

Chapter 1 Introduction

It has been estimated that, throughout the world, there are something like 10,000 animal collections that come under the general heading of zoos (WAZA, 2006). We do not know how many visitors they all receive annually, but it is certainly in the order of at least hundreds of millions. Of these zoos, about 1,000 belong to regional or national associations, which endeavour to foster cooperation and to ensure high professional standards among their members. These 1,000 **accredited zoos** alone receive more than 600 million visits every year (WAZA, 2006), which makes going to the zoo one of the most popular of leisure pursuits across the world. In North America, it is often said that zoos attract more visitors than professional baseball, basketball, and football games combined. In the UK and Ireland, more than 18 million people visit accredited zoos every year, which is one in four of the population (BIAZA, 2007).

So what do these statistics tell us? Firstly, they suggest that the motivation to see, at close hand, real, live **exotic animals** is very strong among people. But they also indicate that the worldwide zoo community can have real influence in shaping people's attitudes towards, and knowledge of, animals. This, in turn, can

result in more public concern and support for raising welfare standards and promoting conservation. Zoos are in an ideal position to capitalize on this.

Modern zoos are no longer only places that keep a few animals for people to go and look at. They are scientifically run and governmentally regulated institutions, which have a significant role to play in our relationship with the natural world. Many zoos describe their role in terms of four key words: conservation; education; research; and recreation. These roles have been defined more precisely in the last two decades, and this has been accompanied by a great increase in knowledge about the needs of animals and the best ways of maintaining them in captivity. In this book, we review and synthesize much of this knowledge to provide an overview of the functions and operations of modern zoos, how they manage their animals, why they keep them the way that they do, and how they try to provide environments that ensure the best welfare of the animals. We try to show what is currently regarded as best practice in accredited zoos, and the knowledge and scientific research on which that best practice is based.

1.1 Who is this book for?

The short answer to the question of who this book is for is that we hope that there will be something of use and value in here for anyone who has an interest in zoos and the animals they keep.

We did, however, have two particular groups of people in mind when preparing this book. Firstly,

we have tried to provide an up-to-date overview of zoos and zoo-related issues for the keepers, vets,¹ curators, education officers, and other zoo professionals who look after exotic collections. These people are highly knowledgeable specialists in their own particular field, but may want to know more about other aspects of how modern zoos work. The second group that we had in mind is the growing

By **accredited zoos**, we mean zoos that are licensed and/or members of one of the regional zoo associations. Much more is said about this in **Chapter 2**.

The term **exotic animals** is used here in a very loose sense. Many zoos keep groups of native species, and some specialize

in this. How exotic you think they are probably depends on where you come from.

¹ We use the abbreviation 'vets' throughout this book to refer to veterinary surgeons and scientists. The word has a somewhat different connotation in North America.

body of college and university students who study zoo animals as part of their course, and who will almost certainly visit a zoo at some stage in their studies to observe and learn about its animals. Courses that include a consideration of zoo animals have proliferated over the past 10 years, and are often to be found with titles such as ‘Animal Management’, ‘Animal Behaviour’, ‘Animal Welfare’, ‘Conservation’, and a variety of other terms. For students on these courses, there has previously been no readily accessible text covering the biology of zoo animals at an appropriate level. There is, of course, the classic and excellent—but perhaps rather formidable—*Wild Mammals in Captivity* (Kleiman *et al.*, 1996), which synthesizes a huge amount of literature about mammals in zoos. We do not intend to compete with that tome. Our book is broader, assumes less prior knowledge, and covers birds, **herps**, fish, and invertebrates, as well as mammals.

With such a diverse intended readership, identifying the appropriate level for the book has been no easy task. Students following modules or courses that include consideration of zoo animals may be registered for particular certificates or diplomas, may be foundation or honours degree undergraduates, may be on taught masters courses, or may be beginning their studies for a PhD. Zoo professionals are likely to have one or more of these qualifications already. What we have assumed is that most readers will have a basic knowledge of biology and that, while they may have very good knowledge of one or two of the biological topics covered in this book, they may not have the same level of familiarity with all of the areas covered. This probably means that the book as a whole is located at around Level 2 or Level 3 (roughly, the second and third year of an honours degree), but we say that only as a guide to its style and content; we hope that the text is not too difficult or too patronizing for those who approach it at a different level.

While we have assumed that most of our readers will already have some basic biological knowledge, biology is a very broad discipline and even professional biologists are not usually proficient in all areas of the subject. For this reason, we have included in each chapter a brief review of the relevant background theory in the hope that the rest of the chapter is intelligible to all readers regardless of their previous knowledge.

Because we are familiar with, and work within, the zoo animal management systems that operate in the UK and Ireland, our perspective in this book very much reflects this orientation. We have tried to include a flavour of other perspectives as well, without making the book too cumbersome, and hope that it will also be of use to readers elsewhere in the world—particularly those located in the rest of Europe, and also in North America and Australia.

1.2 Sources of information

There is now a large literature on zoo animals. Despite this, we have become very aware in preparing this book just how many gaps there are in our knowledge. There are large areas of zoo biology that have not been empirically studied at all and plenty of other areas in which there are very few studies. In some of these areas, we have been able to refer to studies on laboratory, farm, companion, or wild animals, but it should always be borne in mind that the zoo environment is very different from these other environments, so we should apply such studies with caution. We have identified these gaps in knowledge wherever possible and hope that this will stimulate fresh research in future.

Although there is a large zoo literature, accessing it is not necessarily very easy. Many of the **empirical studies** about zoo animals are published in a small

The term **herps** has become popular as a general term to describe reptiles and amphibians, and it will reappear else-

where in this book. **Herpetologists** are people who study reptiles and amphibians; the science itself is **herpetology**.

number of peer-reviewed journals, notably *Zoo Biology*, *Applied Animal Behaviour Science*, and *Animal Welfare*. These are usually within the full-text subscriptions of university (and some zoo) libraries, but also allow free access to abstracts of the papers on their websites. We have tried to use peer-reviewed sources wherever possible, partly because it ensures the reliability of the source, but also because they are relatively easy to access from most libraries. There is, however, a substantial, non-peer-reviewed zoo literature,² some of which contains results from empirical studies, but much of which contains only anecdotal information.

The availability of some of these sources to people outside the zoo world (and perhaps also to some of those within it) can be very poor and, for this reason, we have avoided such sources if alternative sources in the peer-reviewed literature are available. In any case, we have not undertaken exhaustive reviews of the literature in this book. Instead, we have tried to concentrate on notable papers that have advanced theory or practice, together with appropriate examples drawn from those that are available. In doing this, we have attempted to give due prominence to a range of different species, but it remains the case that a large proportion of zoo animal studies are on mammals and that, of the studies on mammals, a large proportion of these focus on primates.

As well as the works to which we refer in each chapter and which are listed in the bibliography at the end of the book (we thought this would be better than having a separate references section for each chapter), we have also tried to identify, in each chapter, sources of further information and appropriate further reading. Of course, websites can come and go, and their addresses can change, so the best we can do is to provide sites that are current at the time of final writing (April 2008), and direct

people to the Online Resource Centre that supports this book.

We have also added a selection of questions at the end of each chapter, and hope that these will stimulate readers to think about what they have read and that they will act as prompts for discussion of some of the issues that we raise.

1.3 What do we mean by 'zoo'?



While the question of what we mean by 'zoo' may, at first sight, seem a rather strange question to ask, it is more than just pedantry to ask for some sort of definition of terms. As we shall see in subsequent chapters, it is important for our interpretation of animal behaviour in the zoo to be able to compare it with behaviour in other situations, and, for this, we need to know how we can separate the zoo environment from those other situations. Furthermore, some of the research that informs our understanding of the needs of animals in zoos and the most appropriate ways of managing them has not, in fact, been done in a zoo, but may have been undertaken at some other kind of animal facility. Again, we can only start to identify ways in which these other facilities differ from zoos if we have a clear idea of what we mean by 'zoo'.

So, what is a zoo?

The UK Government, in the legislation that covers zoos, defines the zoo as:

an establishment where wild animals are kept for exhibition (other than a circus or a pet shop) to which members of the public have access, with or without charge for admission, on more than seven days in any period of twelve consecutive months.

(Zoo Licensing Act 1981)

² The non-peer-reviewed literature about zoo animals is sometimes referred to as the 'grey literature'. Examples range from the newsletters of zoo associations, such as

BIAZA and EAZA, to the UK zookeepers' journal, *Ratel*. (See **Box 14.4** for more information.)

(a)



(b)



Figure 1.1 Places such as butterfly houses (a) and aquariums (b) are regarded as zoos within most definitions, and come within the scope of this book if they are within recognized accreditation systems. (Photographs: (a) Geoff Hosey; (b) Sheila Pankhurst)

Circuses and pet shops are excluded, because they are covered by other legislation, but the definition nevertheless permits the inclusion of such establishments as aquariums, butterfly houses, and safari parks, as well as conventional zoos.

Of course, this definition is driven primarily by the requirements of a legal framework, but it does not differ significantly from the view taken by other organizations within this field. For example, the World Association of Zoos and Aquariums (WAZA), in its 1993 *World Zoo Conservation Strategy* (IUDZG/CBSG, 1993), does not give a formal definition of a zoo, but offers two features that characterize zoos:

- they ‘possess and manage collections that primarily consist of wild (non-domesticated) animals, of one or more species, that are housed so that they are easier to see and to study than in nature’;
- they ‘display at least a portion of this collection to the public for at least a significant part of the year, if not throughout the year’.

These definitions are helpful. They allow us, for example, to include small-animal collections in

museums, specialist collections, aquariums, bird parks, and the like (Fig. 1.1). Significantly, they exclude private and university collections that are not normally open to the public, or are only open for a handful of days each year.

This, then, is the concept of the zoo that we use in this book and, when we use the word ‘zoo’, we use it to include implicitly the aquariums and other publicly accessible collections of wild animals. But while we use the term ‘zoo’ to indicate this range of establishments, virtually all of what we have to say in this book is about, and uses information gained from, accredited zoos and aquariums.

1.4 The scope of the book

The book is about how animals are managed in zoos (their housing, husbandry, health, **nutrition**, and breeding) and also the way in which animals experience the zoo environment (their behaviour, welfare, and interactions with people). But to gain a full understanding of the zoo as an environment for animals and people, it is also useful to

consider the context in which zoos operate, and their contribution to species and habitat conservation both within and beyond the zoo's boundaries. We therefore also briefly consider legislation, **conservation** (both *ex situ* and *in situ*), record keeping, and research.

Zoos have a major role to play nowadays in awareness raising and education about animals and environmental issues, and we consider this role briefly in so far as it affects the animals and their environment. This book is about zoos today and, with the exception of the brief overview of zoo history in **Chapter 2**, its content is about the health, welfare, and management of animals in modern zoos, and not about any failings in welfare provision, or health care, or husbandry, that may have occurred in the past.

We will now provide a brief summary of the content of each chapter of the book.

1.4.1 The history and philosophy of zoos (Chapter 2)

Collections of wild animals are not a new phenomenon. History records a number of private collections of animals, from the parks of ancient China to aristocratic **menageries**, including the menagerie kept at the Tower of London during medieval times. But the 'modern' zoo, in a form that we would recognize now, dates only from the end of the eighteenth century. Zoos increased greatly in public popularity during the nineteenth century, largely as places that provided entertainment and enjoyment for their visitors (even though the intention of their founders may have been the pursuit of scientific ideals).

Nowadays, we tend not to see the zoos of yesteryear as having any particular educational, scientific, or conservation role at that time, yet the two leading zoos of the nineteenth century in Europe (the Jardin des Plantes, in Paris, and London Zoo—**Fig. 1.2**) were very much scientific institutions. In any case, it is possible that, in a society that was becoming increasingly industrialized and urbanized, zoos passively helped to raise visitors' interest and

awareness of the living world simply by giving them the opportunity to experience animals that would not otherwise be a part of their lives.

The history of zoos shows us the evolving context in which wild animals have been kept, and reflects changing views in both society and the zoo world. This history is considered more fully in **Chapter 2**, which concludes with a brief overview of the philosophy and **ethics** of zoos.

1.4.2 The regulatory framework (Chapter 3)

As with so many organizations, many zoos operate within a regulatory framework that includes both mandatory requirements (that is, those required by law) and procedures seen as reflecting good practice, which are stated in various guidelines and codes of practice (**Fig. 1.3**). In **Chapter 3**, we concentrate on describing and interpreting this framework, largely as it applies to zoos in the UK.

Within the UK, the regulatory framework for zoos is stringent, and generally ensures high standards of welfare and husbandry. Similar regulatory frameworks apply to different extents in other regions of the world and these are also briefly considered in this chapter.

1.4.3 Behaviour (Chapter 4)

Modern zoo housing and husbandry often aim to provide the animals with many of the opportunities for behaviour that they have in the wild. Nevertheless, the zoo environment can be quite different from many wild environments and, if we want our zoo animals to behave in the same way as their wild counterparts (**Fig. 1.4**), then we must look closely at the precise ways in which zoo environments differ from the wild and how these differences affect behaviour.

This chapter examines some of the features of zoos that influence behaviour—an area of study that is growing in research importance. It also looks critically at the notion that the 'wild' provides an appropriate benchmark for evaluating and interpreting all aspects of animal behaviour.

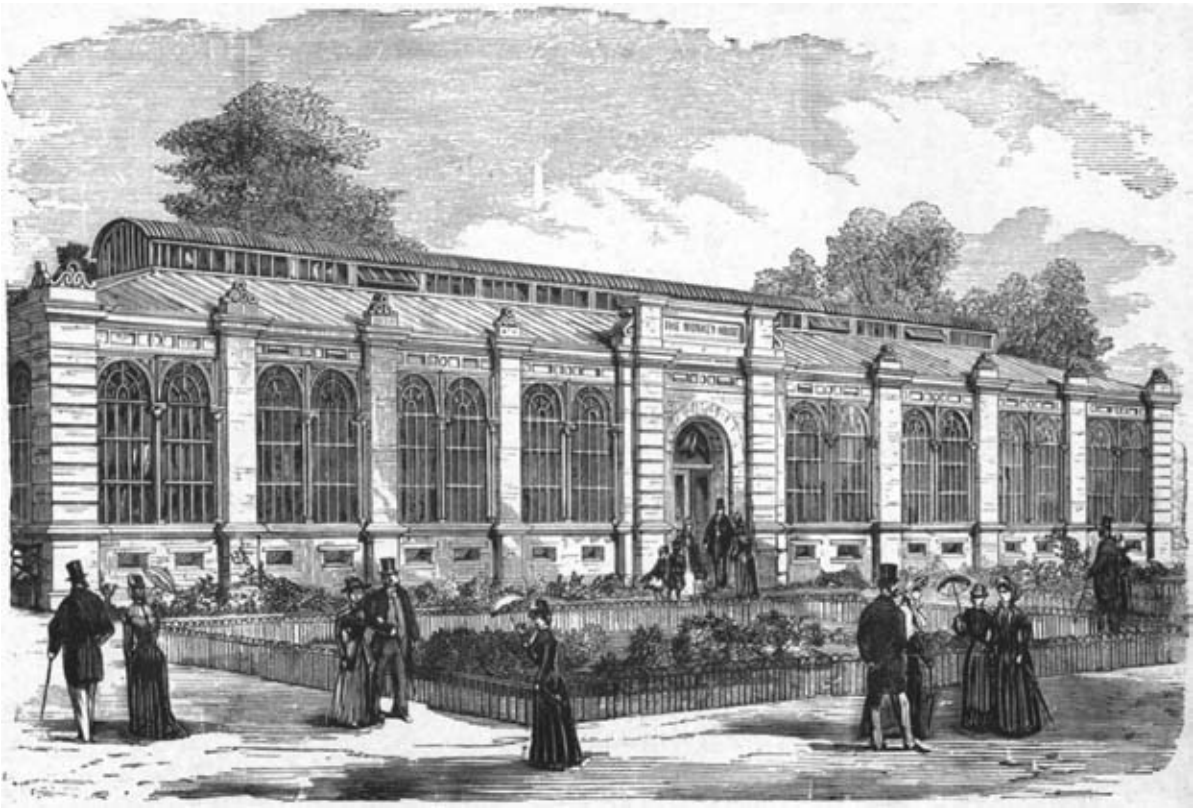


Figure 1.2 The monkey house at London Zoo in late Victorian times (from John Fletcher Porter (1980) *London Pictorially Described*). (Picture: Lee Jackson, www.victorianlondon.org)

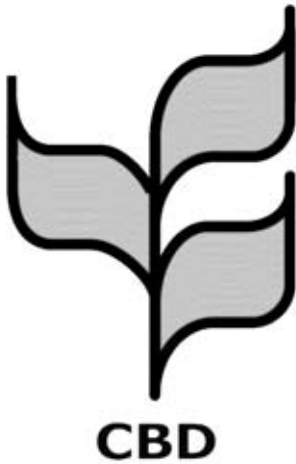


Figure 1.3 The United Nations Convention on Biological Diversity (CBD) was a major outcome of the 1992 'Earth Summit' in Rio de Janeiro, and forms the framework for much national and international legislation on the role of zoos in conservation. (Picture: Secretariat of the CBD)



Figure 1.4 This young Hamadryas baboon *Papio hamadryas* has just been chased by a more dominant animal, and is showing a submissive facial signal and body posture. Social interactions within groups are an important part of the behaviour of both wild-living and zoo-housed animals. (Photograph: Geoff Hosey)



Figure 1.5 Knowing about your animals requires you to be able to recognize them. The ear tag allows easy recognition of this young bongo *Tragelaphus eurycerus*. (Photograph: Paignton Zoo Environmental Park)

1.4.4 Animal identification and record keeping (Chapter 5)

An essential part of managing collections of zoo animals is knowing your animals (Fig. 1.5) and what has happened to them in their lives. For example, a knowledge of previous health issues and veterinary treatments is important in managing an animal's future health, and a knowledge of ancestry and genetic relationships is necessary for planning **captive breeding programmes**.

For most zoos, the days of filing cards have long gone and animal records are maintained on computer databases. This opens up opportunities to look beyond individual zoos and to start to identify trends in whole **taxa**, so these records provide a valuable research database over and above their usefulness in the day-to-day management of the animals.

The use of zoo records for research is considered in more detail in this chapter and also in **Chapter 14**.

1.4.5 Housing and husbandry (Chapter 6)

Housing for zoo animals has changed greatly over the past 150 years and it is rare nowadays—at least in the accredited zoos that are the main focus of this book—to see relatively **barren enclosures** made from concrete, iron bars, and wire. Some ideas of zoo architecture have, in the past, leant more in the direction of what looks good to the visitors rather than what is appropriate for the animals. Today, it is considered necessary to plan housing for zoo animals from multiple points of view, taking into account all of the main 'stakeholders': animals; the public; the zoo staff. This chapter considers these points of view, and examines the different kinds of housing that can be seen in zoos today.

Husbandry is about the day-to-day maintenance of the animals (Fig. 1.6), an area that is still very much dominated by experience rather than empirical data, and the extent of knowledge and practice in zoo husbandry is covered in the rest of this chapter.

1.4.6 Animal welfare (Chapter 7)

Of course, zoos have changed over recent years in more than just the design of their enclosures. An increasingly detailed understanding of the physical and psychological needs of animals (see Fig. 1.7) has led to their welfare being a priority for zoos, and this welfare priority recognizes that animals have needs over and above simply being comfortably housed and fed. There is now a large body of theory underlying our knowledge of welfare issues and, although this has largely been developed in the context of farm and laboratory animals, considerable advances have been made in zoo animal welfare as well—and this is the subject of this chapter.

The term **taxon** (pl. **taxa**) refers non-specifically to any unit of **taxonomy** or classification, so it can variously refer to a species, a genus, an order, or any other classification

category. The system of animal **taxonomy** is briefly described in **Chapter 5**.



Figure 1.6 Housing and husbandry of aquariums can involve getting into the water to clean the tanks. (Photograph: Andrew Bowkett)



Figure 1.7 This giraffe *Giraffa camelopardalis* is showing an oral stereotypy (repetitive licking or chewing movements), which suggests that it has experienced less-than-optimal welfare at some point in its life. (Photograph: Vicky Melfi)



Figure 1.8 Some enrichments are designed to make the animal spend more time in feeding and foraging. (Photograph: Harriet Elson)

1.4.7 Environmental enrichment (Chapter 8)

In some respects, the concept of **enrichment** brings together the behaviour and the welfare of zoo animals. One of the reasons why it is considered important to encourage zoo animals to show similar behaviours to those they display in the wild is the belief that their welfare is compromised if they cannot. Enrichment aims to fill gaps in the opportunities that animals have to display their full range of behaviours (in other words, to change their behaviour—see **Fig. 1.8**), and sometimes to change physiology or other aspects of the animal's biology. What these should be changed to is a debatable issue, which is considered in this chapter, along with descriptions of the main forms of enrichment.

1.4.8 Captive breeding (Chapter 9)

Breeding of zoo animals is often popularly seen as a good thing in its own right, because it implies good welfare and a contribution to conservation. In fact, for many zoo animals, breeding is part of a planned and managed process (**Fig. 1.9**), which is intended to result in self-sustaining zoo populations with high **genetic diversity** and low



Figure 1.9 Captive breeding is an important function of the modern zoo, as illustrated by the successful mating of these spur-thighed tortoises *Testudo graeca*. (Photograph: Warsaw Zoo)

inbreeding (although the extent to which zoos achieve this goal is the subject of much debate and some justified criticism).

Part of this managed breeding process might involve the use of various technologies for assisting (for example, **in vitro fertilization**, **artificial insemination**) and monitoring (for example, **ultrasonography**, **hormone assays**) reproduction. These techniques are described in this chapter, which also considers some of the necessary consequences of managed breeding, such as the issue of surplus animals.

1.4.9 Conservation (Chapter 10)

One of the most significant changes in zoos since their formation has been a shift towards an active role in conservation and education, rather than only the exhibition of exotic species. Human involvement in the extinction of species, through hunting and habitat destruction, goes back to prehistoric times and has been implicated in the extinction of large vertebrates in Australia, Madagascar, and the Americas. In historic times, the first extinctions to



Figure 1.10 Giant waxy tree frog *Phyllomedusa bicolor*. Although this species is not yet of serious conservation concern, it is suffering increasing human pressure because its skin secretions are seen as medicinal. Amphibians as a group are under significant threat of extinction. (Photograph: Douglas Sherriff)

be noticed were probably the dodo *Raphus cucullatus* and Steller's sea cow *Hydrodamalis gigas* in the eighteenth century. There is now widespread recognition of the threats to species and the habitats in which they live, and most accredited zoos see the conservation of endangered species as one of their highest priorities (Fig. 1.10).

This chapter considers both what zoos can do, and are doing, in terms of maintaining self-sustaining populations (the **ex situ conservation**) of animals, with possible **reintroduction** to the wild for some; and their increasing involvement with **in situ conservation**. It also considers some of the problems that zoos face in deciding how many species can be maintained in zoos and which species these should be.

1.4.10 Health (Chapter 11)

A major component of the management of zoo animals is the need to ensure that they are healthy and in good condition (Fig. 1.11), and this is covered in Chapter 11.



Figure 1.11 Maintaining health in zoo animals includes a variety of preventative measures, e.g. checking the oral health of animals, as in this case, where a margay *Felis wiedii* is being examined. (Photograph: Colchester Zoo)

Threats to an animal's health can often come from parasites and infections, but may also result from an inappropriate diet or some other aspect of husbandry. Inevitably, much of our knowledge of zoo animal health issues is derived from experience and case studies. This chapter reviews current practice in preventing illness and treating sick animals, and also looks at the role of veterinary staff and keepers within the zoo in relation to maintaining good health of the animals.

1.4.11 Feeding and nutrition (Chapter 12)

Like health, the nutrition of zoo animals is an area of husbandry that relies, to a great extent, on experience and case studies. The natural diets of

wild-living animals are often poorly known and, even if they are known, they may contain items that are difficult or impossible for the zoo to provide. Diets must be devised for zoo animals that meet their nutritional and health requirements, but also, if possible, their behavioural requirements, because foraging for and processing food are activities that often occupy a large part of an animal's time in the wild.

This chapter briefly reviews the underlying physiological and ecological theory relevant to zoo animal nutrition, and then considers how this is applied in the zoo setting (Fig. 1.12) to provide appropriate and nutritionally correct diets for the animals.



Figure 1.12 Providing a nutritionally balanced diet is only one of the considerations that have to be borne in mind when delivering an appropriate diet to zoo-housed animals. The logistical and practical requirements of delivering food are also important, as with preparing carcasses. (Photograph: Colchester Zoo)

1.4.12 Human–animal interactions (Chapter 13)

The zoo is a setting in which human and non-human animals³ come into contact with one another (Fig. 1.13) in a very intense and intimate way, but the consequences of this had not really been studied empirically until recently. It is important to know what zoo visitors want and get from their zoo experience, and it is also important to know if their presence and behaviour has any effect on the animals. There is also the likelihood that keepers and other zoo staff

themselves play an important part in the animals' lives, and, in turn, affect their behaviour and welfare. These issues, together with the zoo's role in educating visitors, are considered in this chapter.

1.4.13 Research (Chapter 14)

Importantly, most of the changes that have led to the modern zoo, and the way in which zoos manage and display their animals, are built on a solid foundation of scientific research. Even as recently as the 1960s, most of what people thought they knew about zoo

³ We know that humans are animals too, but to avoid being too wordy, we will refer to non-human animals simply as 'animals' from now on.



Figure 1.13 Interactions between people and zoo animals come in various forms. Here, a penguin *Pygoscelis papua* pecks a zoo visitor's foot. (Photograph: Sheila Pankhurst)

animals and the correct way of keeping them was anecdotal. Early attempts to record other aspects of the zoo than the basics of physical maintenance of animals were attempted by people such as Heini Hediger, director of Zurich Zoo, but, again, his

books are largely based on personal observation and experience, rather than on systematic science.

Scientific research in zoos is now a significant undertaking, encompassing areas such as behaviour (Fig. 1.14), nutrition, reproductive biology, and **population genetics**, among other things. This chapter examines the current state of zoo research and also considers some of the methodological issues that frequently, but sometimes unnecessarily, worry those about to engage in zoo research.

1.4.14 We hope you enjoyed your visit (Chapter 15)

The final chapter of this book attempts to look ahead into the future of the zoo, and to reflect on the changing role of the modern zoo. With current concerns about climate change and related issues such as **sustainability** now high on the political agenda (see Fig. 1.15), we are likely to see zoos trying to become not only conservation organizations, but



Figure 1.14 Good practice in the care and management of zoo animals is based on systematic scientific research. Here, a student collects behavioural data as part of an undergraduate project. (Photograph: Sheila Pankhurst)



Figure 1.15 The next challenge towards which zoos are working is reducing their impact on the environment, which can be achieved by moving towards sustainable operating systems, including recycling. (Photograph: Paignton Zoo Environmental Park)

sustainable organizations in the widest sense, with policies on sustainability affecting all aspects of the day-to-day operation of major zoos. In this chapter, we also provide information about careers in the zoo world, for readers who would like to, or already, work with zoo animals.

1.5 The naming of names

Included within the text of this book are a lot of names of species of animals, of zoos, and of other organizations. Referring fully to all of them each time they are mentioned can result in a very cumbersome text and we have tried to avoid this wherever possible. It is important to identify the **scientific names** of the animals to which we refer so that we all know exactly which species we mean. We may all know what a chimpanzee is—but do we all know to what we are referring if we mention the blue poison dart frog (about which you can read more in **Box 10.3**)? We have therefore used the scientific name of each species when we first mention that species in each chapter, but not at subsequent mentions. (Scientific names of species are also given in the index at the end of this book.)

There is a similar problem in referring to the names of zoos. We have tried to give sufficient information for the reader to know where a zoo is when we mention it, without making a very unwieldy text. We have not used any particular rule about this—just a bit of discretion. Not all readers, for example, might know where Brookfield Zoo is, but we might expect them to know where Chicago is, so we would refer to ‘Brookfield Zoo, Chicago’ rather than to ‘Brookfield Zoo, Chicago, IL, USA’. Where it makes it clearer, however, we have used a country name, rather than only a city name.

We have also tried not to be too cumbersome when introducing technical terms. Throughout the text, we have highlighted what we think are significant words on the first occasion that they appear in each chapter and have endeavoured to explain, or define, them when they first appear, or at appropriate places through the text. At the end of the book is a glossary of some of the terms that are particularly used in zoo world, some of which may not be familiar to all readers. We hope that this, together with the index, will guide the reader through any terms that are new or unfamiliar to them.

1.6 Finally . . . abbreviations

We have tried very hard to make this book accessible and readable, and to avoid any unnecessary jargon. But the zoo world is riddled with acronyms and it is hard to avoid using some of these from time to time

when talking about the work that zoos do. For those of you who do not know your ‘EEPs’ from your ‘TAGs’—let alone what ‘ZIMS’ and ‘SPARKS’ might stand for—we apologize now. We have tried to explain all specialist terms and acronyms where they first arise in the text and, to make life a little easier for our readers, there is a list of acronyms at the front of the book.