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Australian spiders: an opportunity for conservation

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Abstract – Attempts to conserve invertebrates face many conceptual and practical problems. Spiders are one group of invertebrates with an undeserved bad public image, and it could be thought that any attempt to promote spider conservation in Australia would be seen as a waste of time and effort. The utilitarian values of and the threats to spiders are summarised. It is argued that spiders have one advantage over most over groups of invertebrates: they are well known, although not well appreciated, by most of the populace. It is suggested that spider conservation in Australia is at a stage where programmes emphasising the positive benefits of spiders may result in a more sympathetic attitude towards spiders.

INTRODUCTION

There is probably more fear and misunderstanding for two large groups of animals, snakes and spiders, than for any other animals at similar levels of classification. There are possibly three reasons for this: both are carnivorous, both contain venomous species, and both contain species that generally do not make much noise.

There is a very real fear of spiders (arachnophobia) amongst a significant proportion of the Australian people exacerbated by sensationalist popular media. This is due to occurrence of three species whose venom has resulted in human fatalities, such as the funnel-web spiders *Atrax robustus* Cambridge and *Hadronyche formidablis* (Rainbow), and the redback spider, *Latrodectus hasselti* Thorell, and other species that have possibly undeserved bad reputations, including the white-tail spider, *Lampona cylindrata* (Koch). From 1927–1980, 14 deaths were reported due to funnel-web spider bites, but none have occurred since the development of an antivenom (Queensland Museum 1987a). More people have been bitten by redback spiders, and there were 13 deaths up to 1956, and between 1968–1976, nearly 2,000 people were supposedly bitten; however, there have been no deaths since the development of an antivenom (Raven and Gallon 1987).

With the development of antivenom, people have to learn to live with funnel-web spiders. Ironically, the largest human settlement in Australia (Sydney), is located in the centre of funnel-web spider distribution and, in fact, urbanisation may be threatening some species of funnel-webs such as the southern tree funnel-web, *Hadronyche cerberea* Koch, which is found in swampy paperbark forest destined for housing subdivision (Gray 1992).

It is interesting to compare public attitudes towards the introduced honey bee, *Apis mellifera* L., and spiders. Between 1960–1970, more people died as a result of bee venom than from spider venom in Australia (Southcott 1978), and many people have severe allergies to bee venom (Sutherland 1981), yet bees are deemed to be of commercial importance and are not feared in the same way as spiders. In contrast, most people are unaware of the ecological importance of spiders, and thus do not view them as important. Spiders are probably the most important group of predatory invertebrates in urban, horticultural and agricultural systems (Humphreys 1988).

Although spiders have been the subject of almost universal fear, there was an early call for the conservation of spiders by McKeown (1936), who outlined the harmless and useful nature of the vast majority of species whose names were tarnished by the very small number of "deadly" species. Later calls for spider conservation were made by Main (1976, 1987a,b, 1991b).

This paper is dedicated to Barbara York Main for her admirable achievements in arachnology, including her championing the need for spider conservation.

This paper briefly summarises the history of spider conservation in Australia, and the possible threatening processes that confront spiders. The importance of spiders is outlined, and it is proposed that the bad public image that spiders have can be used to promote their conservation because spiders, as a group of invertebrates, are well known.

Table 1 Australian spiders that have been listed as 'threatened'. Information derived from the following references (1) Hill and Michaelis (1988); (2) Davey *et al.* (1992); and (3) Watts (1992).

SPECIES	DISTRIBUTION	HABITAT	THREAT	REFERENCE
Aganippe raphiduca Rainbow and Pulleine	WA (Rottnest Is.)	Swamp	Tourism	1
Aganippe smeatoni Hogg	SA			3
Anidiops sp.	SA			3
Arbanitis inornatus (Rainbow and Pulleine)	WA			1
Idiosoma nigrum Main	WA	Forest	Pastoral clearing/ agriculture	1
Kwonkan anatolian Main	SA		Pastoral/ agriculture	1,3
Kwonkan eboracum Main	WA		agriculture	1
Kwonkan moriartii Main	WA		pastoral, agriculture	1
Kwonkan wonganensis (Main)	WA		pastoral, agriculture	1
Moggridgea australis Main	SA (Kangaroo Is.)			3
Troglodiplura lowyri Main	WA	Cave	recreation	1,2

LISTINGS OF THREATENED SPECIES OF SPIDERS IN AUSTRALIA

Selected threatened species have been used as flagships to educate the public about the need for conservation. In the cases of the less speciose groups of vertebrates, this generally includes all known threatened species, usually brought together in national lists, or as international lists such as in the IUCN Red Data books. For the more speciose invertebrates, lack of information prevents compilation of large lists of threatened taxa, and generally a small number of taxa is listed as flagships for other, still undocumented, threatened taxa. Six species of spiders are listed in the IUCN Invertebrate Red Data Book (Wells *et al.* 1983). In the more recent 1988 IUCN Red List of Threatened Animals there are at least 16 species (14 species and one genus) of spiders (IUCN 1988), although none are Australian.

In Australia, there are 11 species of spiders that have been listed as possibly under threat (Table 1) (Hill and Michaelis 1988; Davey *et al.* 1992; Watts 1992). All 11 species are either trapdoor or cave-dwelling spiders, which probably reflects two groups of spiders that have been given greater attention rather than the absence of threatened species in other groups of spiders. It is important to note that as more information becomes available, some of these listed spiders may be found not to be threatened, while other species may be added to the list.

THREATS TO SPIDERS IN AUSTRALIA

On the international level, the main threat to spiders is habitat loss including destruction of caves, drainage of wetlands, forestry, agriculture, commercial development, and urbanisation (Wells *et al.* 1981). While these same threats operate in Australia, spiders are faced with threats that can be grouped into three major categories: (1) habitat destruction and fragmentation; (2) habitat management regimes; and (3) biotic interactions.

Habitat destruction and fragmentation

Land clearance for agriculture

Since European settlement of Australia, large tracts of land, have been cleared for agriculture, either for cropping, plantations, or grazing. The effects of total alienation of habitats on the native spider fauna have not been studied, and speculation can only be made as to possible effects because of the large number of variables involved. These include geographical location, type, extent, and sequence of land clearance, amount of land cleared, and the extent of remnant habitat as a source of recolonisation. It is likely that some native species of spiders were adversely affected by land clearance, while species that are adapted to more open, early successional, habitats may have been advantaged.

According to Main (1987a), much of the invertebrate fauna of the wheatbelt region of Western Australia was adapted to living in naturally fragmented or tenuously continuous microhabitats, even before European settlement. Trapdoor spiders survived natural catastrophes because they did not affect all the habitat, and recolonisation from undisturbed habitat was possible. Since European settlement, the landscape has been artificially fragmented, barriers between remnant fragments are more difficult to cross, and fewer species will survive in the long term (Main 1987a).

Forestry

There have been relatively few studies on the effects of forestry on spiders. Two overseas studies, one in Finland (Huhta 1971) and the other in the United States (Coyle 1981), found that clear felling resulted in altered species composition with an increase in number of species of hunting spider characteristic of more open habitats. In the Finnish study, elements of the original forest spider fauna began to appear seven years after clear felling.

In the karri forests of Western Australia, clearing and burning resulted in marked changes to the arachnid community, and species richness recovered from these practices more slowly on creek sites than on ridge sites (Curry *et al.* 1985). The effects varied according to the species; e.g. lycosids were affected immediately by clearing, but different species returned immediately after burning. The nemesiid *Aname villosa* (Rainbow and Pulleine) was not affected by clearing but almost locally eliminated by burning (Curry *et al.* 1985).

Urbanisation

The effects of urbanisation on native spiders may be similar to the effects of land clearance, although it is possible that more native spiders would survive because many urban dwellings are located in remnant bushland, and the urban habitat (except in inner city areas) can be more diverse than a monoculture crop. However, urban habitats are more likely to have exotic species of spiders introduced along with exotic plants.

Habitat management regimes

Fire

Fire is a major ecological factor in many parts of Australia, yet there is very little information on the effects of different fire regimes on spiders. In one of the few studies on fire and spiders, Main (1991b) studied the differential responses of two species of mygalomorph spiders in forests of south-western Western Australian. One species, *Anidiops villosus* (Rainbow), is a large door-building species that can survive fire by remaining underground, but the absence of shade and litter after the fire reduces its chance of survival. Furthermore, it disperses on the ground and is a slow recoloniser. In contrast, *Cethegus* sp. is a smaller spider that builds a curtain-like web over its burrow and is killed by fire, but is a faster recoloniser than *Anidiops* because it disperses by ballooning (Main 1991b).

Grazing

Much of the Australian environment, although not actually cleared of native vegetation, is subjected to grazing by introduced hard-hoofed mammals. The hooves break up the litter and lichen-crusted surface of bare ground, leading to erosion of top soil, and possible reduced prey potential (Main 1976, 1977). *Anidiops villosus*, the females of which may live for 25 years or more, is a large trapdoor spider found in the wheatbelt of Western Australia. It builds deep burrows, and depends on ground-litter cover to provide material for twiglines as part of the burrow rim. Grazing destroys the litter structure and the species is unable to survive. In Queensland, areas grazed for two years by cattle only had trapdoor spiders in sheltered situations such as against logs, tussocks, shrubs and butts of trees, where cattle hooves had not broken the ground; further, there was no evidence of recruitment (i.e. small burrows) (Main 1976).

Small areas fenced off from grazing can protect trapdoor spiders. A healthy area is indicated by presence of both mature and immature trapdoors, while the presence of mature spiders only suggests decline (Main 1977).

Cultivation

Cultivation leads to a loss of habitat structure and subsequent loss of spider diversity. This can be minimised by permitting recolonisation from adjacent habitats, habitat manipulation and management taking into account the source of spiders, providing suitable conditions for their survival (Riechert and Lockley 1984).

Insecticides

Insecticides can kill all spiders (Raven and Gallon 1987), and broad scale application against pest insects or mites will be deleterious to non-target species such as spiders. Insecticide application limits the effectiveness of spiders as predators (Riechert and Lockley 1984). The effects of insecticides on spiders can be reduced by halting regular blanket insecticide application, using selective insecticides in a sparing manner, restricting spraying to appropriate times in the life cycle of the prey, localising spraying, and spraying at a time of day when spider activity is minimal (Riechert and Lockley 1984).

Fertilisers

Main (1976) suggests that fertilisers may be damaging to spiders, although there is no Australian data on this issue. In Poland, fertiliser treatment over a five year period resulted in changes to the numerical dominance of species, with the replacement of larger species (Lycosidae) by smaller ones (Linyphiidae), resulting in reduced biomass and locomotory activity of spiders on the fertilised plots (Kajak 1978).

Biotic interactions

Trade (legal and illegal)

There is a small trade in spiders as pets, display animals, or for scientific research. Larger spiders, such as tarantulas, form a major component of the invertebrate pet and invertebrate zoo trade. There are several societies that specialise on tarantulas, and among the invertebrates, they are probably only behind butterfly and conchological societies in terms of popularity. They appeal because of their large body size and bizarre nature. Many are long-lived and take several years to mature (Main 1985), and are capable of being kept in captivity.

Euathlus smithii F. Pickard-Cambridge, the red-kneed bird-eating spider from Mexico, is the best known tarantula in the pet industry, but the conservation status of wild populations is not known. It is listed in the IUCN Invertebrate Red Data Book (Wells *et al.* 1983), and is the only spider listed in Appendix II of CITES, which means it cannot be moved from one country to another without appropriate permits. It is a popular species for collectors (Hancock and Hancock 1992), and captive breeding has been quite successful (Clarke 1991); however, its slow developmental rate could encourage collection of adults in the wild.

In Australia, the theraphosids are the largest spiders (Main 1976). In a rather confusing publication on theraphosid classification and identification aimed at the collector market, Smith (1992) lists seven species of Australian theraphosids, although Main (1985) only recognises five of these seven. Of the five species, possibly only *Selenocosmia crassipes* (Koch), *S. stirlingi* Hogg, and *S. subvulpina* Strand would be of interest to overseas collectors. The rather bizarre idea of keeping *Atrax robustus* as pets cannot be discounted.

Legal trade of wildlife into and out of Australia is controlled by the Wildlife Protection (Regulation of Exports and Imports) Act 1982. Although there have been requests to legally import live spiders as pets or for research purposes, all have been rejected because of the risk of accidental release into the Australian environment (Robert Moore, ANCA Wildlife Protection Authority, pers comm. 1993). Several illegally imported tarantulas have recently been confiscated by the Australian Quarantine and Inspection Service in Australia, but the level of trade is thought to be very low.

Specimens of the redback spider (*Latrodectus hasselti*) have been legally exported either for venom products or as mounted specimens (Robert Moore, ANCA Wildlife Protection Authority, pers comm. 1993).

Introduced species of spiders

Biotic interactions may occur between introduced spiders and native Australian predatory invertebrates. Main (1976) lists nine species of spiders introduced into Australia since European settlement. More recently a figure of 33 species has been proposed (Raven, pers. comm. 1993).

The introduced species include the poisonous *Loxosceles rufescens* (Dufour), established around Adelaide (Gray 1974), and the North American brown widow spider (*Latrodectus geometricus* Koch), which has the potential to build up in plague proportions (Queensland Museum 1987b; Raven 1992).

Speleology

Caves are a specialised habitat and invertebrates often form the major faunal component. Many invertebrate species are confined to caves and possess morphological adaptations to the cave environment (troglobitic). Main (1976) lists 15 species of troglobitic spiders from caves in Australia, although this figure has been increased with more recent surveys on the Nullabor (Davey *et al.* 1992), Chillagoe (Howarth 1988), Cape Range (Harvey *et al.* 1993), an in Tasmania (Eberhard *et al.* 1991). Ironically, although cave invertebrates are protected in Tasmania, their actual cave habitats may not necessarily be protected.

In the Nullabor caves, one species of spider, *Troglodiplura lowryi* Main, is considered endangered (Davey *et al.* 1992), although it occurs in three widely separated caves in the southern Nullabor (Main 1993). *Tartarus mullamullangensis* Gray (Agelenidae), though not considered threatened, was considered to have become locally extinct or very severely reduced in an area known as the Dome in Mullamullang Cave because of disturbance by speleologists (Poulter 1991). There have been requests in speleological journals for speleologists to take care for the sake of the cave invertebrates (Poulter 1991).

THE IMPORTANCE OF SPIDERS

Utilitarian reasons

Biological control

Spiders are all predators and their main food is arthropods, especially insects. Due to their diversity and abundance, spiders may be the top invertebrate carnivore in natural, agricultural and urban environments. They occupying a position that could affect the species composition of the invertebrate fauna (Humphreys 1988).

There has been no applied spider work on grain crops in Australia (Humphreys 1988), although there has been studies of the spiders associated with cotton fields (Bishop 1980, 1981). However, applied control studies elsewhere suggest that it is the spider community, rather than particular species, which effect control of pest populations (Humphreys 1988). This is a compelling reason for advocating the use of spider assemblages as a flagship for conservation rather than using individual flagship species.

The theory behind using spiders is to increase the effectiveness of predation by native species and to reduce pesticide use (Booij and Noorlander 1992) and reduce the need to introduce exotic biological control agents (Lockwood 1993).

Classical biological control emphasises the use of specialist predators and parasitoids to control a single pest species. Spiders do not fulfil this role well because they are mostly generalist predators with limited functional and numerical responses to population changes of specific prey species (Riechert and Lockley 1984). However, spiders can kill many more prey than they will actually consume, and a suite of generalist predators such as spiders can effectively control a complex assemblage of prey species rather than a specific prey species. Spider assemblages, through their composite foraging activities, can serve as buffers to limit exponential growth of prey populations, but no single spider species can keep a prey population in check once an outbreak occurs. Community diversity must be maintained to maximise the number of predators (Riechert and Lockley 1984).

There have been attempts to build up natural populations of spiders by habitat manipulation, although this area is still in a pioneering stage. The effectiveness of an assemblage of generalist predators (spiders) was demonstrated in a vegetable system by adding mulch (which provides high humidity and moderate temperatures): spider numbers were significantly higher and prey numbers and levels of plant damage lower in plots with added mulch (Riechert and Bishop 1990). Habitat manipulation is directed to encourage the colonisation of early stage agricultural systems, and relies on an assemblage of spiders rather than any individual species. The significance of spiders is that spider assemblages are often species rich, spiders are generally generalist predators, and spider populations are self-damping through territoriality and cannibalism (Riechert 1990).

Source of useful products

Spiders are noted for two products: silk and venom. The biological uses of the former are well documented; e.g. many species of smaller birds throughout the world use spider silk in the construction of their nests, especially the silk cocoons that protect spider eggs (Hansell 1992; McCulloch 1993). Spider silk is also used by humans; e.g. orbwebs are collected for use as fishing nets in New Guinea (Faulls 1991).

Attempts are being made to develop light high-tensile fibres derived from spider silk (Beattie 1992). Some strong spider silks have a breaking strain greater than that of steel wire of the same diameter (Preston-Mafham 1991), yet it is more elastic than nylon, and tougher than a bulletproof vest: it absorbs more energy before it breaks than any other material (Eliot 1993).

Research is under way on the development of new insecticides based on spider venom (Beattie 1992; Quistad *et al.* 1992). Most research on spider venom has involved medically important species that are known to cause death in humans (such as latrotoxins), and are unsuitable as insecticides. The assumption that other spider venoms are similar to latrotoxin has discouraged research on other spider venoms, but recent research has shown that there are other novel neurotoxins that are of potential as insecticides and in the pharmaceutical industry. Research on less toxic (to humans) spiders has revealed toxins that disrupt the nerve and muscle link in invertebrates, although further work is required before commercial insecticides are developed (Quicke 1988).

Research has been conducted on the possible application of spider venoms that temporarily paralyse their prey in medicine (Beattie 1992). A class of compounds found in spider venom may be useful in treating stroke victims and epileptics (Faulls 1991). The main component of *Latrodectus* venom is latrotoxin, which is used as a neurophysiological probe in both vertebrates and invertebrates (Quicke 1988).

The spitting spiders, *Scytodes*, shower their victims with mucilage-like substance that fastens the prey to the substrate (Main 1976), and there is potential in the use of these adhesives (Beattie 1992).

Scientific study

Spiders have been important in scientific studies, including the areas of systematics, biogeography, ecology, animal behaviour, and are an important experimental organism (Humphreys 1988). Archival biological collections can be used theoretically to reconstruct biological scenarios present at the time of and subsequent to European settlement. Instead of using fossils, Main (1990) advocates the use of fugitive species whose general biology is known or can be deduced from available information. Cave spiders are valuable in reconstructing evolutionary and zoogeographic history of the Australian spider fauna (Davey *et al.* 1992).

Environmental indicators

There is a never ending search for easily identifiable indicators of environmental change or disturbance, generally at the species level. This often presents problems for the applied (non-taxonomic) biologist, and spiders are one group that should be examined more closely to determine their suitability as user-friendly indicators of environmental change at the higher taxonomic level (genus, or preferably, family).

While urging caution on the use of spiders as indicators of change, Main (1977, 1987a, 1991a) argues that a major component of the Australian spider fauna is comprised of burrowing mygalomorph spiders (trapdoor spiders) which can act as indicators because they (1) often have high habitat specificity and depend absolutely on a stable soil/litter structure for survival; (2) have a long life cycle; (3) live their entire lives in one burrow, and adults cannot initiate a new burrow if the old one is destroyed; (4) can only disperse within a restricted area near the parent burrow; (5) do not readily colonise habitats modified by anthropogenic factors; (6) display high levels of local endemism and diversity in relatively small isolated areas because of their low dispersion powers, long life cycle and sedentary life style; and (7) as predators, their prey is caught within close range of the burrow, and their persistence also indicates the persistence of other terrestrial invertebrates.

Main (1987a) warns of the danger of interpreting the presence of particular spiders in disturbed habitats as an indication that the species are able to re-establish rapidly and survive in those habitats. Often the presence of active male mygalomorph spiders on the surface of the ground is a measure of biological activity rather than conservation status. Main (1987a) cites the studies of Curry *et al.* (1985) and Mawson (1986) as examples where this mistake has been made, and cites an example of an agricultural area which was cleared and only cropped once but has not been recolonised in 20 years by mygalomorph spiders from adjacent areas. There is also the danger that the persistence of adults of long-lived species may also be misinterpreted as survival of the species; these adults may actually outlive the viability of the habitat and not breed or if young are produced, they may not survive. In the selection of indicator species, it is important to consider the life history of the species, microhabitat needs, and distribution.

Compared with insects, spiders are relatively immobile because they do not fly, although some species can disperse widely by ballooning. As a group, spiders have some of the characteristics of 'good' indicators, including high relative abundance, ease of collection, not too speciose, occupying a diversity of habitats and micro-habitats, and a diverse range of foraging strategies and tactics. As they are all predators, they could have a major influence on the composition of invertebrate communities.

However, spider assemblages work together as a natural biological control community (Humphreys 1988), then selection of single taxon or groups of spiders may be inappropriate. Possibly a diverse suite of spiders, representing different habitat use and foraging strategies, may be appropriate that can include families with high habitat specificity, pioneering taxa, and introduced taxa. Mawson (1986) examined the arachnids of rehabilitated bauxite minesites, and found that it took eight years for rehabilitated sites to be capable of supporting arachnid communities comparable to that in surrounding undisturbed jarrah forests. It took this time for a suitable depth of leaf litter, adequate ground cover, and numbers of heights of trees to develop for spiders.

Australian spiders include a broad range of taxa that are indicative of biogeographical affinities, often at the genus or family level, e.g. ancient, Gondwanaland and recent (tropical) (Main 1981b). Main (1981a) classifies the families of Australian spiders on the basis of their generalised residency/foraging strategies (ground or plant dwelling, sedentary or vagrant, snare builders, etc; Table 3 of Main 1981a) and their generalised habitat distribution (humid forests, seasonal wet/dry forests and woodlands, semi-arid, arid, and specialised habitats such as caves, the alps, and marine habitats; Table 4 of Main 1981a). It would be an interesting and worthwhile exercise to combine these two criteria in an attempt to identify a suite of spider families in each major habitat that could be used as environmental indicators.

Ethical reasons

The ethical reasons for conserving spiders are difficult for many people to comprehend. They can range from respect for all life, regardless of whatever form it takes, to an acceptance of the need to conserve all natural components of ecosystems (Callicot 1986).

FUTURE STEPS FOR SPIDER CONSERVATION IN AUSTRALIA

To achieve the conservation of spiders in Australia, there are three major requirements:

(1) Educational programmes to make people aware of the biological diversity of spiders, their ecological importance, and the need for their conservation;

(2) Increased knowledge of the taxonomy, biology, ecology and distribution of spiders; and

(3) Identification of threatened species and preparation of recovery plans, which may include captive breeding programmes and translocation.

There is a major conservation impediment: how to conserve something that is feared by a large proportion of the human population, yet form a major, and ecologically essential, part of the Australian biota. The solution may be relatively simple: people are already aware of spiders, unlike many other groups of invertebrates, and it is a matter of educating them about the need for their conservation.

In any conservation discussion, there is a sequence of events that starts with (1) knowing what it is, (2) obtaining public support, and (3) then actually getting things done. With groups such as spiders and snakes, there is a sub-sequence (1a) creating public hysteria about the danger of these animals, and this generally, but not necessarily, prevents (2) and (3) occurring. With spiders, the current situation is somewhere between (1a) and (2). Although there is still much taxonomic, systematic, distributional and biological research required on the Australian spider fauna, the "knowing what it is" phase has been well under way for many years. This has manifested itself in the numerous books about Australian spiders and their biology (Froggatt 1935; McKeown 1936, 1952; Main 1976) and identification guides (Child 1965; Clyne 1969; Hickman 1967; Lee and Southcott 1979; Main 1964; Mascord 1970, 1978, 1980; Walker and Milledge 1992), and keys to families (Austin 1980; Davies 1986). Another group of publications dwell on the venomous spiders, and range from the scientifically/medically based publications (Garnet 1968; Hadlington 1962; Southcott 1978; Sutherland 1981) to the more popularly based ones (Worrell 1977). Today there are many more publications that look at spiders from a more balanced and sympathetic approach, and many of these books are aimed primarily at children (Carter and Howes 1982; Cullen *et al.* 1986; Hunt 1982).

Sympathetic overtones towards spiders are found in Child (1965), Hickman (1967), Mascord (1980), although Mascord (1978) illustrates representatives of spider families but has groups classed as "deadly" and "dangerous". In an unrecognised landmark in the sympathetic literature on spiders, Main (1967) integrated spiders into the general natural history knowledge of a small patch of bushland in the Western Australian Wheatbelt in the book "Between Wodjil and Tor". References to the need for spider conservation are now appearing in the popular literature on spiders, such as in Preston-Mafham's (1991) book on the biology of spiders. In a recent popular magazine article, Faulls (1991) explores interesting aspects of spider biology such as the architectural variation involved in their homes and hunting snares.

In the debate on invertebrate conservation, one of the barriers that needs to be overcome is that many people are simply not aware of invertebrate diversity and function. Spiders, to some extent, have already straddled this barrier; there is much spider awareness in the community, albeit not a very sympathetic awareness. The next step is to alter this unsympathetic attitude by developing educational programmes to emphasise the ecological and utilitarian aspects of spiders, and thus the need for their conservation.

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