How prevalent are invertebrates in human-animal scholarship? A scoping study of *Anthrozoös* and *Society & Animals*.

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Abstract

The field of Human-Animal Studies (HAS) is about human-animal relations. However, which animals does the field encompass? In recent years, some scholars have noted a bias towards vertebrate species, especially domesticated mammals. To assess how prevalent (or not) invertebrates have been in HAS scholarship, a three-stage scoping study was conducted of two pioneering journals in the field: *Anthrozoös* and *Society & Animals.* This article reports on preliminary findings, and confirms that human-animal scholarship, as presented in these two leading journals, is characterised by "institutional vertebratism", albeit the extent of this invertebrate knowledge gap needs to be fully assessed. If the next generation of HAS scholars are to comprehend the extensive range of interspecies contexts, they must be more inclusive in terms of the diversity of animal species studied. Widening the species net is therefore a necessary corrective to addressing vertebrate bias in this field.

Key words: Vertebrate bias, invertebrates, scoping study, HAS scholarship

Introduction

> Particularly in its 'critical' formulation, Animal Studies is supposed to be about challenging anthropocentrism. But what if, in doing so, we're unwittingly placing mammals, vertebrates, or some other preferred taxon at the center of the moral universe? Might we be challenging one moral hierarchy only to install another in its place? (Clark, 2016, paragraph 3).

In 1979, Bryant reminded delegates at the annual meeting of the Southern Sociological Society that we live in mixed species societies, and impelled them to acknowledge the "zoological connection" (p. 399). Despite Bryant's ardent rallying call, colleagues have only sluggishly engaged with "sociological animal studies" (Taylor & Sutton, 2018, p. 469). In more recent years, however, human-animal scholarship has gathered momentum; as evidenced by a critical systematic review of peer-reviewed sociological articles published between 1979-2018:

> Prior to 1997, [human-animal] articles were sporadic with only 1 in 1979, 1 in 1981, 1 in 1987, 2 in 1993, and 1 in 1994. From 1997 [human-animal] articles were published every year with the exception of 2001 and 2004, and there is a general upward trend over time, with publications increasing to as many as 10 (2012 and 2015) or 11 (2013) per year (Taylor & Sutton, 2018, p. 473).

Forty years post-Bryant, a proliferation of multispecies scholarship in sociology and cognate disciplines has ensured HAS "is now an established multi-disciplinary field that provides indispensable empirical and theoretical research on human–animal relationships" (Shapiro & Lynn, 2019, p. 1). Reaching this milestone also affords a

timely opportunity to reflect on Clark's (2016) incisive question: "Which Animals Do We Study"? This question was the title of Clark's short but thought-provoking online contribution to the "Why Animal Studies?" series, run by the Animals in Society Working Group (Flinders University). A catalyst for his query was Lunney's (2014) analysis of conference abstracts submitted to the Australian Animals Study Group in 2013. As a zoologist, he noted a "concentration on large, well-known mammals, which from a zoological standpoint are a miniscule proportion of the world's animals, and even a highly skewed sample of mammals" (p.46), particularly companion and agricultural animals. Within HAS, domesticated mammals have similarly attracted more attention than wild animals (Shapiro & Lynn, 2019; Taylor & Sutton, 2018).

These observations indicate that HAS scholarship is predominantly, albeit not exclusively, built on the backs of mammalian vertebrates, especially domesticated animals. According to Clark (2016, paragraph 2), "In light of our apparent mammal-centrism, perhaps it's time to rename our field. 'Mammal Studies' has a nice ring to it, though 'Vertebrate Studies' may be more accurate". The field's preoccupation with domesticated animals is closely entangled with policy and public debates about the moral and legal status of such animals (e.g., Francione, 2008; Singer, 1995); as evidenced by the increasing politicization of human - farm animal issues in late modernity (e.g., Franklin, 1999; Camm & Bowles, 2000). Given this backdrop, "Perhaps a desire for political relevance has led our field to focus on the kinds of animals that have captured the attention of animal advocates" (Clark, 2016,

paragraph 8). By way of contrast, to initiate a movement for "insect rights" is considered premature:

> We still do not know enough about insect subjective experiences to do that; and, in any case, the world is far from being ready to take such a campaign seriously. We need first to complete the extension of serious consideration to the interests of vertebrate animals, about whose capacity for suffering there is much less doubt (Singer, 2016, paragraph 15).

When this is combined with the widespread development of, and largely uncontested application of "biocidal agricultural compounds" (pesticides) that systematically kills insects, this clearly illustrates the current lack of public concern for such animals (Rivers, 2017, 363). Singers' position not only highlights and justifies a vertebrate bias within HAS, it also strengthens Clark's observation that scholars "study animals not only because [they] find them interesting but also because [they] think they're worthy of moral consideration" (2016, paragraph 4).

If (in)vertebrate animals are deemed less worthy of moral and scholarly consideration, where does this leave less charismatic species (Lorimer, 2007), and "countless other creatures who are less visible, less beautiful, less a part of our cultural lives", such as insects (Rose & van Dooren, 2011, p. 1); a taxon of animals that exemplifies "unloved others" (ibid). Of course, some "charismatic micro-fauna" do attract scientific and public attention, especially aesthetically pleasing species, such as "bees, beetles, butterflies and dragonflies" (Lemelin, 2013, p. 8; Moore & Kosut, 2013). On the other hand, Hatley (2011) attends to pesky critters such as ticks

and invites us to regard them as "kin" (p.74). However, since ticks (and mites) have been excluded from the International Union for Conservation of Nature Red List of Threatened Species, this indicates what Hatley calls "zoomorphic bigotry":

> The seemingly alien morphology of insects and their immediate kin—compound eyes, multiple pairs of legs, an exoskeleton in lieu of skin and a thorax that breathes—makes it difficult for mammalian humans to accept them as fellow creatures (2011, p. 65).

Although this lack of interest in, knowledge about and concern for non-vertebrates is clearly pertinent to HAS, the deprioritization of invertebrates is not limited to HAS scholarship. A similar trend is evident in other animal-related disciplines. For example, systematic journal reviews on wildlife, conservation and biodiversity have also flagged a vertebrate bias (e.g. Grodsky, Iglay, Sorenson & Moorman, 2015; Titley, Snaddon, & Turner, 2017):

> This [taxanomic] bias stems from disparities in our knowledge of different organisms, and in the extent to which they are the focus of scientific research, across a wide range of biological disciplines. Some organisms – mostly plants and vertebrates – are over-represented in various scientific fields (Troudet, Grandcolas, Blin, Vignes-Lebbe, & Legendre, 2017, p. 1).

However, even amongst backboned animals there can be "taxonomic chauvinism" (Bonnet, Shine, & Lourdais, 2002, p. 1). For example, vertebrate species can be subdivided into endothermic (warm blooded animals), and ectothermic (cold blooded animals). A study of research papers published in ecological and behavioural

journals found an overrepresentation of endothermic animals in their sample. The authors' note,

> although there are more than twice as many ectothermic species (fish, amphibians, squamate reptiles, turtles and crocodilians)[1] as endothermic (avian plus mammalian) species (~31 000 versus 13 000), >71% of the papers [n=1171] analysed dealt only with endotherms (Bonnet et al., 2002, p. 1).

They also suggested that "editors and referees [need] to consider their own biases – including their level of interest in different kinds of organisms – when they evaluate manuscripts during the peer-review process" (p. 3). The wider impact of, and possible rationale for, such biases has been applied to animal biodiversity research:

> General perceptions of biodiversity may also be influenced by journal editors publishing a disproportionate number of articles on vertebrates (consciously or subconsciously), because such articles may be more likely to gain traction within a scientific community that is already vertebrate-biased (especially if journals are under pressure to maintain a high impact factor driven by citations) (Titley et al., 2017, p. 11).

We suggest HAS journals are unlikely to be exempt from such editorial pressures and vertebrate biases. If left unheeded, however, this would contribute to a skewed understanding of what is meant by "animals" within HAS, and "[t]here are ethical, ecological and cultural consequences of playing favourites with species" (Lunney, 2014, p. 46). To contextualize this imbalance towards backboned animals, the Center *for* Biological Diversity (n.d.) suggest invertebrates account for

> no less than 97 percent of all animal species on Earth. Invertebrates range from spiders and scorpions to centipedes and millipedes, crustaceans, insects, horseshoe crabs, worms, leeches, earthworms, marine bristle worms, mussels and clams, snails, squid and octopi, sea anemones and corals, among others (paragraph 1).

This preoccupation with vertebrates is symptomatic of "institutional vertebratism" and is characterized by a systematic "dearth of invertebrate knowledge" (Leather, 2009, pp. 413-414). For example, a decade ago, an entomologist explained in a letter to *Trends in Ecology & Evolution*, how this "bias against animals without backbones" raised fundamental concerns about UK food security. Leather evidenced his claim by citing the decrease of entomological Degree courses in the UK and other European countries, the prioritisation of funding for vertebrate-focused research, and the challenge of publishing insect-related papers in high impact conservation and ecology journals. If such institutional knowledge gaps are not addressed, then this could jeopardise the future protection and management of food crops (ibid).

A scholarly penchant for our vertebrate cousins means the "silent majority" have still to significantly register on natural and social science research radars (Moore, 2017, p. 166). This lack of interest in, knowledge about and concern for non-vertebrates has consequences for HAS scholarship too. As Clark notes, "At its best, our scholarship moves animals out of people's ethical blindspot and into their line of vision. But we scholars have our blindspots, too. We focus on some animals but not others" (2016, paragraph 6). We suggest human-animal scholarship is characterised by a level of institutional vertebratism. We also contend, if HAS is to comprehend the full range of

interspecies contexts, and the multifaceted nature of human-animal relationships therein, it must be as inclusive as possible in terms of the diversity of animal species studied.

With growing scientific interest in and ecological concerns about declining numbers and biodiversity of insects worldwide (e.g., Sánchez-Bayo & Wyckhuys, 2019), the next generation of HAS scholars are well placed to contribute to this growing awareness of arthropods and redress the vertebrate bias that currently exists in multispecies scholarship. Developing critical understandings of a range of human-invertebrate contexts is timely for two reasons. Firstly, it will do much to raise the profile of invertebrate animals within HAS. Secondly, findings from such studies could stimulate, inform and transform political, ethical, policy and scholarly debates about the status of invertebrates in an array of socio-cultural backgrounds. For example, in a forthcoming special issue of *Society & Animals* – The Silent Majority - Bear explores the attitudes, practices and situated ethics of insect farmers who kill insects for human food, and Lemelin, Boileau & Russell consider the allure and edutainment role of insects in contemporary entomotourism.

To gain a clearer picture of how prevalent (or not) invertebrates have been in HAS scholarship we conducted a three-stage scoping study of two pioneering journals in the field. The focus of our search was peer-reviewed articles that mentioned invertebrate-type animals during the period of review (from each journal's inception to December 2018). This article reports on our preliminary findings, and the next section discusses how we conducted our study.

Methods

Since the 1990s, the proliferation of different kinds of literature reviews, such as, "(full) systematic review; meta-analysis; rapid review; (traditional) literature review; narrative review; research synthesis; and structured review" … has generated "a plethora of terminology to describe approaches" (Arksey & O'Malley, 2005, p. 20). Inconsistent definitions, paired with minimal guidance, has also contributed to a lack of clarity about what to call these various reviews, and the rationale for selecting one type over another (Munn, Peters, Stern, Tufanaru, McArthur & Aromataris, 2018, p. 1). That being said, systematic literature reviews can be an effective way of "mapping out areas of uncertainty, and identifying where little or no relevant research has been done, but where new studies are needed" (Petticrew & Roberts, 2006, p. 2). A "scoping study", as one form of systematic review, can map relevant literature in a field (Arksey & O'Malley, 2005, p. 20). As the name suggests,

> scoping reviews are an ideal tool to determine the scope or coverage of a body of literature on a given topic and give clear indication of the volume of literature and studies available as well as an overview (broad or detailed) of its focus (Munn et al., 2018, p. 2).

Moreover, such approaches might be "undertaken as stand-alone projects in their own right, especially where an area is complex or has not been reviewed comprehensively before" (May, Roberts & Popay cited in Arksey & O'Malley, 2005, p. 21). Given these definitions, and to the best of our knowledge, our scoping study is the first to appraise the prevalence of invertebrates in published articles in HAS scholarship. More specifically, we focused on the two longest running journals in this

interdisciplinary field: *Anthrozoös* (founded 1987) and *Society & Animals* (founded 1993). According to the stated aims and scope of the former journal:

> ***Anthrozoös*** is a quarterly, peer-reviewed journal that has enjoyed a distinguished history as a pioneer in the field since its launch in 1987. The key premise of ***Anthrozoös*** is to address the characteristics and consequences of interactions and relationships between people and non-human animals across areas as varied as anthropology, ethology, medicine, psychology, veterinary medicine and zoology. Articles therefore cover the full range of human–animal relations, from their treatment in the arts and humanities, through to behavioral, biological, social and health sciences (Taylor & Francis, 2018, emphasis in original).

Although the above information states *Anthrozoös* is a "quarterly, peer-reviewed journal", the consistency of publishing, and numbering of, four issues per year did not occur until 1992. In 2012, the journal also published a 25-year anniversary edition (Volume 25: supplement 1) and from 2018 there were six volumes per year. In total, there have been 1369 published items during our review period (1987-December 2018), of which 958 were categorised as "original articles" in the journal publisher's website (Taylor & Francis). In this website, you can filter a search to title, author, keywords or anywhere. We selected "anywhere" to get as full a search as possible.

The second journal we searched was *Society & Animals.* This publication is now in its 26th year and "publishes studies that describe and analyze our experiences of non-human animals from the perspective of various disciplines within both the social

sciences … and humanities" (Brill, 2016-2019). The aim of this journal is

> to stimulate and support the emerging multi-disciplinary field of animal studies, which consists, broadly, of investigations of the ways in which non-human animals figure in our lives. … It is also unique in its encouragement of data based discussion of ethical and policy issues in the current debate over the place of non-human animals in an increasingly human-centered world (ibid).

From its inception to 1996 *Society & Animals* published bi-annually. From 1997-2001 it published three issues per year, and then quarterly for the next 10 years (2002-2012). From 2013-2018 it has published six issues per year. In total, 863 items have been published during the review period, which includes 48 online advance articles.[2] Advance articles were excluded from our review as we only included material that was published by the end of December 2018. Of the remaining 815 items we excluded 19 repeat publications (17 research articles and 2 book reviews) within the journal to leave a total of 796 items.[3] We then identified 748 items classified as "research articles", of which 17 were repeat publications. This left 731 articles.

For the purpose of our scoping study, our search protocol involved 3 main stages: 1) conducting a systematic keyword search of both journals, 2) creating a "data charting form" (Arksey & O'Malley, 2005, p. 26) to collect some descriptive information about the articles found during our search, and 3) using a random integer set number generator (https://www.random.org) to generate a 10% random sample of papers to be read in more detail. The next section explains how stage one of our scoping search was conducted and our initial findings.

Stage One: Keyword Search and Initial Findings

Given the current dearth of systematic reviews on (in)vertebrate bias within HAS, we drew on a parallel study in animal biodiversity to select five of our keyword search terms. In this systematic review of vertebrate bias, the authors explained how they categorized their sample of 526 research papers from the *Web of Science* database:

> Vertebrate studies were classified into one or more of five major vertebrate groups (Mammals, Birds, Reptiles, Amphibians and Fishes). Correspondingly, five major invertebrate groups were chosen because of their high species richness and because they are relatively well studied (Insects, Arachnids, Nematodes, Annelids, and Molluscs) (Titley et al., 2017, p. 4).

In addition to these five invertebrate groupings, we included the term invertebrates because we thought it would be used in everyday life and parlance. The Centre *for* Biological Diversity (n.d.) strengthens this assumption:

> To group all invertebrates together is an immodest proposal, since the definition of "invertebrate" is any animal without a spinal column … The vast diversity encompassed by the term *invertebrates* says less about the species than it does about our typical, very unscientific habit of giving the term equal footing with the much more narrowly representative “birds” or “mammals” (paragraph 1, emphasis in original).

Finally, we incorporated more colloquial child-like terms such as “bugs”, “creepie-crawlies” and “mini-beasts”[4] because pilot searches highlighted a few studies where study participants were pre-school children (e.g., Howard & Vick, 2010), older school

children (e.g., Tomažič, 2011) and college students (e.g., Shipley & Bixler, 2017).

We searched each journal's publisher website because it enabled us to search the full text of publications therein.[5] In contrast, databases such as SCOPUS only search the abstracts, keywords, title and references.[6] This decision maximized the identification of any fleeting reference to our search terms and bypassed concerns about how informative journal abstract content is "in the arts, the sciences, and the social sciences" (Hartley & Betts, 2009, p. 2015).[7] To maximize replicability all items categorized as "original articles" on Taylor and Francis' journal website were included even if they were book reviews, film reviews or review sections. Similarly, we relied on Brill's cataloguing of "research articles". Although we found 11 articles that were incorrectly classified in both journals (n=22), they were not excluded from our scoping study. Identifying such classificatory discrepancies, however, draws attention to how database materials, can, in practice, be inaccurate, be inconsistent, and change over time. This cautions that journal cataloguing is ultimately based on human decision-making and may be erroneous. The fallibility of databases potentially undermines the "discourse of systematic reviews" because the "claims that are made for the transparency, accountability and trustworthiness of systematic review do not [always] … stand up to scrutiny" (MacLure, 2005, p. 393; Hammersley, 2001).

Furthermore, all journal articles in our study were published in English. This language bias highlights obvious parameters to our search. For example, articles not published in English, books and edited book chapters were not part of the scoping study. "Grey literature" was not searched either, which is "any document that is not an academic

journal article" (Jesson, Matheson & Lacey, 2011, p. 54) or "the vast array of evidence *not* controlled by commercial publishers" (Boland, Cherry & Dickson, 2017, p. 65, emphasis in original). Another potential limitation is our focus on peer-reviewed publications: "experts who have established perspectives and paradigms can act as a barrier to publishing new and unconventional ideas" (ibid, p. 21). Given the academic proclivity for vertebrates, especially domesticated mammals, this may influence how invertebrate-focused papers are (re)viewed within HAS journals. Despite these caveats, our preliminary findings will be of interest to those planning more comprehensive systematic reviews of human-invertebrate literatures in the future (Arksey & O'Malley, 2005, p. 22).

Finally, as recommended when doing any scoping study, the expertise of a library information consultant was enlisted to assist with planning, piloting, developing and executing the keyword search protocol (Boland et al., 2017, p. 24). Prior to conducting finalised keyword searches, two members of the team were also tasked to collect, check and double-check the detailed breakdown of journal website materials to mitigate coding and counting errors. Out of 231 keyword search hits in *Anthrozoös*, 153 were categorized as "original articles" of which 44 were duplicates. This left a total of 109 articles. In *Society & Animals* 161 search hits were identified, of which 44 papers were removed; this included advance articles (n=7), search duplicates (n=33) and repeat journal articles (n=4). This left an overall search hit of 117. If we had searched article titles, abstracts or keywords the number of articles found would have been reduced to 13 in *Society & Animals* and 22 in *Anthrozoös.* However, 10 coding errors during stage one of our search were revealed during the

latter stages of the project, when collating article template data (n=117) in *Society & Animals*. Having identified our erroneous inclusion of three duplicate articles and seven non-articles (3 “book review”, 2 “book received” and 2 “other”), the amended search hit total for this journal is n=107.

As previously noted, cataloguing journal database material is not an automated process; human error and inconsistent classifications cannot be ruled out. Likewise, those conducting literature searches are not exempt from making cataloguing errors either. Despite this, adopting a rigorous cross-checking process allowed us to identify, account for and largely correct this coding discrepancy.[8] The adjusted overall total for our keyword search is therefore 216, *Anthrozoös* (n=109) and *Society & Animals* (n=107), and the comparative breakdown of keyword terms per journal is summarized in Table 1.

Insert Table 1 about here

To further contextualize these search hits, the *Anthrozoös* keyword search results accounted for 11% of the 958 “original articles” published in this journal. Likewise, out of 731 “research articles” our search hits account for 15% of all articles in *Society & Animals*. It is also noteworthy, that when “bugs”, “insects” and “invertebrates” are amalgamated they account for 94% of the total keyword search hits in both journals. Such terms are clearly germane when searching HAS scholarship and highlights their potential usefulness in future scoping studies. Perhaps this finding is to be expected, since lay people have less need for specialist species-specific terms than entomologists and other animal science experts. For example, Waltner-Toews (2017), an epidemiologist and veterinarian, explains in his book, *Eat the Beetles! An*

Exploration into our Conflicted Relationship with Insects: "I shall be careful to use specific terms when those are warranted to make fine distinctions, but will use more general terms like *bugs* and *arthropods* when fine distinctions amount to overspecification …"(p.15: emphasis in original).[9] Finally, although "bugs", "invertebrates" and "insects" have been key generic search terms in our study, they inadequately represent the diversity of species constituting the silent majority. Attending more fully to invertebrates will not only expand our species-specific knowledge about such animals, it may also enlarge and further refine our rather truncated colloquial phraseology. In other words, "We need [to develop] a richness of language to match the diversity of this extended animal family" that we co-exist with but largely overlook (Waltner-Toews, 2017, p. 15; Sealey & Charles, 2013).

Stage Two: Collation of Keyword Search Article Data

To further contextualize our keyword search findings, we now describe some of the article data gathered during our scoping study. Having identified our keyword search articles, we then gathered pre-set bibliographic details, primarily based on the first author, from each item. The finalized "data charting form"(a basic Excel spreadsheet) included the following columns (Arksey & O'Malley, 2005, p. 26): type of invertebrate term(s) mentioned in title, abstract, key words; document type (e.g., article, book review); name of author one; title of article; year of publication; volume, issue and DOI; team size; institutional affiliation; geographical location; gender; career stage or title[10] and discipline. To focus our coding approach, we only collected data for the first named author as written on the article rather than on the journal contents page. To further enhance coding reliability, a coding sheet with

guidance notes for each category was created so that information could be collated in a uniform manner. In practice, the first and second team members divided the 226 articles between them and collected template data for articles from one of the two journals.[11] Both sets of template data were then double-checked by our library consultant. However, at times, article information was unclear or missing, especially for disciplinary background. To aid clarification or verification of indeterminate bibliographic information additional online searches were also conducted (e.g., author's CVs, *LinkedIn*, *ResearchGate* and *Academia.edu*). A summary of preliminary findings for first author characteristics (gender, geographical location and disciplinary background) is outlined in Table 2.[12]

Insert Table 2 about here

Although no noteworthy gendered authorial patterns were identified in either journal, three geographical locations currently dominate in both journals. This is evidenced by 93% of all contributors coming from the Americas (n=90), Europe (n=74), and to a lesser extent Australasia (n=24). In *Anthrozoös*, *the* Americas (n=38) and Europe (n=42) account for 80% of all first authors. More specifically, 33 of those in the Americas were based in the United States (87%), and 15 of the European classification were in the UK (36%). A similar picture is replicated in *Society & Animals*. Once again, the Americas and Europe account for 82% of the geographical location of all first authors. More specifically, 42 of those in the Americas (n=52) were based in the United States (81%), and 17 of the European grouping (n=32) were based in the UK (53%). Based on these findings, more *Anthrozoös* authors contributed from Europe whilst *Society & Animals* authors were more likely to

contribute from the Americas. Finally, although both journals encourage articles from a wide range of disciplinary backgrounds, 55% of first authors held a psychology or science background in *Anthrozoös,* whilst 60% in *Society & Animals* had a social science or humanities background. Although this disciplinary breakdown may not characterize those who study invertebrates per se, it possibly indicates a more general trend of the distribution of scholarly contributions submitted to each HAS journal.

Stage Three: Random Reading Sample

Having identified our keyword search articles (n=226) a random integer set number generator (https://www.random.org) was then used to generate a 10% reading sample (n=22).[13] The first and second team members read these papers separately and in a more exploratory way. Particular attention was given to the types of invertebrates, and how central, or fleeting, they were in each paper. Such information was noted in a data charting form that collated the following information per article: author(s), year of publication, title, document type, discipline, focus on invertebrates, and detail on coverage. The last column cited extracts and page numbers of all mentions to invertebrates per paper, to provide some context of their inclusion. This latter information also allowed us to identify, count and map the use of invertebrate species and terms (n=37) utilized in each journal (see Table 4). The terms highlighted in bold denote those found in *Anthrozoös* articles, and underlined terms were found in *Society & Animals*.To contextualise this random reading sample, first author characteristics have been summarised in Table 3.

Insert Table 3 about here

As indicated above, 71% of first authors were female and 53% were based in European countries. Although there was a wide range of disciplinary backgrounds, which is characteristic of the interdisciplinary nature of HAS scholarship, the main disciplinary background was psychology (29%). We also mapped the breakdown of keyword search terms on to the entire list of search articles published in both journals since their inception.

Insert Table 4 about here

As illustrated in Table 4, the search terms "bugs" (n=2), "insects" (n=17) and "invertebrates" (n=3) account for our entire random reading sample. More specifically, the term "insects" makes up the total hits in *Society & Animals* and 60% of the hits in both journals. As previously mentioned, this possibly reinforces the significance of using these terms in future scoping studies of HAS literatures. Having mapped the range of invertebrate-related terms (n=37) in the reading sample **insects** was the most commonly occurring term (n=21).[14] This was followed by: **invertebrates** (n=9), **spiders** (7), **bees** (n=5), **butterflies** (n=5), **cockroaches** (n=4), **slugs** (4), **flies** (n=3), **worms** (n=3), **ants** (n=2), beetles (n=2) and **bugs** (n=2). If spider-related terms are all combined (i.e. **arachnids**, spiders and tarantula) this gives a total of nine; making spiders the most common invertebrate species mentioned in our sample. There were a further 23 terms only referred to once: **caterpillars**, centipede, cephalopods, **crab**, crickets, **crustaceans**, **cutworms**, decapod **crustaceans**, drosophila, **fleas**, **grasshopper**, huhu grubs, **larvae**, **Lepidoptera**, **lobsters**, **mollusks**, mosquitos, **moths**, **octopus**, ostracod, **scorpions**, **tick** and **wasps**.

It is also noteworthy that *Anthrozoös* used 27 out of the 37 terms found, whilst *Society & Animals* utilized just over half (n=19). This finding might indicate that, to date, *Anthrozoös* has been more inclusive and diverse in terms of the invertebrate species acknowledged in its articles than *Society & Animals*. Moreover, only nine relatively common terms were used by both journals.

Finally, 73% of random reading sample papers (n=16) made fleeting reference to invertebrates in the text. We defined fleeting as ranging from one mention of an invertebrate-related term(s) up to a paragraph in an entire article. This finding possibly relates to how the keyword search was conducted. Since our scoping study set out to explore how prevalent invertebrates are in HAS scholarship, we searched the full text of articles on both journals' publisher websites to maximize our ability to identify any reference, no matter how minimal, to spineless animals.

However, 27% (n=6) of random papers engaged more fully with non-backboned animals of which three described a linguistic, legislative and cultural bias against them. For example, Sealey & Charles (2013) conducted a secondary data analysis to explore the meaning of "animals" to human beings. A primary finding of their research is the term "animal", despite technically inclusive of invertebrates, might not include them due to existing popular beliefs or lay knowledge about the animal kingdom. As they state, "It reminds us that insects are much more numerous than birds or mammals, yet these kinds of creatures may not, for many people, be connoted by the term 'animal'" (p. 490). Peggs' (2010) discourse analysis of a revised European Community Directive pertaining to animal experimentation highlights a significant welfare bias against invertebrate animals within this context. As she

explains, having

> a backbone is decisive. Having a backbone entitles one to restricted inclusion in an expanded network. With a backbone, one's position in the network is determined by closeness to the benchmark of the human; most of those without a backbone are not even given the protection that allows them to be experimented upon under specified conditions. It is human-nonhuman animal power relations, … that underpin this complicated network of ties and moral value (p.13).

Finally, a psychologist's content analysis of British children's television programs in the mid-1990s also found that "Animals of different phylogenetic classes were depicted as deserving of differential moral status. For example, fish and invertebrates were shown to be predated, eaten or suffer cruelty with little or no comment or condemnation" (Paul, 1996, p. 178). She also noted:

> The human-like animals of fictional programs were frequently mammals; birds seemed to occupy an ambivalent middle position; and fish and invertebrates came last, generally playing minor, neutral (or baddie) and animal-like characters. The implicit message seems to be that mammals are very like us and, as such, have the capacity to think, feel and suffer. 'Lower' animals, on the other hand, although sometimes interesting, exotic or dangerous, are unlike us, and children should not worry that they might suffer (ibid).

Conclusion

Our scoping study of two pioneering HAS journals confirms existing claims that human-animal scholarship is more likely to focus on vertebrate than invertebrate animals (Lunney, 2014; Clark, 2016). Although our keyword search identified a total of 11% articles in *Anthrozoös* and 15% in *Society & Animals*, this finding is a generous depiction for two methodological reasons. As we conducted a full text search of both journals' publisher websites this maximized our search hits. If we had relied on journal title, abstract, and keywords our total search hits would have been reduced to 22 in *Anthrozoös* (2%) and 13 in *Society & Animals* (2%). Although this approach allowed an extensive perusal of journal materials, it also included articles that only cited one search term once in the entire article (e.g., Battisti & Zocchi, 2018: 639). When this is combined with inaccurate cataloguing of articles in both publisher websites, this highlights a more fundamental systematic inconsistency that undermines the presumed reliability typically associated with systematic searches of any journal.

We suggest that future research by HAS scholars might reflect on a slight revision of Clark's (2016) question: which animals do we not study? As previously argued, "[t]here are ethical, ecological and cultural consequences of playing favourites with species" (Lunney, 2014, p. 46). If a vertebrate bias is left unchecked in multispecies scholarship this will perpetuate institutional vertebratism in this field. Furthermore, simply acknowledging that study participants or research designs do not incorporate invertebrates is not enough. To address the field's penchant for mammals, especially domesticated mammals, requires its scholars to critically probe why this might be.

To avoid doing so is a missed opportunity, because it runs the risk of shoring up a vertebrate bias in HAS scholarship; which begs a more fundamental question about what "animal" means in this vibrant interdisciplinary field. This point has far reaching implications, because specific taxonomies of (in)vertebrate animals are being systematically included in and excluded from policy, public and scholarly debates about animal cruelty and welfare-related issues. If the next generation of animal scholars is to comprehend the full range of interspecies contexts, including the multifaceted nature of human-animal relationships therein, then they must be more inclusive in terms of the diversity of vertebrate and invertebrate species studied. Widening the species net is therefore a necessary corrective to vertebrate bias and will further augment the field's contribution in future years.

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[1] Squamate reptiles include "lizards (e.g. gekkotans, skinks, chamaeleons), snakes, and amphisbaenians" (UCL, n.d.).

[2] *Anthrozoös* has no advance articles.
[3] See volume 8: issues 1- 3 (2000), volume 10 issue 4 (2002) and volume 11 issue 1 (2003) for duplicated published items.
[4] "Mini-beasts" not used in the US and "creepie crawlies" is also written "creepy crawlies". We used both spellings and searched for "molluscs" and "mollusks".
[5] Scanned versions of articles and digitalized pdfs were searchable in both journals.
[6] SCOPUS is "the largest abstract and citation database of peer-reviewed literature: scientific, books and conference proceedings" Retrieved June 24, 2019, from https://www.elsevier.com/solutions/scopus
[7] We used Mendeley to manage search references. For some unexplained reason 30 sources could not be imported from *Society & Animals* (27 plus 3 duplicates). Our library consultant imported them to Mendeley via RefWorks (using Google Scholar), and the journal forwarded us pdf files of these sources. Inter-library loans requested for four *Anthrozoös* articles; no access to them in the UK or US.
[8] Since our 10% random reading sample (n=22) was conducted prior to discovering this coding error, the sub-sample is based on n=226 articles and not n=216. One of the three duplicate articles was included in the sample (Grier, 1999).
[9] We entered arthropod in both journals publisher websites whilst writing this paper (June 2019): 14 hits in *Anthrozoös* and seven in *Society & Animals*. When cross-referenced with our search reference list we only found three new articles.
[10] Category dropped, as it proved too difficult to collect.
[11] Total is n=226 because it is prior to identifying our coding error of 10 papers.
[12] Total is n=202 because we deducted our 10 coding errors in *Society & Animals*, and removed 14 incorrectly classified articles from both journals (not applicable).
[13] Numbers 1-117 = *Society & Animals*; numbers 118-226 = *Anthrozoös.*

[14] Single and plural versions of a term were combined e.g., insect(s), and multiple references to a term in an article were counted once, as we only wanted to map the range of terms used.

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Table 1: COMPARATIVE BREAKDOWN OF KEYWORD SEARCH TERMS PER JOURNAL

Keyword Search Term	***Anthrozoös* (n=109)**	***Society & Animals* (n=107)**
Annelids	1	1
Arachnids	5	1
Bugs	17	24
Creepy Crawlies and Creepie Crawlies	0	0
Insects	66	64
Invertebrates	20	13
Mini-beasts	0	0
Molluscs and Mollusks[14]	0	3
Nematodes	0	1
Overall total	109	107

Table 2: BREAKDOWN OF FIRST AUTHOR CHARACTERISTICS IN BOTH JOURNALS

	***Anthrozoös* (n=100)[14]**	**%**	***Society & Animals* (n = 102)[14]**	**%**	**Total (n=202)**	**Total %**
Gender						
Female	53	53%	46	45%	99	49%
Male	46	46%	53	52%	99	49%
Not verified	1	1%	3	3%	4	2%
Geographical Location						
Africa	2	2%	2	2%	4	2%
Americas	38	38%	52	51%	90	45%
Asia	4	4%	4	4%	8	4%
Australasia	13	13%	11	11%	24	12%
Europe	42	42%	32	31%	74	36%
Not verified	1	1%	1	1%	2	1%
Discipline						
Environment and Nature	15	15%	8	8%	23	11%
Humanities	9	9%	22	21%	31	15%
Psychology[14]	27	27%	16	16%	43	21%
Social Sciences	18	18%	40	39%	58	29%
Sciences	28	28%	14	14%	42	21%
No data available[14]	3	3%	2	2%	5	3%

Table 3: COMPARATIVE PERCENTAGE BREAKDOWN OF FIRST AUTHOR CHARACTERISTICS IN RANDOM READING SAMPLE

	Anthrozoös (n= 7)[14]	%	*Society & Animals* (n=10)[14]	%	Total % (n=17)
Gender					
Female	4	57%	8	80%	Female = 71%
Male	3	43%	2	20%	Male = 29%
Discipline[14]					
Anthropology	1	14%	1	10%	Anthropology = 12%
Ecology	1	14%	-	-	Human-Animal Studies = 12%
English	1	14%	-	-	History = 12%
Geography	-	-	1	10%	Psychology = 29%
History	-	-	2	20%	Remaining disciplines = 35%
HAS	-	-	2	20%	
Philosophy	-	-	1	10%	
Psychology	4	57%	1	10%	
Science Education	-	-	1	10%	
Sociology	-	-	1	10%	
Geographical Location		*			*
Australia	1	14%	2	20%	Australasia = 24%
Belgium	-	-	1	10%	Americas = 24%
Italy	1	14%	-	-	Europe = 53%
Turkey	-	-	1	10%	
United Kingdom	4	57%	2	20%	
United States	1	14%	3	30%	
New Zealand	-	-	1	10%	

[14] Adjusted n=10 to n=7 because of 3 incorrectly classified articles in *Anthrozoös* (not applicable).
[14] Adjusted n=12 to n=10 because of 2 incorrectly classified articles in *Society & Animals* (not applicable).
[14] *Percentage total does not add up to 100% due to rounding.

Table 4: FREQUENCY OF KEYWORDS IN SEARCH HITS AND RANDOM READING SAMPLE [14]

	Anthrozoös				***Society and Animals***			
	Keyword Search		Random Sample		Keyword Search		Random Sample	
	n.	%	n.	%	n.	%	n.	%
Annelids	1	1%			1	1%		
Arachnids	5	5%			1	1%		
Bugs	17	16%	2	20%	24	22%		
Insects	66	61%	5	50%	64	60%	12	100%
Invertebrates	20	18%	3	30%	13	12%		
Molluscs					3	3%		
Nematodes					1	1%		
Totals	109	101%[14]	10	100 %	107	100%	12	100%