

Zoogeography

Lesson 17

How many species are there?



- biologists have made range between 3 and 500 million species!
- What they all agree upon is that only a **very small proportion** of the total is currently known to science and has been adequately described.
- Some parts of the world have been little studied
- Many very abundant species are extremely small, so they may have gone unnoticed in the past

Counting species

Concept

Box
4.1

A conservative estimate for the possible number of species on Earth is 12.5 million [5], but the tropical ecologist Terry L. Erwin [6] has proposed that the total is far greater than this, perhaps as high as 30 million for tropical insects alone. He came to this conclusion as a result of a study of beetles on a single tree species, *Luehea seemannii* (a tropical tree related to the lime tree of temperate regions) in Panama, which he sampled by 'fogging'. This is an efficient technique for stunning the insects in a canopy by smoking them with an insecticide. The dazed insects fall from the tree and are collected in trays placed beneath the canopy. Erwin examined just 19 individual trees of *L. seemannii* in the Panamanian forests and managed to obtain 1200 species of beetles alone from this analysis. This large number is not entirely surprising, since beetles are extraordinarily successful insects and may comprise as much as 25% of the total number of species of living organisms. But this study does illustrate the remarkable richness of beetles in the tropical forest.

From these data, Erwin made a number of assumptions about the numbers of beetle found

specifically on particular tree species, the numbers of tree species found and the proportions of different organisms in the forest in relation to one another. He extrapolated from the information gathered and came to the conclusion that, if this number of beetles is truly representative of the forest richness, then one might predict a total of 30 million species of insect on Earth. The uncertainty of many of his assumptions, however, should make us very cautious in accepting this figure uncritically. Other entomologists, such as Nigel Stork and Kevin Gaston [7], have checked Erwin's estimates using data from studies in the tropical forests of Borneo. Stork has generated estimates ranging from 10 million to 80 million for the arthropods (a group of invertebrate animals including the insects). Another independent estimate [8] supports the lower end of this scale, placing tropical arthropods at 6 to 9 million. The range of error in all estimates is still so wide that there is bound to be a great deal of discrepancy in the figures arrived at, but the world's wealth of species is likely to exceed 10 million.



Table 4.1 The numbers of described species in selected groups of organisms, together with the likely total numbers on Earth, and the percentage of the group that is currently known. Data from Groombridge [15].

Group	Number of described species	Likely total	%
Insects	950 000	8 000 000	12
Fungi	70 000	1 000 000	7
Arachnids	75 000	750 000	10
Viruses	5000	500 000	5
Nematodes	15 000	500 000	3
Bacteria	4000	400 000	1
Vascular plants	250 000	300 000	83
Protozoans	40 000	200 000	20
Algae	40 000	200 000	20
Molluscs	70 000	200 000	35
Crustaceans	40 000	150 000	27
Vertebrates	45 000	50 000	90

Counting the Biodiversity

- The process of **listing all the species** present at a site
- An alternative approach is **to assess the richness of certain groups** of well-known organisms that are easily observed and identified (such as higher plants, mammals, birds or butterflies) and **to assume that they have a consistent proportional relationship to the less easily observed and identified groups.**
- Considering the **body size**. There are fewer large organisms than small ones (body-size–abundance relationship).

Body-size–abundance relationship

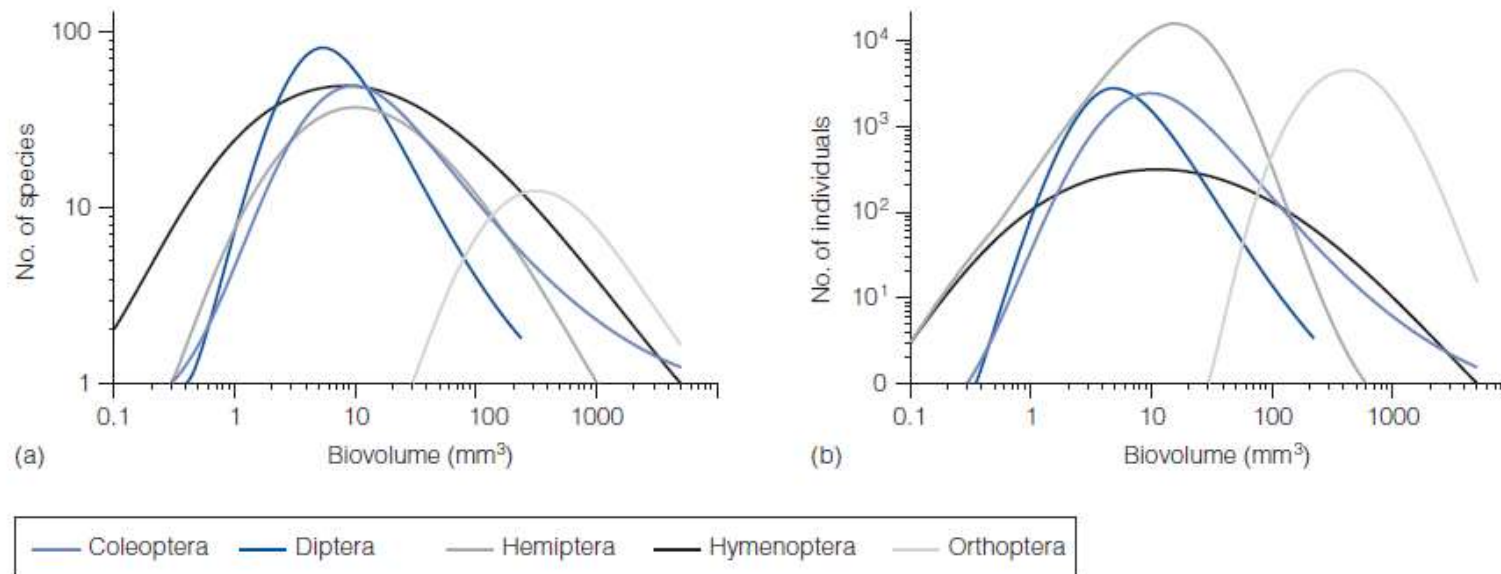


Figure 4.2 The numbers of species and individuals of various insect groups in relation to their body size in grassland in Minnesota. The groups shown are Orthoptera (grasshoppers), Hymenoptera (wasps and bees), Hemiptera (bugs), Coleoptera (beetles) and Diptera (flies). Adapted Siemann *et al.* [21].