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RESEARCH

Rewilding Animal Studies: Biodiversity Bias in Modernist Fiction and Criticism

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We are living through the greatest loss of biodiversity in human history. Yet, little is known about the human subjective experience of biodiversity. Beyond an understanding of the scientific concept, how do we perceive and portray biodiversity in culture? This study investigates the aesthetic dimensions of biodiversity through the lens of European and Latin American modernist fiction, which was written during a period defined by globalisation, urbanisation and industrialisation: key drivers of biodiversity loss. Although biodiversity richness differs greatly between the European and Latin American geographies, sampled works of fiction have similar numbers and types of animal species. According to the sample, biodiversity in modernist fiction is not merely skewed in relation to global representations of biodiversity but is almost reversely correlated to statistics on animal biomass and described species. Animal Studies in the humanities amplifies this bias by focusing almost exclusively on individual animal characters with advanced cognition. By embracing a biodiverse perspective, Animal Studies can be significantly more inclusive, representative, and diverse in its discussion of animals.

Keywords: Anthropocene; Biodiversity; Environmental Humanities; Animal Studies; Modernism

How did we conceptualise animal biodiversity in a non-scientific manner during the onset of the greatest loss of animal biodiversity in human history? Rapidly diminishing animal biodiversity, anthropogenic climate change, and ecological tipping points are visible in statistics and graphs and are now made tangible by rising temperatures and ever more mercurial weather as we approach the first mass extinction since the non-avian dinosaurs died out 66 million years ago (Barnosky et al. 2011; Ceballos and Ehrlich 2018: 1081; Wilson 2022b: 424). The 'rate of species extinction is now as much as 100 times that of the "normal rate" throughout geological time' (Ceballos and Ehrlich 2018: 1080). The World Wildlife Fund's *Living Planet Report* (2024) demonstrates that monitored wildlife populations have decreased, globally, by 73% in the last five decades; terrestrial and marine populations by 69% and 56%, respectively; freshwater populations by 85%. In response to this rampant decimation of the phylogenetic tree, one may ask: how did we, as humans (and global superpredators), experience, value, and narrate the richness of animal biodiversity during its undoing? How did we express biodiversity as we set the extinction apparatus in motion, by the confluence of globalisation, urbanisation and industrialisation? Was our attention skewed towards a specific class of animals, or was it evenly distributed across all species? Although the term 'biodiversity' was first coined in the 1980s (Sarkar 2021)—around the same time as 'Anthropocene' (Crutzen and Stoermer 2013: 487) and shortly after 'global warming' in 1975 (Broecker 1975)—an intuitive understanding of biodiversity was present *avant la lettre.*

When reduced to a comparative metric, biodiversity is the revelatory idea that a single number/ratio is an indicator of the health of an ecosystem, akin to the number on a medical thermometer, calibrated to equate higher numbers with better health.[1] One measure of biodiversity—species richness—is present in nature and in fiction. To approximate the extent of how we experience and document animal biodiversity—not as a scientific concept, but as a lived human experience and aesthetic phenomenon—this paper will look at species richness in fiction: the fauna of fiction. It will also explore how species richness may shape the form of fiction, even if it does not always shape the reader's experience of it. This paper introduces the *Biodiversity Visibility Index* (BVI): a conceptual framework that visualises and approximates the experience and expression of animal biodiversity through the lens of fiction. Although the index is an attempt to answer questions such as: 'is our public perception of animal biodiversity accurate? Does fictional biodiversity correctly correspond to global biodiversity?', the aim is ultimately to go beyond binary and normative questions formulated against the yardstick of scientific intelligence. The index aims instead to address more open-ended questions, such as: how do we imagine animal biodiversity? How do we aestheticise and fictionalise animal biodiversity?

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Following Adam Trexler in *Anthropocene Fictions*, I will examine texts 'not as mirrors of a culture, but as specific artifacts in wider networks of meaning' (2015: 5). While fiction can perpetuate bias (Goffin and Friend 2022), the primary aim of this paper is not to fault fiction and quantify bias, but to articulate an understanding of animal biodiversity and the environmental imagination through the lens of Western modernist fiction, which was written from a place and period defined by globalisation, urbanisation and industrialisation, key drivers of biodiversity loss. A handful of writers have been chosen who are frequently seen as representative of Western literary modernism (according to the convergence of data from the Open Syllabus Project (https://www.opensyllabus.org/), bibliometric analyses in academic journals, and the prominence of these authors in modernist anthologies and scholarly discourse). Although the main sample of writers consulted—Conrad, Kafka, Nabokov, and Woolf—hail from somewhat diverse time periods, and linguistic and national contexts, they are all European, white, middle to upper class, and rooted in the Western modernist canon and literary tradition. To offer a contrast to the European modernist framework and test the viability of the BVI, twenty novels by twenty modern and late modern Latin American authors were surveyed. This sample is greater in number of authors than the European selection, but covers fewer works of fiction. This methodological asymmetry mirrors the ecological asymmetry between the two regions: one relatively homogenised and industrialised, the other among the most biodiverse on the planet.

Looking at the *Biodiversity Visibility Indices* of the aforementioned European and Latin American authors reveals that the BVI is not merely skewed in relation to global representations of biodiversity, but in almost reverse correlation to statistics on animal biomass and described species. Species classes of high ecological significance and presence, such as insects and arthropods, are generally not species classes high in representation and, if you will, aesthetic value. Birds, on the other hand, are thoroughly overrepresented in this modernist fiction sample vis-à-vis planetary biodiversity and biomass (by close to 400 times their real-life prevalence).

Since 'we tend to protect and to invest in the conservation of what we love and find beautiful in our environment' (Tribot et al. 2022), the aesthetic dimension of animal biodiversity is potentially relevant for conservation efforts. Or, as David Lunney puts it: 'There are ethical, ecological and cultural consequences of playing favourites with species' (2014: 46). Thus, section one offers a critique of the Animal Studies claim of universality. The vast fictional faunas of modernist fiction largely consist of mammals and avians, and Animal Studies in literature amplifies this bias by focusing almost exclusively on individual animal characters with advanced human-like cognition. Despite the 'animal turn' in literary studies,[2] there is an abundance of animal species in fiction that has escaped critical notice. Section two showcases the richness of animal biodiversity in modernist texts and suggests that Animal Studies does not fully reflect its object of study: animals in fiction. Section three offers an explanation of the skewed statistics, including why charismatic species occupy an 'oversized' proportion in fiction and Animal Studies. Section four explores multiple ways of reading for animal biodiversity. The conclusion maintains that a biodiverse 'turn' holds the potential to chart a new species-inclusive path for Animal Studies, unveil concealed networks and faunas in fiction, bridge Animal Studies and ecocriticism, and pave the way for an alternative canon of animal-centric writers.

1. In search of diversity: rethinking the animal turn

Biodiversity is not a key concept of Animal Studies, a cross and inter-disciplinary field in the humanities, which questions and examines the uses and understandings of animals across cultures and in societies. Neither the Routledge nor the Oxford *Handbook of Human-Animal Studies* (Marvin and McHugh 2014; Kalof 2017), nor *The Animals Reader* by Routledge (Kalof and Fitzgerald 2021) or the *Between the Species* anthology by Pearson (Arluke and Sanders 2008), devotes any significant space to biodiversity. In the comprehensive *Animal Studies: The Key Concepts* (Calarco 2021), race, queer, feminism, and disability are included among the key concepts of the field, but not biodiversity. The exclusion reflects the history of Animal Studies, which came on the heels of the 1960s civil rights movement in the United States. In the 1970s and 80s, Peter Singer and Tom Regan applied the contemporary thoughts of equality, dignity, and rights to the plights of factory animals. They coined terms such as 'speciesism (on analogy with racism and sexism) and human chauvinism (on analogy with male chauvinism), and have made animal liberation seem, perhaps not improperly, the next and most daring development of political liberalism' (Callicott 1980: 313). In their canonical works, they argue for the rights of animals as sentient beings. They urge us to minimise animal suffering on the basis of Bentham's utilitarian ethics (Singer) and on the Kantian ethics of absolute value (Regan). While the destruction of physical habitats for monoculture factory farming has been the main driver of biodiversity loss to date (Wilson 2022b: 395), animal-rights ethics were not formulated in response to the environmental crisis. Thinkers working in this ethical tradition of animal rights sometimes treat the environmental crisis as an exogenous variable; terms such as 'global warming', 'climate change' and 'biodiversity' are absent from many key texts.[3] The absence, according to John Miller, 'reveals a good deal about the evolution of environmental criticism and animal studies as separate enterprises' (2013: 207).

With tools and frameworks aimed at dismantling categorical and discriminatory language, it is perhaps unsurprising that biodiversity—despite and because of its inclusivity—is absent from the major strands of Animal Studies. Biodiversity subsumes all animals under one concept and umbrella term, where they are reduced to an aggregate number on the basis of their species identity: 'biodiversity concerns the properties of a set, not the properties of the members of the set' (Kiester 1996: 2).

Cheryl Lousley (2016) identifies a 'commodity fetishism' in the way biodiversity narratives abstract species from embodied life as if species were 'living souvenirs', where 'each animal becomes both representative of its biological order and equivalent to the others on the universalizing grid of biodiversity'. Christine von Weizsäcker, similarly, maintains that the biodiversity framework reduces diverse species to quantities (1993: 124). Tom Regan explains that an interest in 'the stability, diversity and beauty of biotic communities' (1985: 361) dangerously ignores the rights of the individual, akin to fascism. But do the rights of the individual trump that of the biotic community? How should one weigh the rights of the individual against the welfare of the biotic community, when the Earth approaches the first mass extinction in human history?

If factory animals were liberated, they would devastate local ecosystems. All else being equal, in the Singer-Regan ethical framework, the last members of a species—such as the dodo or the passenger pigeon—have the same ethical value as one factory chicken (of which there are billions of quasi-genetic replicas), on the assumption that they have the same capacity to suffer. In this egalitarian utilitarian calculus, there is no direct, added ethical value for preserving species diversity and for not chopping down the phylogenetic tree, which has taken millions of years of evolution to establish. Singer's argument (2009: 174) that one can eat oysters because they appear to lack the capacity to feel pain (there would be no evolutionary advantage of having that capacity as oysters cannot respond to sensory input, he reasons) has not aged well: oysters are keystone species (Sanjeeva Raj 2008) and most wild populations are functionally extinct (Beck et al. 2011).

While factory farming and biodiversity loss are interconnected, the ethical framework of animal rights primarily addresses the former, neglecting the latter. The biologist E. O. Wilson sidesteps the ethical concerns of animal rights and argues for biodiversity richness on the basis of 'biophilia', heritage, utility, and aesthetics; to clear the rainforest for beef production 'is like burning a Renaissance painting to cook dinner' (2022a: 27). Saving this metaphorical Renaissance painting goes hand in hand with reducing suffering, but they are ultimately different ways of looking at and valuing 'life'. For Wilson, the whole has ethical priority over its parts—a position of environmental ethics that values the biotic community over and above the individual. This perspective is deeply rooted in Indigenous worldviews and folk traditions, such as the traditional teachings of the Hopi, who emphasise *sumac k'yavi*, or the communal responsibility to live in balance with all life forms (Sekaquaptewa and Washburn 2009: 195–214). In Hopi cosmology, humans are seen as caretakers of the Earth, and survival depends on fulfilling reciprocal obligations to other beings—plants, animals, and elements—as part of a broader moral community. A parallel to this emerges in modern Western environmental thought through Aldo Leopold's notion of 'land ethic' in *A Sand County Almanac* (1949). Leopold argues that humans should see themselves not as conquerors of the land, but as members and citizens of the biotic community. His land ethic calls for extending ethical consideration beyond human society to include soils, waters, plants, and animals, insisting that something is right when it preserves the integrity of the biotic community.

The animal-rights ethic dominates the humanities discourse and appears to operate outside of ecological imperatives, environmental ethics, and concerns for the biotic community. In Animal Studies, animals are typically analysed based on their perceived autonomy, mirroring a hierarchical value system rooted in human likeness (Benton 1993; Tester 1991). This perspective, influenced by the Singer-Regan ethic, asserts that animals deserve rights because of their sentience, akin to humans, in contrast to entities like oysters. Guided by what they consider an ethical and inclusive approach, literary critics often locate and portray animals as protagonists and individuals, challenging the traditional Judeo-Christian, pre-Darwinian view that relegates animals to soulless automatons.[4] In this manner, literary critics in Animal Studies tend to 'conceptualize agency as more than simply a property of the human subject' (McHugh 2009: 489), and investigate 'the degree to which an animal is presented [as] true to himself or herself' (Shapiro and Copeland 2005: 344), 'with some measure of autonomy, agency, voice, character, and as a member of a species with a nature that has certain typical capabilities and limitations'. Animals are here given moral standing and aesthetic significance in a work of fiction on the basis of their role as conscious and sentient beings with voices and agencies. For all its merits, this emphasis on agency and consciousness prioritises charismatic megafauna with advanced intelligence, like us, while downplaying invertebrate species, i.e., the absolute majority of animals on the planet. Although invertebrates constitute an estimated 97 percent of all animal species types (Center for Biological Diversity n.d.), human-animal studies journals almost exclusively focus on vertebrates (Wilkie, Moore & Molloy 2019).[5] As zoologist Daniel Lunney observes, in Animal Studies the term 'animal', with few exceptions, means mammal (2014: 46). Highlighting the need for broader inclusivity within the field, Jonathan Clark rhetorically proposes that Animal Studies should be renamed 'Mammal Studies', 'Vertebrate Studies', or the unwieldy: 'Those Animals Who Are Most Like Who I Take Myself To Be Studies' (par. 2).

From an environmental ethics perspective, all species, regardless of their resemblance to humans, hold ethical significance. In terms of biodiversity metrics and ethics, there is significance and dignity to being a cog in the ecological machinery (which needs to be distinguished from the indignity of being a cog in the factory farm). Most invertebrate species, however, become invisible through the personalising and individualising lens of Animal Studies. This lens filters out animals that derive meaning from their collective existence, such as eusocial species that swarm and colonise. An individual ant in an ant colony may appear to lack autonomy, agency and voice, but the structure in which the ant is a part, is an almost unparalleled evolutionary achievement of organised intelligence. Take, for example, the leafcutter ant colony, comprising millions of individuals meticulously organised into various roles based on size: queen, soldier,

forager, farmer, nurse. Although genetically similar, the ants are reared and raised in the nursery to gain the size and habit corresponding to vastly different ant occupations. A soldier is three hundred times the weight of a farmer, who is instead produced for the delicate work of cultivating microscopic fungal strands within a subterranean chamber. E. O. Wilson aptly describes this intricate system as 'an organic machine' (2022a: 36), where the superorganism functions akin to a unified brain, and its workers serve as crude analogues of nerve cells. Viewed from above, the leafcutter colony resembles a colossal amoeba, highlighting the interconnectedness and complexity of its structure. To isolate an individual ant from its role within the superorganism is to overlook the fundamental essence of its existence.

Given the significant shifts in climate and the biosphere, it is now evident that we inhabit an intricately interconnected world. Even the tiniest species are integral parts of vast ecosystems, biospheres, and superorganisms. 'But what sort of literature remains possible if we relinquish the myth of human apartness [and its view of animals through an anthropocentric like-us lens]? It must be a literature that abandons, or at least questions, what would seem to be literature's most basic foci: character, persona, narrative consciousness. What literature can survive under these conditions?' (Buell 1996: 145). In response to Buell's inquiry, one compelling avenue is the exploration of species richness and fictional faunas. This approach represents a departure toward a more holistic and environmentally conscious form of literary analysis—an ecocriticism divested of many human-centric biases. By broadening our literary horizons, we encounter biodiverse fictional worlds, teeming with hundreds of species within a single novel. As we delve into these biodiverse fictional realms, we can uncover layers of meaning and extra-textual insights. Indeed, the essence of biodiversity lies in the recognition that the whole exceeds the sum of its parts.

2. The Biodiversity Visibility Index and animal biodiversity in fiction

While the burgeoning field of Animal Studies has succeeded in asking and answering complex epistemological questions about the status and meaning of nonhuman animals in literature, there is almost no hard data about their numbers and types: 'literary animal studies are framed by a paradox: animals abound in literature across all ages and cultures, but rarely have been the focal point of systematic literary study' (McHugh 2006). In general, there are many detailed studies of one or a few animals, but there is next to no comprehensive information about the majority of animals in an author's work. Take Herman Melville, who, despite populating his fiction with more than 350 distinct species (Warodell 2020b), has had potential interpretations about animals in his fiction be overshadowed by the indomitable albino whale in *Moby-Dick* (Armstrong 2008).

In their introduction to a recent anthology on ecocriticism, Schneider-Meyerson et al. (2023) stress that 'empirical methods and systematic data analysis are often considered foreign and even antithetical to contemporary literary and cultural criticism' (pp. 7–8). In a foundational work on the literary imagination, Lawrence Buell summarily concludes that all 'major strains of contemporary literary theory have marginalized literature's referential dimension by privileging structure, text(uality), ideology, or some other conceptual matrix that defines the space discourse occupies apart from factical "reality"' (1996: 85). In this reading of the history of literary criticism and its methods, nature in fiction serves a symbolic function and is outside the scope of empirical observation.

Until recently, researchers had only catalogued animal species in major religious and philosophical texts (identifying around 100 species in the Bible (Slifkin 2025) and about 500 species (Voultsiadou and Vafidis 2007: 103) in Aristotle's work on scientific taxonomy: *History of Animals* and *Parts of Animals*). No comprehensive and systematic data on animals in fiction were published until 2020, when three numerical measures appeared: on Herman Melville (350 species), Virginia Woolf (300), and Vladimir Nabokov (400)—and in 2021, on Conrad (150) (Warodell 2020b; 2020a; 2021a; 2021b). Later attempts by computer scientists to count species names in fiction (Langer et al. 2021; Piper 2022) are useful for plotting macro trends. However, these attempts produce staggering numbers of 'false positives,' inflating taxa label prevalence by about 80% (Piper 2022: 3). They also fall short in addressing language evolution, regionalisms, abbreviations, neologisms and mis/idiosyncratic spellings. Due to modernisation of names, standardisation of the English language, and progress in taxonomical research and classification methods, it is often necessary to consult external sources to correctly classify species names in fiction, such as the Biodiversity Heritage Library (https://www.biodiversitylibrary.org), which makes centuries of biodiversity literature openly available and easily searchable, the World Register of Marine Species (WORMS) (https://marinespecies.org/), and the *Oxford English Dictionary*.

To limit inaccuracies in the classification of texts and to base any findings on authoritative primary texts, all numbers of named species in fiction in this paper derive by manual (rather than computerised) compilation. I take a cue here from art history. Art history has recently taken steps in plotting biodiversity in visual art. A manual survey of animals in 1700 paintings across 17 major museums in Europe and the United States, found that representation of animals in painting had decreased over three millennia, from nearly 60% to 15% of all artworks (Baenninger 1988). In 2023, when manually classifying different species of fish in more than 2000 paintings on Dutch and Flemish art, researchers found that trends in paintings of fish correspond to major environmental changes and human diets (Overduin-de Vries and Smith 2024). Vladimir Nabokov sought to undertake a similarly comprehensive longitudinal study of paintings, which he never completed. During more than two decades, he planned and researched a book that would plot butterflies in art history. He identified more than 100 depictions of moths and butterflies in paintings across museums in

Italy and France. The book was to be called *Butterflies in Art* and it would trace 'the evolution of butterfly painting from ancient times and through the Renaissance, to 1700, with reproductions of still-life pictures of flowers and insects by Dutch, Italian, Spanish, etc. masters' (Nabokov 1989: 508).

The first four pie-charts (**Figure 1**, **Figure 2**, **Figure 3**, **Figure 4**) that follow are based on a detailed, manual and comprehensive compilation of animal species mentioned across the complete works of Nabokov, Woolf, Kafka, and Conrad (Warodell 2021a; 2020a; 2023; 2021b). Using the same methodology, **Figure 5** displays a composite index derived from twenty influential novels by twenty modern and late-modern Latin American authors, as listed in **Table 1**. These authors were selected to reflect the vastness and diversity of Latin American modernism. Modernism, as used here, is understood broadly—encompassing not only stylistic and thematic concerns, but also historical period and intertextual influence. As such, individual works may exhibit modernist characteristics in some aspects, while aligning with realism or postmodernism in others.

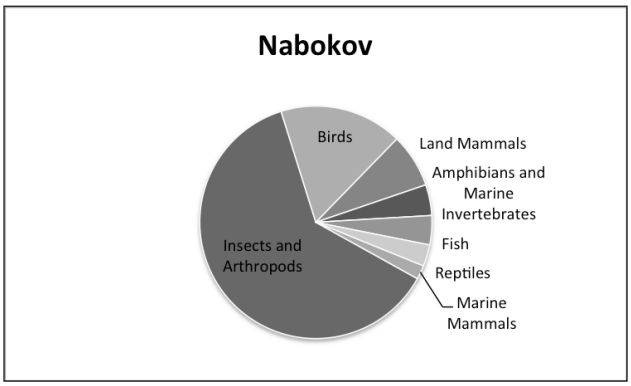

Figure 1: Pie-chart of the Biodiversity Visibility Index of the works of Vladimir Nabokov.

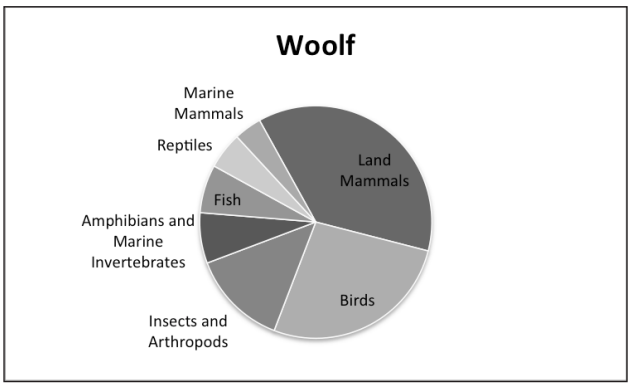

Figure 2: Pie-chart of the Biodiversity Visibility Index of the works of Virginia Woolf.

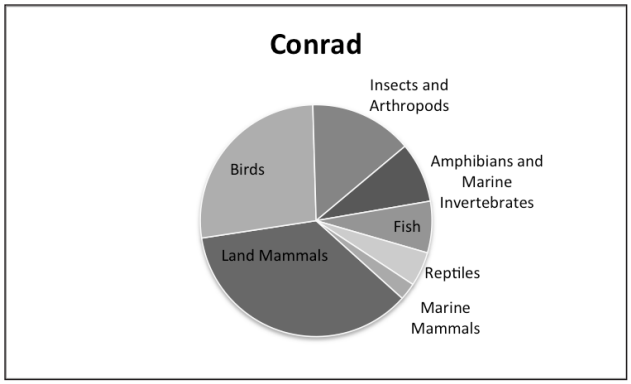

Figure 4: Pie-chart of the Biodiversity Visibility Index of the works of Joseph Conrad.

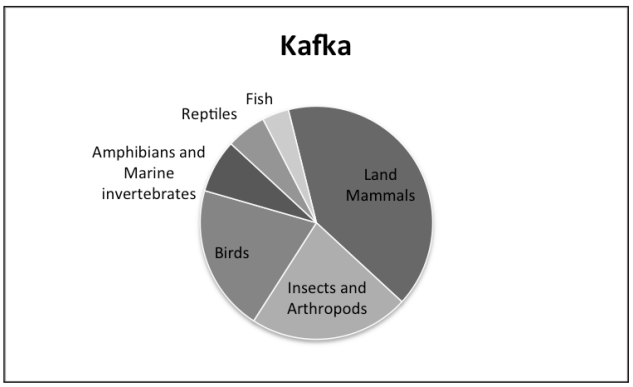

Figure 3: Pie-chart of the Biodiversity Visibility Index of the works of Franz Kafka.

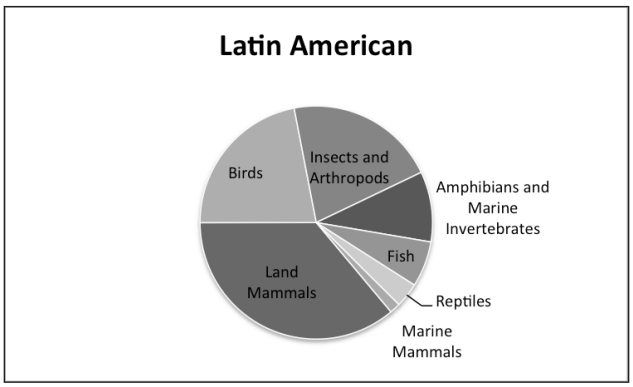

Figure 5: Pie-chart of the Biodiversity Visibility Index of the works of Latin American fiction.

The numbers of named animal species in the samples of Western and Latin American fiction have been compiled to illustrate the *Biodiversity Visibility Index,* a way of visually expressing animal biodiversity in fiction. The index subdivides the presence of animals into classes and ratios: reptiles, fish, birds, land mammals, marine mammals, insects and arthropods, amphibians and marine invertebrates. The index shows relative proportions of distinct species rather than relative abundances. The idea is to visualise an author's idiosyncratic fauna and biodiversity, and to show how it compares to real-world biodiversity and the biodiversity of other authors' fictional faunas. To limit the number of taxonomic labels, increase readability and usability, and to reflect the authors' blended use of common and scientific names, the charts organise the animal species into folk-biological categories. Folk-biological categories are conceptual ways of ordering

Table 1: List of Latin American novels surveyed.

Novel and Year Published	Author and Nationality
Memorias Posthumas de Braz Cubas (1881)	Joaquim Maria Machado de Assis (Brazil)
Ifigenia (1924)	Teresa de la Parra (Venezuela)
The House of Mist (1935)	Maria Luisa Bombal (Chile)
La invención de Morel (1940)	Adolfo Bioy Casares (Argentina)
El túnel (1948)	Ernesto Sabato (Argentina)
El reino de este mundo (1949)	Alejo Carpentier (Cuba)
Pedro Páramo (1955)	Juan A Rulfo (Mexico)
Balún-Canán (1957)	Rosario Castellanos (Mexico)
La Tregua (1960)	Mario Benedetti (Uruguay)
Aura (1962)	Carlos Fuentes (Mexico)
Los Recuerdos del Porvenir (1963)	Elena Garro (Mexico)
Rayuela (1963)	Julio Cortázar (Argentina)
Cenizas de Izalco (1966)	Claribel Alegria and D.J. Flakoll (Nicaragua-Salvador)
Cien años de soledad (1967)	Gabriel García Márquez (Colombia)
Yo el Supremo (1974)	Augusto Roa Bastos (Paraguay)
El beso de la mujer araña (1976)	Manuel Puig (Argentina)
A hora da estrela (1977)	Clarice Lispector (Brazil)
El jardín de al lado (1981)	José Donoso (Chile)
La casa de los espíritus (1982)	Isabel Allende (Chile)
¿Quién mató a Palomino Molero? (1986)	Mario Vargas Llosa (Peru)

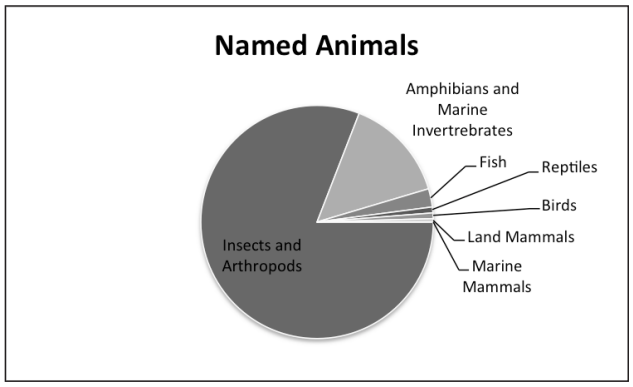

Figure 6: Pie-chart showing the proportionate number of named animals on Earth by taxonomic group, created using data from the International Union for Conservation of Nature Red List of Threatened Species (2024). There are about one million named insects, which represent about 75% of all named animal species. The vast majority of animal species are unnamed (Mora et al. 2011).

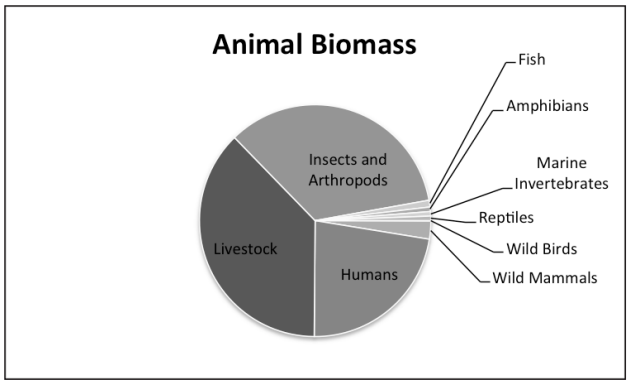

Figure 7: Pie-chart representing the distribution of animal biomass on Earth, created using data from Bar-On, Phillips & Milo 2018. Biomass is mostly plants and bacteria. Animals represent less than 0.5% of the total biomass on Earth. Humans and livestock account for close to 50% of animal biomass.

the world in everyday culture and life but are not perfectly aligned with modern scientific classification (Atran 1998). For instance, the list distinguishes between birds and reptiles. According to modern scientific classification, all birds are reptiles (based on the hypothesis about the most recent common ancestor (Stacy, Pendl & Wencel 2020)).

The pie-charts were inspired by an attempt to map the imagination of biodiversity in school children (Snaddon, Turner & Foster 2008). Pupils were asked to pictorially estimate the number of species in the rainforest that belonged to different categories in a pie-chart. The study found that the children's environmental awareness was highly skewed in its over-representation of the proportion of land mammals and birds.

The parameters of the imagination become apparent when compared to the global distributions of species (**Figure 6**) and biomass (**Figure 7**). Although measures vary widely, most researchers agree that there are about 9 million species of animals on the planet (Mora et al. 2011), of which about 2 million have been named and classified (IUCN 2024). There are about 11,000 named bird species (IUCN 2024). Although wild and domestic birds constitute less than half a percent of the planet's named species and less than 0.08% of animal biomass (Bar-On, Phillips & Milo 2018: 6508), they make up about 30% of all animals in fiction, according to the above sample. Thus, they are, relatively speaking, about 400 times more prevalent in these fictional faunas than in corresponding global estimates of animal biomass. The asymmetrical distribution of animals reveals aesthetic preferences and is likely a response to the emotional salience of certain species over others (such as the aural and aerial quality of birds), and a reflection of the authors' bioculture.

No bird specimen plays a major part in the plots of Nabokov's and Woolf's fictions, but they each name about 70 to 80 distinct species (Warodell 2021a; 2020a). Insects and arthropods constitute the majority of named species on the planet and constitute about 42% of all animal biomass (Bar-On, Phillips & Milo 2018: 6507), but they are significantly underrepresented in fiction. For instance, beetles constitute a quarter of all named animal species on Earth (Stork et al. 2015: 7519) but a small percentage of the species names found in fiction: Latin American sample (2%), Nabokov (2%), Woolf (2%), Conrad (3%), and Kafka (8%) (Warodell 2021a; 2020a; 2021b; 2023). Nabokov's fictional fauna is, however, exceptional for its diversity of insects and arthropods, in which more than 50% of all species names are insects and arthropods. This reflects Nabokov's scientific knowledge. As a professional entomologist, he published eighteen papers on lepidoptery in scientific journals; worked as a curator of lepidoptery at Harvard's Museum of Comparative Zoology; and named twelve valid species and genera.

3. Wildly popular: charismatic species

The uneven representation of different species in fiction partly reflects the fact that not all species have the same visibility, aesthetic appeal, and 'cuddle factor'. Conservation biologists speak about 'flagstone' and 'charismatic species', which are used as ambassadors for conservation efforts (Ducarme, Luque & Courchamp 2013). 'Nonhuman charisma', in Lorimer's helpful conceptualisation, 'can best be defined as the distinguishing properties of a non-human entity or process that determine its perception by humans and its subsequent evaluation' (2007: 915). Charismatic species—such as tigers, dolphins, lions, and elephants—are widely discussed in conservation biology for their outsized role in stirring human affection and sympathy. Empirical evidence suggests that 'Body size is a good proxy for vertebrate charisma' (Berti et al. 2020), which is a problematic 'taxonomic bias' (Nguyen et al. 2023: 2) for conservationists 'because the majority of species are small-sized'. Animal charisma, however, is not necessarily related to innate aesthetic appeal; the Komodo dragon became a charismatic species after an ambitious conservation program (Ducarme, Luque & Courchamp 2013: 3). While 'charismatic megafauna' exhibit widespread popular appeal, the ten most charismatic species are endangered: 'the widespread use of images of these animals has given the public the impression that the animals are abundant, obscuring their high risk of imminent extinction' (Courchamp et al. 2018). Thus, the dominant presence of tigers and lions in children's books (Hooykas et al. 2022) is in reverse correlation to their fragile presence as living species in the wild. The phenomenon of charismatic species are also present in 'the scientific literature' (Genovart et al. 2013: 484) where a few species command 'a great proportion of scientific attention'.

A study of the perception of biodiversity and species conservation among 7–11 year old French schoolchildren revealed that they were better at identifying and sympathising with 'exotic' African species than with local species (Ballouard, Brischoux & Bonnet 2011). Similarly, a survey of the knowledge of vertebrate fauna of 11–15 year old children living in the biodiversity hotspot of the Balearic Islands in Spain found that they were better at identifying non-native than local fauna (Genovart et al. 2013). A sample of 164 books marketed to children in Chile contained close to 90% non-native fauna (Sousa et al. 2017), which echoes the domineering presence of non-native fauna in Dutch children's books (Hooykas et al. 2022). Charismatic megafauna—from polar bears to giant pandas—occupy the environmental imagination of children, whether they live in Spain, Chile, France, or the Netherlands.

Beyond surveys of children and their books, an understanding of lay peoples' perception of biodiversity can be sourced in the aggregate statistics of fiction. While 'there is still relatively little understanding of the knowledge lay people have of the concept of biodiversity as well as their overall perception of what biodiversity is about' (Bernardo, Ramos & Carvalheiro 2021), the *Biodiversity Visibility Index* (**Figure 1**, **Figure 2**, **Figure 3**, **Figure 4**, **Figure 5**) is yet more evidence of our asymmetrical awareness of and partial interest in the animal kingdom, and a proxy for nonhuman charisma. It is further evidence that species of great ecological importance are not necessarily species with charisma. According to the sampled works of Western and Latin American fiction, birds are significantly overrepresented in fiction, which echoes the finding that 'most charismatic species communicated to the public belong to a tiny fraction of biodiversity, particularly large-bodied mammals and birds' (Nguyen et al. 2023: 2). It is also intriguing that this sample of works fictionalises animals in similar asymmetrical ways to children's literature, where picture books 'reinforce children's perceptions toward only a small part of animal biodiversity' (Hooykaas et al. 2022).

In my sample of twenty canonical Latin American novels, the number and types of named animal species are similar to those found in European fiction. Rather than being restricted to regional species, the listed species span a wide variety of ecosystems, climates,

and biomes. As in the study of children's literature in Chile (Sousa et al. 2017), endemic species are practically absent. Charismatic megafauna, domesticated animals, and animals that thrive in human environments (such as rats, squirrels, and cockroaches) dominate the fictional landscape, as they do in European fiction. There are many plausible and complementary explanations for why this may be the case, including: genre characteristics (e.g., *modernismo*, *Boom latinoamericano*); the reach and impact of globalisation, urbanisation, and modernisation, across cultures and regions; canon/sample bias, as well as the unique characteristics of canonised Latin American fiction (many of which were written in exile, in locations such as London and Paris). Thematically, many Latin American novels are not about the natural environment, but are about colonialism, dictatorship, oppression, and social inequality. Canonised Latin American novelists also tend to be part of a global, urban elite. Although Latin America is home to many Indigenous peoples, in the sample of twenty canonical authors, most are from mestizo or European-descendant backgrounds. Eight were educated abroad.[6] This cosmopolitan authorial background informs the unique global tapestry of canonised Latin American fiction. In the sample, *El jardín de al lado* is set in Sitges, Spain; *Rayuela* in Paris; *Ifigenia* in Paris.

On the other hand, although the number and types of animals found in the Latin American sample mirror those found in the works of Woolf, Kafka, Nabokov, and Conrad, Latin American fiction often articulates and presents biodiversity in a different way. In Latin American fiction, nature often plays a mythical or spiritual role, rooted in magical realism or Indigenous cosmologies, in which the emphasis is on a few iconic species that have deep spiritual, mythical, or symbolic significance, rather than a large register of species. In works by authors such as Maria Luisa Bombal, Gabriel García Márquez, Isabel Allende or Juan Rulfo (all included in the sample), nature is sometimes depicted as being sentient and having its own agency, with the weather, forests, and rivers actively influencing human events. For example, in *Cien años de soledad*, the perpetual rain that descends on Macondo reflects the town's decline, and a swarm of yellow butterflies follow the character Mauricio Babilonia and his lover. In Alejo Carpentier's *El reino de este mundo*, Macandal metamorphoses into animals to serve the revolution, linking spirituality with history. In *La casa de los espíritus*, the child Clara talks to animals and inanimate objects as if they could hear and understand her, which they appear to do.

4. Reading for biodiversity: making animals count

What does 'reading for animal biodiversity' mean and how is it done? What happens when we read a writer like Woolf for biodiversity, and encounter more than 350 animal species within the pages? Or Nabokov's 400 species? The scale of these numbers is at times dizzyingly large. Do we have the capacity to fully grasp this vastness, or is its purpose instead to evoke a sense of awe at the uncontainable richness of nature—an effect reminiscent of the Kantian sublime, which conveys the immensity and complexity of nature beyond human comprehension? Biodiversity, as a phenomenon, suggests that the ensemble of species within an ecosystem contributes to its richness and complexity in a manner that transcends individual entities. In fiction, this idea is manifested through various metrics and perspectives. This paper focuses on species richness in texts and their relative distribution across different folk-biological taxonomical classes. These comparisons reveal biases that favour certain species or classes of animals based on human aesthetic or cultural preferences. There are, however, many plausible measures of animal biodiversity in fiction. For instance, one might assess biodiversity by looking at the frequency of mentions of specific species and at the contexts in which they appear, or by examining portrayals of ecological interdependence and keystone species, such as oysters, that assume prominence from environmental and ecological perspectives. Another approach involves the exploration of fictional perspectives and conceptualisations of animal biodiversity (rather than instantiations); another could distinguish between animals presented as living species and those that are artificial and commodified. Nabokov's animals, for instance, are seldom presented as living creatures; instead, they are inflated, eaten, stuffed, and worn. His fictional fauna is partly made of rubber, chocolate, stone, diamond, cast-iron, pencil, paint, cotton, wool, textile, and 'porcelain animals with glossy rumps' (Nabokov 2017: 36), reflecting the reduction of animal identities to mere commodities, paralleling the ecological alienation caused by modernisation.

I came across animal 'biodiversity' in fiction by accident. As a stubborn formalist, I thought it was as arbitrary to ignore the presence of animals in fiction as it would be to ignore a painter's use of a specific colour. At first, I thought the aggregate numbers were arguments for the specificity and variety of an author's writing, evidence of their curiosity in non-human animals, and—in the case of Nabokov and Melville—a testament to their tendency to meticulously label and categorise phenomena. Beyond a formal property of the text and as an incidental byproduct of style, however, the vast numbers of animal species are also an indirect proxy of ecological literacy and perhaps even a reverse measure of modernity. Modernism is usually defined by industrialisation, urbanisation, and globalisation; these parameters are also the primary drivers of monoculture and biodiversity loss. John Berger identifies the loss of direct contact with animals as a defining feature of the last two centuries: 'Before this rupture,' in Western Europe and North America, 'animals constituted the first circle of what surrounded man'. Public zoos, household pets, realistic animal toys, animal decor in children's rooms, and the 'commercial diffusion of animal imagery' (Berger 1980), came into appearance as animals disappeared from daily life. Yet, while animals remained prevalent in cultural representations, not all species enjoyed equal visibility in the post-industrial landscape. The concept of 'charismatic megafauna' and the evident bias toward certain species in fiction underscore this selective visibility.

Woolf's fiction offers a glimpse into this modern urban fauna, envisioned by John Berger, featuring no less than 37 dog breeds. Animals of the home, garden, street, and city park dominate. Synanthropic species, i.e., non-domesticated animals evolved to live in proximity to humans, such as pigeons and mice, are prominent in Woolf's fiction. Her fictional fauna, however, is not strictly urban but post-urban in the sense that it reflects how a modern literary consciousness thinks about animals, not just how it sees them. For example, while the majority of the more than 80 bird species Woolf names are UK natives (including regular visitors, breeding residents, and permanent migrants), there are also tropical and 'exotic species' (such as cockatoo and macaw), blurring natural and cultural geographies. Woolf's fauna is a kind of layered ecology, merging actual presence with cultural resonance: creatures of the urban everyday, domesticated animals and synanthropes share pages with charismatic and non-native species.

Synanthropes are overrepresented in the works of all surveyed authors, comprising about one fifth of all listed species. In *Cien años de soledad,* Macondo's houses are undone by termites, moths, cockroaches, and red ants. Near the end of the novel, red ants invade the Buendía house and eventually consume the newborn child of Aureliano (II) and Renata Remedios (García Márquez 1967). In Franz Kafka's *Die Verwandlung* (1915), Gregor Samsa transforms into an *Ungeziefe*r (loosely, 'vermin'), a symbolic human-animal hybrid—a supercharged synanthrope—co-inhabiting human flesh, mind, and room. This recurring focus on synanthropes in modernist fiction may unintentionally distort readers' perceptions of biodiversity and animal life. Readers frequently exposed to these adaptable and abundant generalist species might mistakenly believe that most animals can thrive in urbanised conditions and can cope with pollution and anthropogenic climate change. However, roughly half of species in many ecological groups are habitat and/or resource specialists (Chazdon et al. 2011), dependent on undisturbed ecosystems. For instance, many butterflies are monophagous (Slansky 1976), relying entirely on one plant genus.

The presence or absence of animals in modern literature is complicated by the movement's tendency to place significant events in the margins of texts or even outside the texts themselves. For instance, Leopold, Belgium, and the Congo are not mentioned by name in Conrad's *Heart of Darkness* but are nevertheless essential to the novella. Elephants are nowhere to be seen in *Heart of Darkness*, although the entire story hinges around an ivory-economy, which occupies and blinds the colonial agents as they seek to maximise quotas. The novella is set in 'the true ivory-country' (Conrad 1899/2010: 60), where the 'word ivory rang in the air, was whispered, was sighed. You would think they were praying to it' (65), as the main narrator Marlow explains with contempt, when describing the attitudes of his fellow colonial agents. Kurtz, in his distinct brand of entrepreneurial imperialism, raids villages for ivory with the help of an Indigenous tribe in the story. His success in bringing up the ivory quota is unparalleled: 'he had collected, bartered, swindled or stolen more ivory than all the other agents together' (92). The presence of ivory and the complete absence of African elephants (a keystone species) exemplifies the relevance and reach of commodity fetishism ('All Europe contributed to the making of Kurtz' (95)), and reflects the fact that animals were hunted almost to extinction in the Congo, during Conrad's time.[7]

Although one might expect that a high aggregate number of named animal species in an author's works would code for an animal-centric theme, the case of Franz Kafka proves that such a statistical inference is misguided, if not outright flawed. Animals are either conspicuously absent in Kafka's fiction (aggregately, comparatively, nominally) or occupy leading roles, as narrators and central characters. As I discuss elsewhere (Warodell 2023), since names for animal species are common-use words, even authors not commonly noted for writing on animals tend to mention a significantly higher number of animal species than Kafka (there are about 50 distinct animal species in his fiction, while his private letters and diaries contain more than 100 species references). Although Kafka's extant writings (three extant novels and some 40 stories) have fewer aggregate word tokens than most established writers (for instance: the biographies of Woolf, Nabokov and Conrad are significantly more extensive), the aggregate size of a writer's literary production has little correlation to the size of their total vocabulary (number of word types) (Chacoma and Zanette 2020). Kafka's writings demonstrate that an animal-centric writer is not easily identified as such by frequency counts and attention to a register of animal names. The assumption—common in digital humanities—that frequency equals content (Rhody 2012) is partly false: it fails to align with dominant reader responses to Kafka's stories (Warodell 2023: 1117). The comparative absence of species names in Kafka's fiction is, rather, part and parcel of an innovative approach to animal description, which—by design—evades categorisation and qualification. For instance, *Der Ba*u is written from the first-person perspective in an elevated language with a range of historical and philosophical references. Suddenly, as an aside, the creature, who speaks to us in the first-person, wakes up with a rat hanging from its mouth.

Together, these works underscore the multifaceted ways that fiction reflects and distorts biodiversity. In reading fiction for biodiversity, we uncover much more than a catalogue of species or mere references to animals; we engage with one measure of the ecological consciousness of an era, the selective visibility of species, and the underlying cultural biases that shape our environmental imagination. By questioning which animals are foregrounded and why, this method bridges literary analysis with ecological understanding, inviting us to see beyond the individual species to the broader ecosystem.

Conclusion: towards a biodiverse animal turn

The information age coincides with the age of extinction—that much we know. For most of us in the urbanised Western world, however, neither scientific data nor unfiltered access to the natural world monopolise our experience and understanding of animal biodiversity.

From the dinner plate to the stuffed toy to the children's book, our daily access points to the animal kingdom are dead, artificial, or fabricated.

In answering the question posed in the introduction regarding the portrayal of animal biodiversity during the onset of the sixth mass extinction, each author selected for study offers a distinct perspective that intersects with those of others. Conrad's answer in *Heart of Darkness* centres on the abundant presence of ivory in the novella and on the complete absence of elephants. Kafka defies species categories altogether, subverting the tendency to classify animals by resisting taxonomies that constrain understanding. Woolf's fiction offers a glimpse into a modern urban fauna, while Nabokov diverges from convention by focusing on invertebrates. The sampling of twenty Latin American novels largely follows the same pattern. Although the BVI reveals similar taxonomic biases in the Latin American authors and in the four European modernists, these authors convey divergent worldviews: while both samples overrepresent birds and mammals, the meaning of that representation differs in each literary tradition. Where European modernist texts may emphasise commodification and naming of discrete species (e.g., Nabokov's artificial taxidermy), Latin American fiction foregrounds animistic and sacred understandings of animal life (e.g., Márquez's butterflies). The BVI measures a direct representation of species, but not ecosystem-based settings, such as richly biodiverse environments like rainforests, oceans, and wetlands. Future work could look to pair the Biodiversity Visibility Index with a 'Nature Setting' Visibility index.

The writers discussed in this paper have a distribution of fictional animals in reverse proportion to global estimates, on most measures. While vertebrates comprise a mere three percent of estimated species types, they constitute the overwhelming majority of animals depicted in the sample. Birds, in particular, are thoroughly overrepresented. This bias towards certain phyla is further exacerbated in literary criticism, which tends to focus almost exclusively on familiar domestic animals and charismatic megafauna. For literary criticism to be representative of animals in fiction, it needs to be more expansive in its discussion of animals, include more than a few species in its discussion, or otherwise relate the individual focus on one animal to the context of the hundreds of species that tend to populate a single book. As such, this paper indirectly rejects the implicit idea that there are representative species in an author's work. It challenges the idea that a case-study of a single animal is sufficient to reveal the entire idea about animals within its pages, where with an Ahab-like focus we pursue the whale in *Moby-Dick* or pin-down the butterfly in *Lolita.* The whole is large, diverse and interconnected: there are 150 species in *Moby-Dick* alone (Warodell 2020b: 69).

Emphasising animal biodiversity in fiction creates new pathways for Animal Studies, moving beyond focusing on sentient, autonomous animal characters with advanced cognitive abilities. It also bridges ecocriticism and Animal Studies through the concepts of biodiversity, fauna, and ecosystems, highlighting animals' environmental significance. The Biodiversity Visibility Index focuses on visibility and aesthetic form, and it demonstrates the idiosyncratic makeup of authored animals for a single author and the skewed nature of our environmental imagination vis-à-vis global and regional biodiversity. These insights are relevant to conservation efforts, to the extent that fictional representations echo and shape public perceptions of biodiversity and bioculture. Looking ahead, further research into animal biodiversity in fiction can elevate underrepresented voices and perspectives, particularly those of Indigenous cultures, whose rich connections to the natural world offer valuable perspectives in an era of ecological crisis (Berkes 2018).[8] Further research on animal biodiversity in fiction has the potential to chart a new course for Animal Studies and to uncover hidden networks and faunas, paving the way for an alternative canon of animal-centric writers. Ultimately, a focus on biodiversity in fiction promises to provide a more comprehensive, diverse, and inclusive understanding of animals in literature—in terms of texts, contents, and authors—than is currently available.

Notes

1 The term 'biodiversity' encompasses a range of metrics, including taxonomic, phylogenetic, and functional diversity. In *The Diversity of Life*, Wilson defines biodiversity as: 'The variety of organisms considered at all levels, from genetic variants belonging to the same species to arrays of genera, families, and still higher taxonomic levels; includes the variety of ecosystems, which comprise both the communities of organisms within particular habitats and the physical conditions under which they live' (2022b: 505).

2 The 'animal turn' represents a broader trend towards recognising and critically engaging with the significance of animals in academic, cultural, and social contexts. Some scholars attribute the beginnings of the 'animal turn' to the 1970s and 1980s, with the rise of animal rights movements and the publication of influential works such as Peter Singer's *Animal Liberation* (1975). Kari Weil dates the turn to the early 2000s, which saw 'an explosion of conferences, books, and discussion networks around the question of the animal' (2010: 1). The term 'animal turn' itself became more prominent in academic discourse in the late 20th and early 21st centuries, as scholars across various disciplines, including cultural studies, anthropology, sociology, philosophy, literature, and environmental studies, increasingly focused their attention on animals and their roles within human societies.

3 Jacques Derrida, for instance, does not mention global warming in his classic text on the animal, *The Animal That Therefore I Am* (2008).

4 The history of Western philosophy is frequently faulted for its instrumental view of animals. There are many exceptions, found in the writings of Pythagoras, Empedocles, Plato, Saint Francis of Assisi, and Jeremy Bentham (Callicott 1980; Passmore 1975).

5 For an exception consider the anthology *Unloved Others: Death of the Disregarded in the Time of*

Extinctions (2011), edited by Deborah Bird Rose and Thom van Dooren. The anthology has chapters on moths, ticks, and mushrooms.

6 Maria Luisa was educated in Paris; Carlos Fuentes, Washington, D.C.; Alejo Carpentier, Paris; Clara Isabel Alegría Vides finished upper-secondary school in Louisiana and graduated from George Washington University; José Donoso graduated from Princeton in the United States; Isabel Allende attended English and American schools (in Bolivia and Beirut); Teresa de la Parra was educated in Spain and settled in Europe (France, Spain, Switzerland); Julio Cortázar was born in Europe. Aníbal Quijano, in his essay 'Coloniality of Power, Eurocentrism, and Latin America' (2000), maintains that Latin America's literary and intellectual output remains largely framed within a Eurocentric epistemological structure.

7 Myers was the first to bring attention to the absence of elephants in *Heart of Darkness*: 'While 'ivory' seems to be everywhere in this text, the elephants from which the tusks are severed do not appear at all' (2001: 103).

8 My next research project will explore biodiversity in Indigenous writings, looking at texts by Charles Eastman (Ohiyesa), Sarah Winnemucca, John Joseph Mathews, Eden Robinson, and Louise Erdrich.

Competing Interests

The author has no competing interests to declare.

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