Research in animal behaviour faces the continual challenge posed by the fact that those of us doing the research are animals as well. The subjectivity provided by anthropomorphism (endowing nonhuman animals with human-like attributes), zoomorphism (the converse, endowing humans with nonhuman animal-like attributes), and the sociocultural surroundings researchers finds themselves in, can bias what research is done, how it is done and how the resulting data are interpreted. While no means unique to animal behaviour (or indeed biology), the problem of maintaining objectivity is perhaps more immediate in behavioural research, especially when that research crosses human and nonhuman boundaries (e.g. in primatology; for an influential critique see Kennedy 1992). Perhaps the clearest case in point concerns the study and interpretation of sexual behaviour in nonhuman animals (presented in detail by Zuk 2003). Since the resurgence of interest in sexual selection and related phenomena following Trivers's (1972) seminal paper, there have been repeated calls for the terminology and language used to describe or explain sexual behaviour to be free from either anthropomorphic connotations (avoiding such words as ‘rape’ or ‘homosexuality’: Gowaty 1982; Bailey & Zuk 2009) or stereotypical sex roles that might have more to do with prevailing human cultural norms than biological reality (Gowaty 1982; Hrdy 1986; Martin 1991; Zuk 1993; Fox Keller 2004).

Recently, Karlsson Green & Madjidian (2011) extended the critique of how we use language by surveying the literature and scoring the language used in describing sexually antagonistic traits in males and females. Sexual conflict is said to occur when the optimum value of a given trait differs for males and females (Parker 1979; see Arnqvist & Rowe 2005 for a thorough review). Sexual conflict is therefore the result of conflicting patterns of selection in the two sexes, selection that may be the result of natural selection (in the narrow sense, i.e. fertility and viability selection: Endler 1986), sexual selection (Andersson 1994) or both. Depending on the traits involved, the sexually antagonistic selection underpinning sexual conflict may engender cycles of sexually antagonistic coevolution (for instance through the sex-limited expression of genes associated with sexual dimorphism: Fairbairn et al. 2007). Sexual conflict may arise over any trait, but conflicts over parental care and over mating have perhaps attracted the most attention.
Here, using similar methods to Karlsson Green & Madjidian (2011), we surveyed the sexual cannibalism literature to look for patterns of gender bias when describing behaviour. We assessed which terms were used to describe the way in which males and females respond to each other, and whether there was a gender bias in active or reactive terms. Sexual cannibalism provides a useful counterpoint for the study of language use and sex role stereotypes for two reasons. First, such extreme behaviour (i.e. the consumption of partners), whether on purpose or not, might be expected to result in the use of strong, colourful or emotive language. Second, in the majority of cases it is the male being cannibalized by the female. Thus the sexual cannibalism literature might be expected to provide an interesting exception to the patterns of language bias found in the sexual conflict literature as a whole, as females should take an ostensibly active role in the process. However, if the active male/passive female stereotype is truly pervasive, we may predict active words again to be associated with male behaviours.

METHODS

Literature Search: Sexual Cannibalism Terminology

We searched ISI Web of Science (Thomson Reuters) using the search term ‘sexual cannibalism’ (initial search undertaken in February 2012; search used for analysis 17 September 2012). This search resulted in 556 papers. However, not all of these papers were relevant to our study: the search also brought up papers on other types of cannibalism (e.g. filial cannibalism in fishes) and infanticide in primates. Those papers deemed not relevant were removed from the list, leaving 210 papers. Following Karlsson Green & Madjidian (2011), we initially took the 30 most-cited papers, including reviews, empirical papers and theoretical studies. However, these 30 most-cited papers (not counting reviews) considered only 13 species. Therefore, we went further down the list in order of citations adding studies that added a new species until we had a total of 30 study species, from a total of 47 papers (number of citations per paper ranged from 17 to 152; see Table A1 in Appendix 1). Of the 43 nonreview papers, 17 studies were concerned with cannibalism during and after copulation (postcopulatory cannibalism), whereas 26 studies considered species in which cannibalism may occur before copulation (precopulatory cannibalism; Table A1 in Appendix 1). The four review papers all included references to both pre- and postcopulatory cannibalism. In terms of the taxonomic coverage, 23 of the species were spiders (35 papers and two reviews), six were mantids (six papers) and one was an orthopteran (one paper, concerning the sagebrush cricket, Cyphoderris strepitans). Two of the papers contained mathematical models of the evolution of sexual cannibalism: Buskirk et al. (1984) modelled postcopulatory cannibalism in which males could increase their inclusive fitness by allowing themselves to be cannibalized, while Newman & Elgar (1991) modelled precopulatory cannibalism as a female foraging strategy. In addition, Arnvist & Henriksson (1997) presented a verbal model that considered precopulatory cannibalism as an indirect result of selection on high female aggression in earlier life stages. See Table A1 in Appendix 1 for the full list of references and study species.

In their paper, Karlsson Green & Madjidian (2011) selected terms used to describe sexually antagonistic traits. Here, for each paper we recorded the words used to describe males and females, and the words used to describe behaviours performed by either sex during cannibalistic or potentially cannibalistic sexual interactions. As such there was some judgement involved in which words we...
selected for analysis. For instance, we decided to exclude any purely descriptive words such as ‘approach’ and ‘kill’, and several words associated with the act of eating, such as ‘eat’, ‘decapitate’ and ‘cannibalize’ (as this word came up in almost every paper in our list). We also excluded the word ‘devour’, again because of its association with eating, although some may argue this is also potentially a loaded term (or at least unnecessarily colourful). Across all papers surveyed, we identified 72 terms used to describe the behaviour of males and females during sexual cannibalism. After excluding those terms not deemed relevant, we were left with a list of 49 valid terms (see Appendix 2 for the excluded words). Each word was scored once for each paper, so that the frequency of use within each paper was not recorded.

Once we had identified our terms we asked three independent parties to classify them as active, reactive or neutral (for a full description of the meanings of active, reactive and neutral see Karlsson Green & Madjidian (2011)). Any words classified differently by two people were excluded from the analysis, leaving us with 31 consistently classified terms: 13 active, 11 reactive and seven neutral. We then performed chi-square tests to determine whether the usage of active and reactive terms varied for males and females. We note that there is the potential for pseudoreplication in these kinds of data: terms used in the same paper may not be independent of each other, and word use among papers written by the same authors might also not be independent. However, our main aim was to explore the association between words and gender that might be experienced by readers of those papers as a whole, rather than ascribe a given level of gender bias (if present) to a particular paper or author.

RESULTS

Active words were significantly more likely to be used to describe females than males in the context of sexually cannibalistic behaviour (chi-square test: χ² = 13.78, P<0.001; Table 1, Fig. 1). Likewise, reactive words were significantly more likely to be used to describe males (χ² = 33.98, P<0.001). In terms of neutral and unclassified words, females were significantly more likely to be described using neutral words than males (χ² = 3.86, P = 0.049), but significantly less likely to be described using unclassified (i.e. equivocal) words than males (χ² = 43.2, P<0.001).

We also considered papers concerning pre- and postcopulatory cannibalism separately, as there are different theories of how these events are interpreted. For instance, precopulatory cannibalism, and these females were more likely to be termed ‘voracious’. This may follow from the nature of cannibalism in these species: precopulatory cannibalism cannot be adaptive for males, and so cannibalism is hypothesized to represent a female foraging strategy (Newman & Elgar 1991) or emerge as a by-product of selection on female aggression (Gould 1984; Arnyquist & Henriksson 1997). If cannibalism is not considered in the male’s interest, then male–female interactions are perhaps more likely to be interpreted a certain way: aggressive, predatory females killing cautious, helpless males.

Yet for other terms the usage is not so straightforward. Words such as ‘sacrifice’, ‘suicide’ and ‘complicit’ were used at similar frequencies to describe males being cannibalized before or after copulation. The terms ‘attack’, ‘aggressive’ and ‘predatory’ were also used similarly to describe females showing precopulatory cannibalism, and these females were more likely to be termed ‘voracious’. This may follow from the nature of cannibalism in these species: precopulatory cannibalism cannot be adaptive for males, and so cannibalism is hypothesized to represent a female foraging strategy (Newman & Elgar 1991) or emerge as a by-product of selection on female aggression (Gould 1984; Arnyquist & Henriksson 1997). If cannibalism is not considered in the male’s interest, then male–female interactions are perhaps more likely to be interpreted a certain way: aggressive, predatory females killing cautious, helpless males.

To what extent is the language used in studies of sexual cannibalism justified? Let us consider males first. In the Australian red-back spider, Latrodectus hasselti, males appear to perform a ‘somsault’ during mating that brings their abdomen within reach of the female’s jaws, and they are subsequently cannibalized (Forster 1992). Phrases such as ‘male suicide’ or ‘male suicide’ might be taken to imply that there is some benefit to the male from being cannibalized (despite the lack of evidence for such a benefit). Here then is an example of how words might lead to an implicit inference about behaviour being presented, whether deliberately so by the authors or not.

To what extent is the language used in studies of sexual cannibalism justified? Let us consider males first. In the Australian red-back spider, Latrodectus hasselti, males appear to perform a ‘somsault’ during mating that brings their abdomen within reach of the female’s jaws, and they are subsequently cannibalized (Forster 1992). Phrases such as ‘male suicide’ or ‘self-sacrifice’ might seem reasonable to describe a behaviour that seems unequivocal: the male does appear to present himself to the female. However, ‘suicide’ and ‘self-

**Table 1**

Frequency of terms used to describe males and females across the 47 papers used in our study

<table>
<thead>
<tr>
<th></th>
<th>All words</th>
<th>Active</th>
<th>Reactive</th>
<th>Neutral</th>
<th>Unclassified</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>49</td>
<td>13</td>
<td>11</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Male</td>
<td>203</td>
<td>43</td>
<td>56</td>
<td>8</td>
<td>96</td>
</tr>
<tr>
<td>Females</td>
<td>136</td>
<td>85</td>
<td>9</td>
<td>18</td>
<td>24</td>
</tr>
</tbody>
</table>

There were 49 terms in total. Each term was scored once for each sex if it appeared in a paper. Words in the unclassified category are those that were not classified by the same three independent parties.

**DISCUSSION**

Among the most highly-cited papers in the field of sexual cannibalism, females are more likely to be described using active terms, whereas males are more likely to be described in reactive terms. This is in contrast to a survey of the more general sexual conflict literature presented by Karlsson Green & Madjidian (2011), which found the opposite result: males are typically portrayed as the active sex while females are portrayed as the reactive sex (Fig. 1). Instead, our results confirm the caveat that Karlsson Green & Madjidian (2011) themselves included in their paper, namely that a gender bias in the use of language may depend upon which particular sexual conflict is being studied. As such, our results argue against there being a general male–female sexual stereotype that pervades all studies of sexual conflict. However, as we discuss below our results do not necessarily contradict the broader point that language may reflect or influence sexual stereotyping.

Within the phenomenon that is sexual cannibalism, there is a clear distinction between cannibalism that occurs before copulation and cannibalism that occurs during or after copulation (Elgar & Schneider 2004). Our survey shows that authors have used slightly different language in these two instances. For example, in species that show precopulatory cannibalism, males are more likely to be described as ‘cautious’ and ‘avoiding’ females, compared to species that show postcopulatory cannibalism. The words ‘rapacious’ and ‘indiscriminate’ were used exclusively in reference to females showing precopulatory cannibalism, and these females were more likely to be termed ‘voracious’. This may follow from the nature of cannibalism in these species: precopulatory cannibalism cannot be adaptive for males, and so cannibalism is hypothesized to represent a female foraging strategy (Newman & Elgar 1991) or emerge as a by-product of selection on female aggression (Gould 1984; Arnyquist & Henriksson 1997). If cannibalism is not considered in the male’s interest, then male–female interactions are perhaps more likely to be interpreted in a certain way: aggressive, predatory females killing cautious, helpless males.

Please cite this article in press as: Dougherty, L. R., et al., Sexual stereotypes: the case of sexual cannibalism, Animal Behaviour (2012), http://dx.doi.org/10.1016/j.anbehav.2012.12.008
sacri
ci
ce
are rather loaded terms. As mentioned above, ‘sacri
ci
ce
might imply a benef
to males. Alternatively, the use of ‘sacri
ci
ce
may present males in a rather noble, sel
fl
ess manner (to be con
trasted with the female sexual predator). Finally, such terms at the
very least suggest a level of anthropomorphic goal orientation we
should be wary of (Kennedy 1992). Instead, why not just say that
males present themselves to females during copulation with
a particular manoeuvre?

In terms of the words used to describe females, while sexual
cannibalism is predicated on the fact that one of the pair ends up
being the meal of the other, some of the words used to describe
female behaviour are a long way short of being value free: for
instance, females have been called ‘voracious’ or ‘rapacious’
more than once. Moreover, if we are concerned with either the
causes or consequences of negative sexual stereotyping more
generally, the use of such words suggests that there may be scant
comfort in our find
ings here of the assignment of active agency
to female animals in the context of sexual cannibalism. Not least
this is because it is well-known across human culture that
sexually aggressive or violent females are themselves a negative
stereotype: from the Gorgons of Greek myth to the femme fatale,
the ‘black widow’ or the ‘lethal seductress’ of today (Sjoberg &
Figure 2. Frequency of terms used when describing male and female behaviour of sexually cannibalistic species considered separately for (a) studies in which cannibalism occurs only during and after copulation (17 papers), and (b) studies in which cannibalism occurs before and/or during copulation (26 papers), excluding reviews. See the appendices for references and excluded words. The frequency for each sex is the number of articles the term appears in, in the context of describing behaviour. Words were also classified by three independent observers as active (a), reactive (re) or neutral (n). Terms marked with an asterisk were classified differently by at least two of the parties and so could not be given an overall classification.
Gentry 2008). These negative stereotypes are clear in many forms of modern entertainment (e.g. film noir: Bozzer 1999) and also in the media, where they may engender narratives that both reflect and influence associations between sexuality, gender and violence (Oliver 2007; Sjoberg & Gentry 2008). As such we appear to be in something of a dilemma when it comes to sexual behaviour and gender, caught between different negative stereotypes of females.

To help us go forward and address dilemmas such as this, we wish to make three points. First, we need to discriminate between looking for general patterns and stereotyping. As scientists, much of what we do is to look for general patterns in the natural world, from which theory and eventually understanding can be drawn. According to the Oxford English Dictionary (online version: www.oed.com), a stereotype is ‘a preconceived and oversimplified idea of the characteristics which typify a person, situation, etc.’. Clearly there is potential for tension here: an unsophisticated grasp of general patterns might lead to preconceptions or oversimplifications, yet the search for simple rules is also a valid one. Only history can tell us how well we get the balance right in any particular case. However, this is to frame the discussion only in terms of academic research. The dialogue between the academic and the nonacademic community also be wrong to oversimplify. For instance, vernacular usage, particularly in nonacademic community and avoid easy sensationalism (Barron & Brown 2012; Madjidjan & Karlsson Green 2012). First and foremost, scientists may bring preconceptions and oversimplifications from their sociocultural surroundings, with ‘general principles’ merely serving to validate those preconceptions. This will forever be an inescapable part of science, and something that we must always be aware of and try and guard against as much as we can. However, there is also the concern that scientific findings about sexual behaviour (or indeed anything else) may travel the other way and provide the basis for sociocultural norms that are chauvinistic, demeaning, or that justify oppression and violence towards some members of society (for instance women or in terms of sexual identity: Barron & Brown 2012). While animal behaviour researchers cannot change the natural world to fit any particular cultural worldview, we can be careful about how we present that natural world to the nonacademic community and avoid easy sensationalism (Barron & Brown 2012). We suggest that the key message that we should put across is that there are no easy lessons about how we should live or love to be learned from nonhuman animals (Huxley 1893; Zuk 2003).

Second, we need to remain grounded on the extent to which progress has been impeded by the cultural baggage of researchers. Even though we accept the critiques of how research into sexual behaviour has progressed since Darwin (1871; e.g. Cronin 1991; Birkhead 2010), clearly there has been considerable progress in our understanding of animal sexual behaviour and mating systems (for example as reviewed in major edited volumes and monographs: Bateson 1983; Thornhill & Alcock 1983; Bradbury & Andersson 1987; Birkhead & Møller 1993; Andersson 1994; Eberhard 1996; Simmons 2001; Arnvist & Rowe 2005; Oliveira et al. 2008; Leonard & Córdoba-Aguilar 2010). Perhaps ironically, the rise of one particular cultural artefact, feminism, may well have helped contribute to this progress (Hardy 1986; Fox Keller 2004). This is neither to be complacent of future progress nor to suggest that we currently have all the answers. Such confidence would be foolish, and the last few years have shown that there is still plenty to talk about (e.g. Roughgarden & Akçay 2010; Shaker 2010; Rubenstein 2012). But it would also be wrong to overinterpret current trends and fashions. For instance, Madjidian & Karlsson Green (2012) are correct to point out that the wonderful review of Bonduriansky (2001) on male mate choice has helped make male mate choice a ‘hot topic’ (in their words). And we recommend that review paper unresolved. But hot topics are themselves as much a phenomenon of how we do science as anything else, providing something new (or at least something old enough to have received limited attention for a while) to write grants and papers about. In terms of sexual selection, the problem that females have been ignored in studies of sexual mating systems has been addressed at least three times over the last three decades or so, from the initial renaissance of female mate choice in the early 1980s (e.g. Bateson 1983; Bradbury & Andersson 1987), the appreciation of the role of females in postcopulatory sexual selection in the early to middle 1990s (e.g. Birkhead & Møller 1993; Eberhard 1996), to the current revival of interest in females in sexual selection (e.g. Clutton-Brock 2007, 2009; Rosvall 2011; Rubenstein 2012). In summary, we think animal behaviour researchers have made, and will continue to make, significant advances in how we understand the reproductive behaviour of animals, and that the role of females has actually been increasingly appreciated since Trivers (1972; Bonduriansky 2011).

As highlighted by Perry & Rowe (2012), those advances are perhaps most clearly seen in terms of our theory.

Third, while we fully recognize the risks presented to our thinking and understanding by the traps laid for us by our own societal influences and cultural baggage (Karlsson Green & Madjidjan 2011), we would hope that does not necessitate the removal of all words and terminology beyond the starkest of descriptions of behaviour. Words are powerful, but while we need to be aware of the implications they carry we need not be beholden to them. For instance, consider the widespread acceptance of one phrase that was previously considered loaded: mate choice. The typical definition for mate choice is now generally given as any aspect of the phenotype of one sex that leads to nonrandom mating success of the other (after Halliday 1983; Maynard Smith 1987). The phenotype may be behavioural, physiological or morphological. Importantly, that mate choice can result from a phenotype need not be the evolutionary cause of that phenotype (Maynard Smith 1987), an awareness of which perhaps deflects criticism of the potentially goal-oriented nature of the word (Kennedy 1992). Given what has happened over the last 30 years or so, one might argue that emancipating ‘choice’ from only ‘conscious’ (i.e. human) decision making allowed modern studies of mate choice to flourish (Bateson 1983; Andersson 1994). Moreover, when we realized how morphology and physiology could act as arbiters of choice (particularly female reproductive tracts: Eberhard 1996), so the full extent of female agency in sexual selection became clearer. Choice has thus proved a useful word to cover the sexual selection outcomes engendered by all these phenotypes, once freed from the anthropomorphic baggage about conscious choice, aesthetics and so on, and progress has probably been swifter for it. We therefore join Perry & Rowe (2012) in urging the animal behaviour community not necessarily to proscribe words, but rather to encourage consensus in how we define behaviours and the contexts in which we use them. Some words will be easier to reach consensus on than others (probably not ‘rapacious’ for example), but we should also not delude ourselves that words will not continue to have double lives. The authors of this paper are happy to be thought of as animals, but not necessarily happy to be thought of as animals.

Acknowledgments

We thank the Natural Environment Research Council for supporting our research (Ph.D. studentships to E.B.S. and L.D.; Advanced Research Fellowship to D.S.). We are also grateful to Nathan Bailey for comments and discussion that improved the manuscript, to two anonymous referees for their advice and encouragement, and finally to our three independent parties for classifying endless lists of words.
References


Appendix 1. Literature used in terminology analysis

Table A1
The 47 papers used in our literature survey, including species studied and the type of cannibalism

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Times cited</th>
<th>Class</th>
<th>Family</th>
<th>Species</th>
<th>Pre- or postcopulatory cannibalism?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrade 1996</td>
<td>Sexual selection for male sacrifice in the Australian redback spider</td>
<td>152</td>
<td>Arachnida</td>
<td>Theridiidae</td>
<td>Latrodectus hasselti</td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Andrade 1998</td>
<td>Female hunger can explain variation in cannibalistic behaviour despite male sacrifice in redback spiders</td>
<td>46</td>
<td>Arachnida</td>
<td>Theridiidae</td>
<td>Latrodectus hasselti</td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Andrade 2003</td>
<td>Risky mate search and male self-sacrifice in redback spiders</td>
<td>65</td>
<td>Arachnida</td>
<td>Theridiidae</td>
<td>Latrodectus hasselti</td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Andrade &amp; Banta 2002</td>
<td>Value of male remating and functional sterility in redback spiders</td>
<td>67</td>
<td>Arachnida</td>
<td>Theridiidae</td>
<td>Latrodectus hasselti</td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Arnqvist &amp; Henriksson 1997</td>
<td>Sexual cannibalism in the fishing spider and a model for the evolution of sexual cannibalism based on genetic constraints</td>
<td>73</td>
<td>Arachnida</td>
<td>Pisaurida</td>
<td>Dolomedes fimбриatus</td>
<td>Pre</td>
<td>Includes verbal model</td>
</tr>
<tr>
<td>Barry et al. 2008</td>
<td>Female praying mantids use sexual cannibalism as a foraging strategy to increase fecundity</td>
<td>19</td>
<td>Insect</td>
<td>Mantidae</td>
<td>Pseudomantis albofimbriata</td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Birkhead et al. 1988</td>
<td>Sexual cannibalism in the praying mantis Hierodula membranacea</td>
<td>55</td>
<td>Insect</td>
<td>Mantidae</td>
<td>Hierodula membranacea</td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Buskirk et al. 1984</td>
<td>The natural selection of sexual cannibalism</td>
<td>71</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Post</td>
<td>Model</td>
</tr>
<tr>
<td>Elgar 1991</td>
<td>Sexual cannibalism, size dimorphism and courtship behaviour in orb-weaving spiders (Araneidae)</td>
<td>63</td>
<td>Arachnida</td>
<td>Araneida</td>
<td>Orb-weaver sp.</td>
<td>Pre</td>
<td></td>
</tr>
</tbody>
</table>

Please cite this article in press as: Dougherty, L. R., et al., Sexual stereotypes: the case of sexual cannibalism, Animal Behaviour (2012), http://dx.doi.org/10.1016/j.anbehav.2012.12.008
Table A1 (continued)

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Times cited</th>
<th>Class</th>
<th>Family</th>
<th>Species</th>
<th>Pre- or postcopulatory cannibalism?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elgar et al. 2000</td>
<td>Female control of paternity in the sexually cannibalistic spider <em>Argiope keyserlingi</em></td>
<td>57</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Argiope keyserlingi</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Elgar &amp; Fahey 1996</td>
<td>Sexual cannibalism, competition, and size dimorphism in the orb-weaving spider <em>Nephila plumipes</em></td>
<td>69</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Nephila plumipes</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Elgar &amp; Nash 1988</td>
<td>Sexual cannibalism in the garden spider <em>Araneus diadematus</em></td>
<td>80</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Araneus diadematus</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Fahey &amp; Elgar 1997</td>
<td>Sexual cohabitation as mate-guarding in the leaf-curling spider <em>Phonognatha graefei</em></td>
<td>36</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Phonognatha graefei</em></td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Foellmer &amp; Fairbairn 2003</td>
<td>Spontaneous male death during copulation in an orb-weaving spider <em>Argiope aurantia</em></td>
<td>41</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Argiope aurantia</em></td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Forster 1992</td>
<td>The stereotyped behaviour of sexual cannibalism in <em>Latrodectus hasselti</em></td>
<td>61</td>
<td>Arachnida</td>
<td>Theridiida</td>
<td><em>Latrodectus hasselti</em></td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Fromhage &amp; Schneider 2005</td>
<td>Safer sex with feeding females: sexual conflict in a cannibalistic spider <em>Nephila fenestrata</em></td>
<td>44</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Nephila fenestrata</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Fromhage &amp; Schneider 2006</td>
<td>Emasculation to plug up females: the significance of pedipalp damage in <em>Nephila fenestrata</em></td>
<td>39</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Nephila fenestrata</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Gaskell et al. 2004</td>
<td>Changes in mate choice in a sexually cannibalistic orb-web spider (<em>Araneus</em> : <em>Araneidae</em>)</td>
<td>34</td>
<td>Arachnida</td>
<td>Araneida</td>
<td><em>Argiope bruennichi</em></td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Huber 2005</td>
<td>Sexual selection research on spiders: progress and biases</td>
<td>86</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Small section on sexual cannibalism</td>
</tr>
<tr>
<td>Johnson 2001</td>
<td>Sexual cannibalism in fishing spiders (<em>Dolomedes triton</em>): an evaluation of two explanations for female aggression towards potential mates</td>
<td>46</td>
<td>Arachnida</td>
<td>Pisaurida</td>
<td><em>Dolomedes triton</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Johnson et al. 1999</td>
<td>Female remating propensity contingent on sexual cannibalism in sagebrush crickets, <em>Cyphoderris strepitan</em>: a mechanism of cryptic female choice</td>
<td>26</td>
<td>Insecta</td>
<td>Prophalangopsidae</td>
<td><em>Cyphoderris strepitan</em></td>
<td>Post</td>
<td>Nonlethal cannibalism</td>
</tr>
<tr>
<td>Kynaston et al. 1994</td>
<td>Courtship, mating behaviour and sexual cannibalism in the praying mantis, <em>Sphodromantis lineola</em></td>
<td>26</td>
<td>Insecta</td>
<td>Mantidae</td>
<td><em>Sphodromantis lineola</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Lawrence 1992</td>
<td>Sexual cannibalism in the praying mantid, <em>Mantis religiosa</em>: a field study</td>
<td>52</td>
<td>Insecta</td>
<td>Mantidae</td>
<td><em>Mantis religiosa</em></td>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Liske &amp; Davis 1987</td>
<td>Courtship and mating behaviour of the Chinese praying mantis, <em>Tenodera aridifolia sinensis</em></td>
<td>46</td>
<td>Insecta</td>
<td>Mantidae</td>
<td><em>Tenodera aridifolia</em></td>
<td>Pre</td>
<td></td>
</tr>
</tbody>
</table>

(continued on next page)
## APPENDIX 2. WORDS EXCLUDED FROM ANALYSIS

<table>
<thead>
<tr>
<th>Approach</th>
<th>Benefit</th>
<th>Cannibalize</th>
<th>Capture</th>
<th>Consume</th>
<th>Conflict won</th>
<th>Cost</th>
<th>Decapitate</th>
<th>Decide/decision</th>
<th>Devour</th>
<th>Eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elaborate (courtship)</td>
<td>Gift</td>
<td>Ignore</td>
<td>Injure</td>
<td>Indirect result</td>
<td>Kill</td>
<td>Profit</td>
<td>Response</td>
<td>Sated</td>
<td>Survive</td>
<td>Wait</td>
</tr>
</tbody>
</table>

We chose the top 30 most cited papers from Web of Science (including reviews) resulting from the keyword search ‘sexual cannibalism’ performed on 17 September 2012, and after excluding results not deemed relevant. After the top 30, we also included another 17 studies of species that were not already in our list (excluding reviews), so that we covered a total of 30 species, across 47 papers. Cannibalism was classed as precopulatory when it was recorded before copulation at least once, regardless of whether it also occurs after copulation. Postcopulatory cannibalism only includes those cases in which cannibalism occurs after insemination by the male, but can occur during or after copulation. In all species females are larger than males.

### APPENDIX 2. WORDS EXCLUDED FROM ANALYSIS