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EVIDENCE

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Number of species in Bhutan

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Bhutan, a tiny Himalayan country nestled between India and China, is well-known for its rich biodiversity inhabiting variable landscapes across the country's 38,394 km^2 area. With 70.46% of its land covered in forest, a lowest elevation point of around 100 m above sea level (masl) in southern Bhutan, and the highest peak, Gangkhar Phuensum, rising to 7,570 masl, the country provides diverse habitats for a wide range of endemic, endangered, and native flora and fauna. However, documentation of these species of flora and fauna has been limited and unmethodical.

Beginning in December 2016, the National Biodiversity Centre (NBC) in Thimphu, Bhutan, has coordinated the collation of species checklists provided by a range of taxonomic experts from various institutions in Bhutan. Data was collected from numerous government agencies, colleges, individual researchers, NGOs, peer-reviewed journal articles, theses, books, institutional databases, and museum specimens until December 2017, when compilation of the publication "Biodiversity Statistics of Bhutan 2017, A Preliminary Baseline" (BSB 2017) began. Contributions were made by the following agencies: NBC; Sherubtse College; College of Natural Resources; Naturalis Biodiversity Centre (The Netherlands); Ugyen Wangchuck Institute for Conservation and Environmental Research; Department of Forests and Park Services; Department of Livestock; National Mushroom Centre; and the National Plant Protection Centre. Additional information on species data was obtained from the Bhutan Biodiversity Portal, National Herbarium, and the National Invertebrate Repository Centre at the NBC. These checklists were then cross-checked against websites including the Global Biodiversity Information Facility, Australian Plant Name Index, Catalogue of Life, International Union for Conservation of Nature (IUCN), BirdLife, and other databases to ensure scientific accuracy in nomenclature and classifications. They were also further discussed with groups of taxonomic experts in order to validate the data and confirm agreement between different authorities in Bhutan. The resulting document published on International Biodiversity Day, 22 May 2019, was the BSB 2017.

During the development of checklists, including those for new records and discoveries, some data may have been overlooked due to limitations including a lack of access to scientific publications, and a paucity of publishing newly discovered scientific data in formally recognized sources such as peer-reviewed journals. Species records from media such as newspapers, television and social media, as well as anecdotal information and data from nonscientific sources was not included.

The BSB 2017 is Bhutan's first baseline describing the country's species richness and recording a total of 11,248 species across the seven kingdoms (Table 1). A further breakdown of the two largest kingdoms (Plantae and Animalia, accounting for 93.2% of total known species) has been represented in Table 2, Figure 1 and Figure 2. Between 2009 and 2017, at least 33 species new to science were discovered in Bhutan. The new discoveries include: 16 species of plants; four months; four molluscs; three fishes; two beetles; two aphids; one dragonfly; and one stonefly species. A total of 566 species of flora and fauna new to Bhutan were recorded from 2009 to 2017. The year 2009 was chosen as the beginning of the time frame

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TABLE 1 Number of species in Bhutan as per the seven kingdoms classification system

Kingdom	Classification	Number of species	Percentage of total number of species
Plantae	Tracheophyta	4978	44.26
	Bryophyta	367	3.26
	Charophyta	23	0.20
	Chlorophyta	1	0.01
	Subtotal	***5369***	***47.73***
Animalia	Insects	3511	31.21
	Vertebrates	1148	10.21
	Invertebrates (excluding insects)	455	4.05
	Subtotal	***5114***	***45.47***
Fungi	Lichens	280	2.49
	Ascomycota (excluding lichens and Entomopathogenic fungi)	182	1.62
	Basidiomycota	133	1.18
	Entomopathogenic fungi	82	0.73
	Oomycota and others	13	0.12
	Subtotal	***690***	***6.13***
Chromista	Bacillariophyceae	54	0.48
	Phaeophyceae	1	0.01
	Subtotal	***55***	***0.49***
Eubacteria	Cyanobacteria	10	0.09
	Other bacteria	8	0.07
	Subtotal	***18***	***0.16***
Protista	Protozoa	2	0.02
	Subtotal	***2***	***0.02***
Archaebacteria		0	0.00
	Subtotal	***0***	***0.00***
	Total	**11248**	**100.00**

TABLE 2 Number of species of plants in Bhutan

Classification	Number of species	Percentage of total number of plant species
Seed plants	4567	85.06
Ferns	411	7.66
Mosses	298	5.55
Liverworts and hornworts	69	1.29
Freshwater algae	23	0.43
Green algae	1	0.02
Total	**5369**	**100**

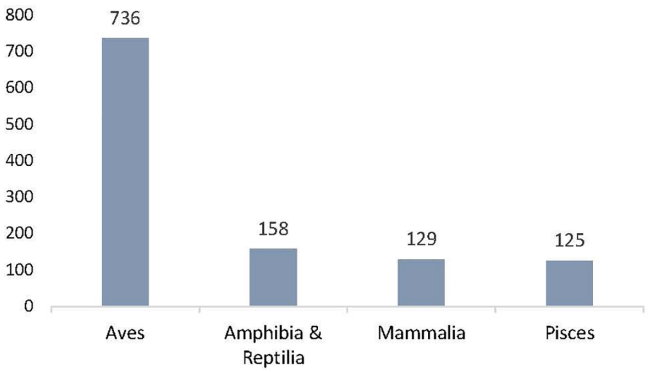


FIGURE 1 Number of species of vertebrates in Bhutan

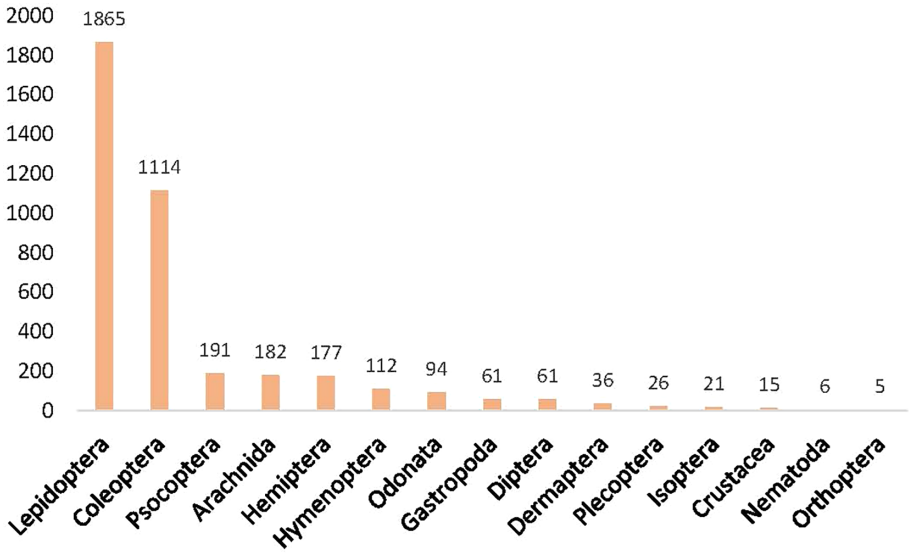


FIGURE 2 Number of species of invertebrates in Bhutan

as the World Wide Fund for Nature (WWF) published a list of new species discoveries in the eastern Himalayan region up to 2009 (WWF, 2009).

Of the species recorded, as of 2017, 133 species (from the kingdoms Animalia and Plantae) are considered to be threatened with extinction according to the IUCN Red List categories. Of these, 20 species are critically endangered, 43 species endangered, and 70 species vulnerable. Furthermore, *Eulophia stenopetala* is extinct and *Brugmansia suaveolens* is extinct in the wild (there are no records of its survival in its known and/or expected habitat but naturalized populations have been recorded outside its past range; IUCN, 2019).

A total of 511 of Bhutan's species are protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora, 2017. This includes 40 species of fauna and three species of flora in Appendix I as well as 56 species of fauna and 412 species of flora in Appendix II.

The BSB 2017 is available online at www.biodiversity.bt. An updated version of the Biodiversity Statistics of Bhutan document will be published in 2020. The development of the BSB 2017 has enabled key stakeholders to better understand gaps in research, for instance, the lack of knowledge about archaebacteria in Bhutan. It will also (along with future issues of the publication) assist in monitoring discoveries of species that are new to science and new records for the country. This research provides vital input for policy makers in charge of conservation planning, resource allocation, and environmental decision-making in Bhutan.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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