		
<i>Avellopsis capensis</i> Purcell, 1904	MOWB	EP, FB
<i>Menneus camelus</i> Pocock, 1902	MOWB	EP, FB
Family: Desidae		
<i>Desis formidabilis</i> (O.P.-Cambridge, 1890)	GW	IZ
Family: Dictynidae		
<i>Archaeodictyna</i> sp.	HWB	FB
<i>Dictyna</i> sp. 1	HWB	FB
<i>Dictyna</i> sp. 2	HWB	FB
Family: Eresidae		
<i>Dresserus collinus</i> Pocock, 1900	SWB	EP, FB
<i>Gandanameno spenceri</i> (Pocock, 1900)	SWB	EP, FB

APPENDIX 1 (CONT...)

FAMILY/GENUS/SPECIES	GUILDS	HABITATS
Family: Gallieniellidae		
<i>Drassodella quinquelabecula</i> Tucker, 1923	GW	FB
<i>D. vasivulva</i> Tucker, 1923	GW	CD, EP, FB
Family: Gnaphosidae		
<i>Aneplesa sculpturata</i> Tucker, 1923	GW/PWB	EP, FB
<i>Aphantaulax stationis</i> Tucker, 1923	GW	CD
<i>Asemesthes</i> sp. imm.	GW	CD
<i>Camillina corrugata</i> (Purcell, 1907)	GW	EP, FB
<i>C. pavesii</i> (Simon, 1897)	GW	EP, FB, WL
<i>C. procurva</i> (Purcell, 1908)	GW	EP, FB
<i>Drassodes ereptor</i> Purcell, 1907	GW	WL
Echeminae sp. indet.	GW	PW
<i>Echemus</i> sp. imm.	GW	WL
<i>Megamyрмаekion schreineri</i> Tucker, 1923	GW	WL
<i>Micaria</i> sp.	GW	CD, FB
<i>Poecilochroa anomala</i> (Hewitt, 1915)	GW/PWB	EP, WL
<i>Setaphis subtilis</i> (Simon, 1897)	GW	EP
<i>Upognampa aplanita</i> Tucker, 1923	GW/PWB	EP, WL
<i>Xerophaeus capensis</i> Purcell, 1907	GW	FB
<i>X. crusculus</i> Tucker, 1923	GW	CD, EP, FB, WL
<i>X. phaseolus</i> Tucker, 1923	GW	EP, FB
<i>Zelotes anchora</i> Tucker, 1923	GW	CD, EP, FB, WL
<i>Z. capsula</i> Tucker, 1923	GW	EP, WL
<i>Z. fuliginus</i> (Purcell, 1907)	GW	EP, FB, WL
<i>Z. montanus</i> (Purcell, 1907)	GW	EP, FB
Family: Hahniidae		
<i>Hahnia clathrata</i> Simon, 1898	SWB	FB
<i>H. tabulicola</i> Simon, 1898	SWB	CD, EP, FB
<i>Hahnia</i> sp. 3‡	SWB	EP
Family: Idiopidae		
Idiopidae sp.	GW	EP
Family: Liocranidae		
<i>Rhaeboctesis</i> sp.	GW	FB
Family: Linyphiidae		
<i>Callitirchia</i> sp.	SWB	CD, FB
<i>Ceratinopsis dippenaari</i> Jocqué, 1984?	SWB	CD, FB
Linyphiidae sp. 1	SWB	FB
Linyphiidae sp. 2	SWB	FB
Linyphiidae sp. 3	SWB	FB
Linyphiidae sp. 4	SWB	FB
<i>Mecynidis</i> sp.†	SWB	FB
<i>Meioneta</i> sp.	SWB	FB
<i>Metaleptyphantus</i> sp.	SWB	FB
<i>Microlinyphia sterilis</i> (Pavesi, 1883)	SWB	EP, FB
<i>Ostearius melanopygius</i> (O.P.-Cambridge, 1879)	SWB	WL
Family: Lycosidae		
<i>Arctosa</i> sp.	GW	CD
<i>Hogna</i> sp.	GW	EP, FB, WL
<i>Lycosa</i> sp.	GW	EP
<i>Pardosa</i> sp. 1	GW	CD
<i>Pardosa</i> sp. 2	GW	CD
<i>Proevippa albiventris</i> (Simon, 1898)	GW	WL
<i>Trabea purcelli</i> Roewer, 1951	GW	CD, WL
<i>T. rubriceps</i> Lawrence, 1952	GW	EP, FB, WL
<i>Trochosa</i> sp.?	GW	WL
<i>Zenonina</i> sp.	GW	EP, FB, WL
Family: Migidae		
<i>Moggridgea peringueyi</i> Simon, 1903	PWB	EP
Family: Mimetidae		
<i>Ero</i> sp.	PWF	EP
<i>Mimetus</i> sp. 1‡	PWF	EP
<i>Mimetus</i> sp. 2‡	PWF	WL

TABLE CONTINUES ON THE NEXT COLUMN

APPENDIX 1 (CONT...)

FAMILY/GENUS/SPECIES	GUILDS	HABITATS
Family: Miturgidae		
<i>Cheiramiona ansiae</i> Lotz, 2002	PWF	FB
Family: Nemesiidae		
<i>Lepthercus rattrayi</i> Hewitt, 1917	GW	CD, EP, FB, WL
<i>Pionothele</i> sp.†	GW	EP
Family: Nephilidae		
<i>Nephila fenestrata</i> Thorell, 1859	OWB	FB
Family: Oecobiidae		
<i>Oecobius navus</i> Blackwall, 1859	PWB	CD, FB
Family: Oonopidae		
<i>Gamasomorpha humicola</i> Lawrence, 1947	GW	FB
Oonopinae sp.	GW	EP, FB
<i>Opopaea speciosa</i> (Lawrence, 1952)	GW	CD, EP, FB, WL
Family: Orsolobidae		
<i>Afrilobus</i> sp.†	GW	CD, EP, FB
Family: Oxyopidae		
<i>Hamataliwa kulczynski</i> (Lessert, 1915)	PWF	EP, FB
<i>Hamataliwa</i> sp. 2	PWF	EP, FB
<i>Oxyopes russoi</i> Caporiacco, 1940?	PWF	EP
<i>Oxyopes</i> sp. 2 imm.	PWF	EP
Family: Palpimanidae		
<i>Palpimanus</i> sp. 1	GW	EP, FB, WL
<i>Palpimanus</i> sp. 2	GW	EP
Family: Philodromidae		
<i>Philodromus guineensis</i> Millot, 1941	GW	FB
<i>Suemus punctatus</i> Lawrence, 1938	GW	CD, EP, FB, WL
<i>Tibellus minor</i> Lessert, 1919	PWF	EP, FB
Family: Pholcidae		
<i>Quamtana</i> sp.	SpWB	CD, FB
<i>Smeringopus</i> sp.	SpWB	EP, FB
Family: Phyxelididae		
<i>Lamaika</i> sp.†	HWB	EP, FB
<i>Vidole capensis</i> (Pocock, 1900)	HWB	EP, FB
Family: Pisauridae		
<i>Chiasmopes</i> sp. imm.	PWF	FB
<i>Cispus</i> sp.	PWF	FB
<i>Euprosthenoopsis</i> sp. imm.	PWF	FB
<i>Rothus purpurissatus</i> Simon, 1898	PWF	EP, FB
<i>Thalassius spinosissimus</i> (Karsch, 1879)	GW	WL
Family: Prodidomidae		
<i>Prodidomus capensis</i> Purcell, 1904	GW	FB
<i>Theuma ababensis</i> Tucker, 1923	GW	EP
<i>T. capensis</i> Purcell, 1907	GW	FB
<i>T. schreineri</i> Purcell, 1907?	GW	FB
Family: Salticidae		
<i>Asemonea</i> sp.	PWF	EP
<i>Baryphas ahenus</i> Simon, 1902	PWF	FB
<i>Dendryphantus purcelli</i> Peckham & Peckham, 1903	PWF	EP
<i>Euophrys purcelli</i> Peckham & Peckham, 1903	GW	FB
<i>Euophrys</i> sp. 2‡	GW	EP, FB
<i>Evarcha dotata</i> (Peckham & Peckham, 1903)	PWF	EP
<i>Habrocestum sapiens</i> (Peckham & Peckham, 1903)	GW	FB
<i>Habrocestum</i> sp. 2	GW	EP
<i>Heliophanus claviger</i> Simon, 1901	PW	FB
<i>H. modicus</i> Peckham & Peckham, 1903	GW	EP, FB, WL
<i>H. patellaris</i> Simon, 1901	GW	WL
<i>Heliophanus</i> sp. 4	GW/PWF	CD, IZ
<i>Massagris regina</i> Wesolowska, 1993	GW	CD, EP, FB, IZ, WL
<i>Menemerus bivittatus</i> (Dufour, 1831)	PWB	EP
<i>Menemerus</i> sp. 2	PWF	FB
<i>Myrmarachne leleupi</i> Wanless, 1978	GW	CD, FB
<i>Myrmarachne</i> sp. 2	GW	FB

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APPENDIX 1 (CONT...)

FAMILY/GENUS/SPECIES	GUILDS	HABITATS
<i>Natta chionogastra</i> (Simon, 1901)	GW	EP, FB
<i>N. horizontalis</i> Karsch, 1879	GW	CD, EP, FB
<i>Pellenes geniculatus</i> (Simon, 1868)?	GW	FB, WL
<i>Phintella aequipes</i> (Peckham & Peckham, 1903)	GW	EP
<i>Phlegra</i> sp.?	GW	EP
<i>Pignus</i> sp.‡	GW	EP
<i>Pseudicius africanus</i> Peckham & Peckham, 1903	PWB	EP
<i>Pseudicius</i> sp. 2	PWF	FB
<i>Rhene</i> sp. imm.	PWF	FB
Salticidae sp. indet. 1	PWF	FB
Salticidae sp. indet. 2	GW	CD
<i>Thyene inflata</i> (Gerstaecker, 1873)	PWF	EP, FB
<i>T. ogdeni</i> Peckham & Peckham, 1903?	PWF	EP, FB
<i>Thyene</i> sp. 3	PWF	FB
<i>Thyenula</i> sp.?	GW	EP
Family: Scytodidae		
<i>Scytodes cedri</i> Purcell, 1904	GW	CD, EP, FB, WL
<i>Scytodes</i> sp. 2	GW	EP
Family: Segestriidae		
<i>Ariadna</i> sp.	TWB	FB
Family: Selenopidae		
<i>Anyphops capensis</i> (Lawrence, 1940)	PWB	EP, FB
<i>Anyphops</i> sp. 2	PWB	EP, FB, WL
Family: Sicariidae		
<i>Loxosceles spinulosa</i> Purcell, 1904	GW	EP, FB
<i>Loxosceles</i> sp.‡	GW	EP
<i>Sicarius spatulatus</i> Pocock, 1901	GW	EP, FB
Family: Sparassidae		
<i>Olios</i> sp. 1	PWF	FB
<i>Olios</i> sp. 2	PWF	FB
<i>Palystes castaneus</i> (Latrielle, 1819)	PWF	EP, FB
<i>P. superciliosus</i> L. Koch, 1875	PWF	CD, EP, FB
<i>Panaretella</i> sp.	PWF	FB
<i>Pseudomicrommata</i> sp.	PWF	FB
Family: Tetragnathidae		
<i>Leucauge festiva</i> (Blackwall, 1866)	OWB	EP, FB, WL
<i>L. levanderi</i> (Kulzcynski, 1901)	OWB	EP, FB, WL
<i>Tetragnatha ceylonica</i> O.P.-Cambridge, 1869	OWB	EP, FB
<i>Tetragnatha</i> sp. 2	OWB	EP
Family: Theraphosidae		
<i>Harpactira cafreriana</i> (Walkenaer, 1837)	GW	EP, FB
<i>Harpactirella</i> sp.	GW	FB
Family: Theridiidae		
<i>Achaeearanea</i> sp.	GWB	EP
<i>Anelosimus</i> sp. 1	GWB	FB
<i>Anelosimus</i> sp. 2	GWB	FB
<i>Dipoena</i> sp. 1	GWB	CD, EP, FB
<i>Dipoena</i> sp. 2	GWB	FB
<i>Dipoenura</i> sp.	GWB	FB
<i>Euryopsis</i> sp. 1	GWB	FB, WL
<i>Euryopsis</i> sp. 2	GWB	FB
<i>Latrodectus geometricus</i> C.L. Koch, 1841	GWB	EP, FB
<i>L. indistinctus</i> O.P.-Cambridge, 1904	GWB	EP
<i>Pholcomma</i> sp.?	GWB	FB
<i>Phoroncidia capensis</i> (Simon, 1895)?	GWB	EP
<i>Steatoda capensis</i> Hann, 1990	GWB	EP, FB, IZ
<i>Theridion delicatum</i> O.P.-Cambridge, 1904	GWB	EP, FB
<i>Theridion</i> sp. 2	GWB	EP, FB
<i>Theridion</i> sp. 3	GWB	EP
Family: Theridiosomatidae		
Theridiosomatidae sp.	OWB	FB
Family: Thomisidae		

APPENDIX 1 (CONT...)

FAMILY/GENUS/SPECIES	GUILDS	HABITATS
<i>Avelis hystriculus</i> Simon, 1895?	PWF	EP
<i>Diæa</i> sp.‡	PWF	EP, FB
<i>Firmicus abnormis</i> Lessert, 1923	PWF	EP, FB
<i>F. bragantinus</i> (Brito Capello, 1866)	PWF	FB
<i>Heterogriffus berlandi</i> (Lessert, 1938)	PWF	EP, FB
<i>Heterogriffus</i> sp. 2‡	PWF	FB
<i>Holopelus almaie</i> Dippenaar-Schoeman, 1986	PWF	FB
<i>Monaeses pustulosus</i> Pavesi, 1895	PWF	FB
<i>Oxytate argenteooculata</i> (Simon, 1886)	PWF	EP, FB
<i>Pactactes obesus</i> Simon, 1895	GW	CD, EP, FB, WL
<i>Pherecydes tuberculatus</i> O.P.-Cambridge, 1883	PWF	FB
<i>Pherecydes</i> sp. 2‡	PWF	EP, FB
<i>Phrynarachne melleoleitoa</i> Lessert, 1933	PWF	EP
<i>P. rugosa</i> (Latreille, 1804)	GW	EP
<i>Runcinia aethiops</i> (Simon, 1901)	PWF	EP, FB
<i>Simorcus capensis</i> Simon, 1895	PWF	FB
<i>Stiphropus</i> sp.	GW	FB
<i>Synema abnorme</i> Lessert, 1923	PWF	EP, FB
<i>S. decens</i> (Karsch, 1878)	PWF	EP, FB
<i>S. nigrotibiale</i> Lessert, 1919	PWF	EP, FB
<i>Thomisus australis</i> Comellini, 1957	PWF	FB
<i>T. stenningi</i> Pocock, 1900	PWF	FB
<i>Tmarus comellinii</i> Garcia-Neto, 1989	PWF	EP, FB
<i>T. foliatus</i> Lessert, 1928	PWF	FB
<i>Tmarus</i> sp. 3‡	PWF	EP, FB
<i>Xysticus lucifugus</i> Lawrence, 1937	GW	EP, FB
Family: Trochanteriidae		
<i>Platyoides leppanae</i> Pocock, 1902	PWB	EP
<i>P. quinquedentatus</i> Purcell, 1907	PWB	EP
Family: Uloboridae		
<i>Miagrammopes brevicaudus</i> O.P.-Cambridge, 1882	MOWB	EP
<i>Uloborus</i> sp. imm.	OWB	CD, EP, FB
Family: Zodariidae		
<i>Caesetius globicoxis</i> (Lawrence, 1942)	GW	EP, FB
<i>Chariobas cylindraceus</i> Simon, 1893?	PWF	EP, FB
<i>Chariobas</i> sp. 2‡	PWF	FB
<i>Chariobas</i> sp. 3‡	PWF	FB
<i>Cyriocetea griswoldorum</i> Platnick & Jocqué, 1993	GW	EP, FB
<i>Diores simoni</i> O.P.-Cambridge, 1904?	GW	CD, FB, WL
<i>Heradida extima</i> Jocqué, 1987	GW	WL
<i>Procydrela precursor</i> Jocqué, 2000	GW	FB
<i>Psammorygma</i> sp.	GW	FB
<i>Ranops</i> sp.?	GW	CD
<i>Rotundrela rotunda</i> Jocqué, 2000	GW	EP, FB
<i>Systemoplacis</i> sp.‡	GW	EP, FB
Family: Zoridae		
<i>Voraptus</i> sp.	GW/PWF	EP, FB
Family: Zoropsidae		
<i>Griswoldia robusta</i> (Simon, 1898)	GW	CD, EP, FB, IZ, WL
Machadoniinae sp.	GW	FB
<i>Phanotea digitata</i> Griswold, 1994	GW	CD, EP, FB
ORDER: OPILIONES (HARVESTMEN)		
Family: Caddidae		
<i>Caddella</i> sp.‡	GW	CD
Family: Phalangiidae		
<i>Rhampsinitus vittatus</i> Lawrence, 1931?	GW	CD, EP, FB
Family: Triaenonychidae		
<i>Adaeum spatulatum</i> Lawrence, 1931	GW	EP, FB, WL
<i>Ceratomontia annae</i> Lawrence, 1934	GW	FB
<i>C. karoensis</i> Lawrence, 1931	GW	FB, WL
<i>C. minor</i> Lawrence, 1931	GW	FB, WL

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APPENDIX 1 (CONT...)

FAMILY/GENUS/SPECIES	GUILDS	HABITATS
<i>Larifuqa granulosa</i> Lawrence, 1931	GW	EP, FB
Triakononychidae sp. imm.	GW	EP
ORDER: PSEUDOSCORPIONES (FALSE SCORPIONS)		
Family: Atemnidae		
<i>Cyclatennus</i> sp.	GW	IZ
Family: Cheliferidae		
<i>Beierius simplex</i> Beier, 1955	GW	FB
<i>B. walliskewi</i> (Ellingsen, 1912)	GW	FB
<i>Hansenius</i> sp.	GW	EP
Family: Chernetidae		
<i>Caffrowithius biseriatus</i> Mahnert, 1983	GW	FB
<i>C. natalensis</i> (Beier, 1947)	GW	FB
<i>Pselaphochernes natalensis</i> Beier, 1947	GW	FB
Family: Geogarypidae		
<i>Geogarypus purcelli</i> (Ellingsen, 1912)	GW	EP, IZ
Family: Tridenchthoniidae		
<i>Anaulacodithella angustimana</i> Beier, 1955	GW	FB
ORDER: SCORPIONES (SCORPIONS)		
Family: Buthidae		
<i>Parabuthus planicauda</i> (Pocock, 1889)	GW	CD, EP, FB
<i>Uroplectes lineatus</i> (C.L. Koch, 1844)	GW/PWB	EP, FB, WL
Family: Liochelidae		
<i>Opistacanthus capensis</i> Thorell, 1877	GW	EP, FB
Family: Scorpionidae		
<i>Opisthophthalmus macer</i> Thorell, 1877	GW	EP
ORDER: SOLIFUGAE (SUN-SPIDERS)		
Family: Solpugidae		
<i>Solpugema</i> sp. imm.	GW	FB