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Zoos Expert Committee Handbook

November 2012



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Introduction

In February 2011 the Zoos Expert Committee replaced the Zoos Forum as the body providing UK Ministers with independent, technical advice on zoo matters. The Committee will continue to update and add to this Handbook, previously the Zoos Forum Handbook.

Please note that generally references to legislation in this Handbook relate to legislation that has effect in England. As there may be differences in legislation between England, Scotland, Wales, and Northern Ireland please apply the applicable legislation throughout this document.

The Handbook's purpose is to supplement the guidance contained in the Secretary of State's Standards of Modern Zoo Practice. The Handbook is a living document and will be reviewed, updated and added to on a regular basis to reflect new developments in animal management and best zoo practice etc. The Handbook is for all who are interested in zoos and the management of zoo animals.

However, it should be noted that the Handbook is not meant to be an exhaustive source of information. It is non-statutory and simply contains guidance with recommendations and examples that all zoo stakeholders – inspectors, local authority representatives, zoos and others - should find helpful.

This new Zoos Expert Committee Handbook contains updated chapters on conservation, education and research and on animal welfare and its assessment in zoos. There are also two new chapters, one setting out the background to zoo licensing legislation and one on managing zoonotic risk in zoos.

The chapter on UK sustainability initiatives has not been included in this new Handbook. Although the chapter contained useful information when it was first written, up to date information on sustainability initiatives is now accessible from other sources.

Professor Anna Meredith
Zoos Expert Committee Chair
November 2012

Chapter 1 Background to zoo legislation

What is the Zoo Licensing Act?

The Zoo Licensing Act 1981 ('the Act') came into force in 1984 and requires the inspection and licensing of all zoos in Great Britain (Northern Ireland has separate legislation: The Zoos Licensing Regulations (Northern Ireland) 2003).

The Act aims to ensure that, where animals are kept in enclosures, they are provided with a suitable environment to provide an opportunity to express most normal behaviour.

The Zoo licensing Act (Amendment) (England and Wales) Regulations 2002 amended the Act. The amendment Act gives force to European Council Directive 1999/22/EC, which deals with the keeping of wild animals in zoos. The Regulations have force of law from 8 January 2003.

How does the Zoo Licensing Act work?

Responsibility for the day-to-day operation of the licensing system and the administration of the Act rests with local authorities (usually the Environmental Health Department). However Central Government does have a role. The Secretary of State for Environment, Food and Rural Affairs has responsibility for maintaining a list of zoo inspectors and for setting detailed standards for zoo management with which zoos are expected to comply - the Secretary of State's Standards of Modern Zoo Practice (SSSMZP). The SSSMZP can be seen on the Defra website at the following address: www.defra.gov.uk/wildlife-pets/zoos/

Following devolution the Scottish Government and the Welsh Government have taken on these responsibilities in their respective countries. In Wales, "The National Assembly for Wales Standards of Modern Zoo Practice" are equivalent to the SSSMZP.

The Secretary of State has a two-part list of inspectors who can be called on to inspect zoos. The first part contains names of veterinary surgeons and veterinary practitioners who have experience of zoo animals. The second part lists persons who are competent (in the Secretary of the State's opinion) to inspect animals in zoos, to advise on their welfare and to advise on general zoo management issues. Inspectors' expenses are paid by the licensing authority, and recharged to the owner of the zoo.

What does the Zoo Licensing Act cover?

A zoo is defined in the Act as being 'an establishment where wild animals are kept for exhibition ... to which members of the public have access, with or without charge for admission, seven or more days in any period of twelve consecutive months'.

The wide scope of this definition means that licensed zoos range from traditional urban zoos and safari parks to small specialist collections such as butterfly houses and aquaria. The Act recognises this wide range of establishments by allowing dispensations to be granted for small zoos. Dispensations for these types of collection reduce the number of inspectors to a reasonable level for a small establishment, and do not in any way weaken a zoo's obligation to achieve the levels of animal welfare and modern public safety set out

in the SSSMZP. The Act does not extend to circuses, or to pet shops, both of which are covered by other legislation.

EC Zoos Directive

In June 1998, the Council of EC Environment Ministers agreed proposals drawn up by the UK Presidency for an EC Zoos Directive aimed at strengthening the conservation role of zoos. The Directive entered into force on 9 April 1999 and required all Member States to set up national systems for the licensing and inspection of zoos.

The Act already implemented many of the measures in the Directive such as the provision of proper accommodation and care for the animals; keeping up-to-date records; and taking appropriate measures to prevent escapes. But the requirements that zoos participate in conservation and education activities was new. Although most zoos were already participating in conservation and education, once the legislation was in place, it became a statutory requirement to do so.

The Government's view is that well-managed zoos can play an important role both in educating the public about wild animals and their habitats, and through participating in activities which help conserve and protect threatened wildlife.

Zoos have put together a conservation strategy, published in 2005, looking at how zoos worldwide can contribute to conservation. Building a Future for Wildlife: The World Zoo and Aquarium Conservation Strategy' can be found on the website of the World Association of Zoos and Aquariums: www.waza.org/en/site/home

Zoo licensing and the Animal Welfare Act

In addition to the requirements of the Act, vertebrate animals kept in zoos are also subject to protection under the [Animal Welfare Act 2006](#) although the Zoo Licensing Act remains the primary piece of legislation to regulate zoos. Furthermore, the SSSMZP, which already provides guidance on best practice standards for the welfare of zoo animals, also provides practical guidance in respect of provisions made by or under the Animal Welfare Act.

Further guidance on the zoo licensing process can be found in 'Zoo Licensing Act 1981: Guide to the Act's provisions' on the Defra website at the following address: www.defra.gov.uk/wildlife-pets/zoos/

There is also guidance and information on the Animal Health and Veterinary Laboratories Agency website at <http://animalhealth.defra.gov.uk/cites/zoos-inspectorate.html>

Chapter 2 The ethical review process

1. Introduction

The Secretary of State's Standards of Modern Zoo Practice (SSSMZP), which can be viewed at: www.defra.gov.uk/wildlife-pets/zoos/ require that:

7.14...as a general principle zoos should establish ethical review processes and, where appropriate, seek appropriate help in planning and implementing their conservation and education strategies.

Appendix 2.4 of the SSSMZP also states that this is particularly for:

...situations where the use of animals (e.g. acquisition, management or disposal for conservation, education or research) may be in conflict with the best welfare interests of the animal or animals involved.

This chapter provides practical guidance on establishing and auditing ethical review processes in zoos. Developments in animal-welfare standards in one field can often, subsequently, be used to help raise standards in others and it is hoped that this document will be helpful to the zoo community and perhaps also for future developments in other animal 'industries'. Attention has been drawn to relevant standards and codes that have been set for farm and laboratory animals and adapted for use in the zoo context. This is not a static field and we envisage that this will be a 'living' document and, along with the SSSMZP, be subject to regular revision and update.

2. Background

Zoos pursue a variety of aims, including conservation, education, research and the provision of recreation, and they have to operate within financial and other resource constraints. Zoos are also generally committed to high standards of welfare (World Zoo Organisation, 1999). There are times when a balance has to be struck between what is best in terms of conservation, education, disease control or other goals and what is best for the interests, particularly the welfare, of individual animals. These decisions may be difficult and the aim of ethical review is to help ensure that all these concerns are taken fully into account.

Appendix 1 provides introductory notes on ethical concerns for species conservation and animal welfare, and some key principles for animal welfare (the Five Freedoms and the 3Rs).

3. What is the ethical review process?

The ethical review process is a mechanism for consideration of ethical dilemmas in order to provide advice to the zoo management.

Much of the work of participants in the ethical review process is likely to involve judging the ethical acceptability of obtaining, keeping and disposing of animals or their use in conservation, education, research or other programmes. This requires 'weighing' the benefits of these activities as a whole against the welfare (and other possible) costs to the individual animals involved.

It is likely that matters for review will be selected largely by the zoo's management based on problems that have arisen or may be foreseen. It is important that attention is focused on substantial matters, rather than the minor ethical problems that are a feature of life, in zoos and elsewhere, and which have to be dealt with on a day-to-day basis. However, careful judgement needs to be exercised.

Problems that might be considered for ethical review include (see also section 5):

- for breeding purposes, as part of a conservation programme, a gorilla should be moved to another zoo. However, there may be concerns about the possible stresses of leaving a natal group, transport and introduction to a new group. In this case there may be a need to balance the benefits to the global captive gorilla population against the interests of the individual;
- faced with a nutritional problem in a highly threatened species, a zoo may wish to try to solve this by investigating nutrient requirements in a more common but closely related species. Once again, an action with potential benefits for the conservation of species biodiversity may not be in the best interests of the animals involved;
- in order to solve a problem with breeding a highly threatened species, a zoo may wish to carry out research on individuals of that species or of a more common, or better understood, species. While such research may be for the benefit of species conservation, it may not be in the best interests of the animals involved;
- a small captive population needs the introduction of unrelated wild individuals to prevent inbreeding. Do the benefits outweigh the welfare costs associated with the capture of wild animals?
- *ethical review may be required as part of the collection-planning process. Can the zoo provide adequate resources to meet the welfare needs of species that are difficult or expensive to maintain? Other ethical considerations may be necessary when assessing the inclusion of species in the collection plan; can inclusion be justified on conservation, education, research or recreation grounds?*

The ethical review process provides a mechanism for addressing two key questions:

- (i) Should the zoo do this?
- (ii) If so, have steps been taken to minimize the risk of harm to welfare?

The first question requires a cost/benefit analysis. This is a judgement as to whether or not an action should be undertaken (or continued) and is based on consideration of the likely and possible benefits and welfare or other costs to the animals involved.

If the answer to the first question is yes, then the second question requires a consideration of all that can be done to lessen the chance of any adverse welfare impacts.

The ethical review process serves a number of purposes:

- it provides a forum through which the interests of the animals can be represented. Where the welfare of individual animals may be in conflict with other interests, for example, their use in conservation or education programmes, the role of the ethical review process is to help in deciding whether the use is an absolute wrong or

whether, on balance, it may be justifiable and defensible on the grounds that the benefits are judged to outweigh the costs (see Appendix 1);

- where, on balance, the decision is made to use an animal in a way that may not be to its best welfare advantage (e.g. in a release as part of a reintroduction programme), the ethical review process should include consideration of all that can be done to minimize any adverse welfare impact through application of the 3Rs (see 4.3);
- it provides an opportunity for checking that zoo practices are consistent with all relevant current legislation and with all relevant codes defining best practice;
- it provides a mechanism through which the concerns of external communities can be considered and addressed. The attitudes of society to animals change and it is important that zoos keep in touch with these changes in opinion. A dynamic system for the review of animal-management practices is needed to ensure that zoo standards *are as high or higher than those expected by society*. In the ethical review of issues it may be helpful to consider, specifically, the views, or likely views, of various groups, for example, zoo visitors, the membership (if there is one), the wider conservation community and the local community, as well as the evolving ethical considerations in society (e.g. changes in perspective based on new scientific discoveries of the psychological and physical needs of animals).

Mepham (2008) provides a useful decision-making tool, where those making decisions structure their deliberations by using a matrix (the use of which he describes in Chapter 3 of his book). It is based upon the various ethical perspectives that underpin our relationships with non-human animals that we manage. The decision-makers identify: all those individuals that would be affected by a decision; the benefits that would accrue to each group; the disadvantages/harm that might be experienced by each group; the level of autonomy of those affected to make decisions; and the equitability of the proposed action. It does not make the decision, but it provides a way to add consistent structure to the decision-making process.

Appendix 2.3 of the SSSMZP also envisages a role for a committee which looks at human ethical issues, such as the routine vaccination of staff against zoonotic transmission of diseases or evaluation of facilities for disabled people. The issue of public interaction with animals might also be included in this list. However, we suggest that ethical concerns relating to the interests of staff, volunteers or visitors should not deflect the ethical review process (which was established to address the interests of animals) from its primary focus. It is not that ethical concerns about human issues are any less important but their consideration is a different task and one which may be better addressed separately, through a different review process.

4. How to undertake an ethical review

4.1 Principles

Zoos vary greatly in size; the range of species maintained; the focus of their work; and in other ways. Therefore it is not appropriate to define one model ethical review process that should be adopted by all. Zoos should give careful thought to developing an appropriate and effective ethical review process to suit their own needs (see 4.2). The credibility of the

review process will be linked to its conduct, openness, transparency and accountability. Some key points are listed:

- zoo staff should demonstrate commitment and support for the ethical review process;
- the outcome of the ethical review process is more important than how it is carried out;
- the system for ethical review should be appropriate for the size and nature of the zoo;
- the aim is not to create unnecessary bureaucracy but to help ensure high standards of welfare;
- the work should be partly proactive. It is expected that, even in the smallest establishments, meetings should be held at least once a year to consider, in advance, matters such as future collection, conservation, education, research and strategic plans for the zoo and how these might have an impact on animal welfare;
- the work should also involve a review of past records of animal health and welfare, focusing in particular on any problems that have emerged;
- zoos should be encouraged to make public the arrangements that they put in place for ethical review and any ethical and animal-welfare policies that they develop;
- zoos should be encouraged to share experiences in establishing and using ethical review processes, with a view to evolving improved systems;
- records of meetings and other ethical review process activities should be maintained and these should be made available to zoo inspectors (an outline of the ethical review process is required in the Research section of the Pre-Inspection Audit form, see <http://animalhealth.defra.gov.uk/cites/zoos-inspectorate.html>).
- the process should facilitate the development of principles and precedents that apply within the institution.

4.2 Composition of the ethics committee

The SSSMZP encourage zoos to establish an ethics committee to undertake the ethical review process. However, a smaller establishment, with fewer personnel, may have more practical difficulty setting up a committee than a larger zoo. Therefore a small zoo may obtain ethical advice from another committee or individuals. More important than the precise nature of the committee is that, for all zoos, the review process itself is credible and stands up to independent scrutiny.

Other important points listed in the SSSMZP (Appendix 2.6) that have a bearing on the composition and conduct of the ethical review committee are:

- the committee must not be perceived as merely an agent of the management: it should have independence and, at the very least, provide advice to the zoo operator;

- the committee should not consist only of scientists – although they may be able to advise on practicalities and research, they are not necessarily qualified to judge what is ethically acceptable;
- where possible, junior staff from the zoo and members of the local community should be represented on the committee;
- the committee's work should be carried out in as open a way as possible, bearing in mind the need, on occasions, to respect confidentiality;
- the committee itself should be subject to review, with formal arrangements for changes to membership, rotation of chairman, and co-option of persons with particular skills.

The ethical review process is, by its very nature, not something that can be carried out by one person: consensus views, on what may be contentious issues, need to be established. Therefore the process is best performed by a group or committee and while regular meetings are likely to be advantageous (at a frequency to be decided by them but see 4.1) some of the work may be carried out by telephone and/or email rather than through formal meetings alone.

As mentioned above, it is important that zoos develop systems that are in line with Appendix 2.6 of the SSSMZP and are appropriate to the scale and nature of the enterprise:

Large zoo

In a large zoo, the ethical review process might be carried out by a formal committee that included the following persons:

- the zoo director
- member(s) of curatorial staff, including junior keeper(s)
- the zoo veterinarian
- a senior member of the zoo marketing/PR department
- a senior member of the zoo education department
- person(s) independent of the establishment (see below)
- person(s) co-opted on a regular or occasional basis to provide specific expertise e.g. in aspects of zoo animal care, disease control, welfare, etc.
- a secretary whose sole function is to record the discussions and decisions.

Small zoo

At the other end of the spectrum, for a small zoo the ethical review process might be included within the remit of a suitably constituted existing committee. A small zoo might carry out its ethical review process through discussions and consultations involving:

- the zoo director
- the zoo veterinarian
- an appropriate member of the curatorial staff
- a person who is independent of the establishment (see below)

Zoos may find it helpful to consult other bodies, such as the British and Irish Association of Zoos and Aquariums (BIAZA), and the European Association of Zoos and Aquaria (EAZA), which may be able to assist in considering ethical concerns (see Appendix 3, this chapter).

It is suggested that those involved in the ethical review process should elect a chair and establish a constitution/mode of operation, including rules and responsibilities regarding maintenance of records, rotation of membership, frequency of meetings and regular items for inclusion on the agenda. Similar measures, as appropriate, can also be put in place by smaller establishments.

In order to maintain independence, it is suggested that the chair will not normally be the zoo director: it is the role of the committee/group to advise the director on the matters that fall within its remit. In view of the nature of the work of the committee/group, it is also important that all serving members should be able, regardless, for example, of their rank in the zoo management, to contribute fully as individuals without fear or favour.

The person(s) selected from outside the organization should be able to contribute constructively to the committee's process of reasoning and to reflect the concerns of the external community. In a report published by the Hastings Center, New York, it was concluded that the ideal unaffiliated person for an institutional animal-care committee is 'assertive, self-confident and intelligent and able to make mature judgements and be sensitive with a strong sense of ethical values' (Donnelley & Nolan, 1990). However, this is an area in which it is difficult to generalize and zoos should select persons carefully with whom they can work. Candidates for suitable independent persons might include (after Jennings *et. al.*, 1999):

- local councillors
- clergy
- hospice workers
- teachers
- legal representatives
- philosophers
- veterinary surgeons

- scientists
- animal-welfare scientists
- ethologists
- representatives of animal-welfare organizations

See Appendix 3 for a list of organizations that may be able to provide further information.

4.3 Issues the committee should address

As mentioned earlier, when considering a proposed or existing practice that might raise ethical concerns, the ethics committee should consider, as a minimum, two questions: (1) Should the zoo do this? (2) How should the zoo do this? The committee may also wish to check that any proposed new action is consistent with all the relevant codes and legislation. The committee should consider consistency with previous good practice within the zoo/aquarium and justify changes.

Should the zoo do this?

In a cost/benefit analysis it is important to try to consider all the likely and possible types of costs and benefits. Welfare costs can be categorized in terms of the types of harm (e.g. physical effects, which can be determined objectively, and the likely emotional corollaries, including pain or fear, assessment of which involves a subjective component), the number of animals that will be affected and estimates of the severity of the effects and their duration. Benefits should also be categorized and assessed and, where possible, quantified, as fully as possible (e.g. in terms of the likelihood of being achieved and their importance). The benefits of the keeping, management or 'use' of animals in zoos might include various contributions to conservation, education or advances in veterinary science.

Some have advocated using scoring systems to facilitate the process of 'weighing' welfare costs against the proposed benefits (e.g. Porter, 1992). However, it is important to be clear that the process cannot be a mathematical procedure. Welfare costs cannot be measured and/or described in the same units as possible benefits to conservation or other causes. The cost/benefit analysis is a process through which a reasoned judgement is reached.

How should the zoo do this?

If, following a cost/benefit analysis, the decision is made to proceed with an action that may compromise the welfare of the animals, those involved with the ethical review process should review steps which can be taken to minimize any risks to welfare. A useful approach is to consider the 3Rs (see Appendix 1), refinement, reduction and replacement:

Refinement

Where an endeavour might compromise welfare, the husbandry and specific procedures should be refined so as to minimize any adverse effects upon welfare. For example, if it is decided, for conservation reasons, that animals should be taken from the wild to increase genetic diversity in captive populations, then the procedures used for capture, quarantine and husbandry should minimize risks to welfare.

The other two 'Rs' – reduction and replacement – may have less general application in zoos but should not be overlooked.

Reduction

Where an endeavour (e.g. use of animals in conservation research or for translocations for conservation) might compromise welfare, no more animals should be involved than necessary to achieve the aim. For the same reasons, no fewer animals should be used than are likely to be necessary to achieve the aim, as this might also compromise welfare for no conservation gain.

Replacement

It is a universally accepted principle that, where possible, alternatives to live animals should be used in research which might compromise their welfare. There are unlikely to be other situations in which replacement is relevant in zoos but it is important not to overlook the possibility of using alternatives to live animals in situations where welfare might be compromised. For example, use of remote cameras for viewing animals at times when close proximity of visitors may be stressful.

Is the action in line with relevant codes and laws?

It is recommended that those involved in the ethical review process clarify who is responsible for ensuring that any proposed actions are in compliance with the relevant national and international laws, and with codes and conventions espoused by the organization. In many cases this may be one of the functions of the ethics committee.

5. Concerns the ethics committee might be expected to address

Examples of issues that the ethics committee may need to consider (in individual cases and in developing policies to be put forward for adoption by the zoo) are provided. When considering procedures that some might regard as mild or minor, committees should ask whether the procedure is a one-off event or is something that the individual animal(s) will experience repeatedly.

This list is not exhaustive but illustrates some of the issues that may require scrutiny:

- collection plans/choice of species (in relation to method of acquisition, facilities for management, etc.);
- acquisition of wild-caught and other animals;
- handling/husbandry procedures (where the ethical merits of the procedures may be in question e.g. the use of some forms of physical restraint or isolation for the collection of faecal samples);
- relocations of animals (to other zoos or elsewhere);
- use of animals for reintroductions;
- euthanasia and culling policies;
- inbreeding/genetic management;

- breeding and contraception policies
- application of assisted-breeding techniques for conservation programmes;
- mixed-species exhibits where, for example, as in shark tanks, some species may be at risk from others;
- pinioning of waterfowl and other mutilations;
- non-emergency veterinary procedures (where the ethical merits of the procedures may be in question);
- training and use of animals for therapeutic, educational or other reasons;
- public contact with animals e.g. in touch pools, snake encounters, children's zoos;
- keeper contact with animals;
- use of animals in entertainment;
- hand-rearing of young for meet-the-animals events;
- use of animals in promotional activities;
- use of animals for research e.g. nutrition studies.

In Appendix 2, two examples (the ethical and welfare implications of hand-rearing and euthanasia/culling) are described in detail to illustrate the range of points that may be considered as part of a careful ethical review.

6. Feedback and review of the ethical review process

The requirement for zoos to have their own policy for dealing with ethical issues was introduced in the SSSMZP (2000). The Zoos Expert Committee will review the introduction and running of the systems that zoos have put in place, with a view to revising these guidelines where necessary. To this end, feedback from Zoo Inspectors, zoos and other parties interested in the implementation of ethical reviews would be welcomed.

Appendix 1 Ethics, species conservation and animal welfare

The human population reached the six billion mark in the last months of the twentieth century and continues to grow rapidly. Anthropogenic pressures on the environment threaten the viability of large numbers of species through loss of habitat, direct or indirect killing, pollution and introductions of non-indigenous species. The rate of loss of species at the end of the twentieth century is thought to be unprecedented and, in response, many programmes have been initiated for the protection and preservation of biological diversity. The conservation of animal species has been taken up by the world zoo community as a key goal and under the 1999 European Zoo Directive zoos are required to contribute to species conservation. Zoos carry out this work through education, captive-breeding programmes, research and support of *in situ* programmes. It is important that zoos pursue these endeavours with full and careful regard to the welfare of individuals.

Attitudes to animal welfare have varied over time and between cultures but in recent decades there has been a growing worldwide consensus about the importance of animal welfare. Among the many contributory factors has been the growing certainty, arising through a variety of fields of science, that consciousness (the capacity for awareness of pleasant and/or unpleasant feelings) is likely to be present in a wide range of species. It follows that we have a strong moral obligation to take animals' feelings into account in our dealings with them. This position was reflected, for example, by the agreement of the European Heads of State at the Amsterdam Summit meeting in 1997 to make provision in the Treaty of Rome (which established the European Community in 1957) 'to ensure improved protection and respect for the welfare of animals as sentient beings'.

Ethics is about what ought to be done: about what is the morally right and wrong course of action, and why. Some believe that the correctness of actions should be judged on their consequences: that is, that it can be justifiable to cause a minor harm in pursuit of a greater good. Persons who hold this 'consequentialist' view might consider, for example, that pursuit of important species-conservation objectives should not be blocked on the grounds that the procedures may have a minor adverse effect on the welfare of the animals involved. Thus, they may allow that a vaccine or a capture drug be tested on, say, domestic cats before it is used in a tiger-conservation programme. Others believe that actions can be right or wrong regardless of their consequences and that it is an absolute wrong to harm an individual because causing harm cannot be justified under any circumstances. Persons who espouse this 'deontological' (rights) view may agree with Regan (1992) that 'The rights of the individual are not to be violated in the name of some collective good, whether that good be the good of the ecosystem or the good of sentient life (both human and non-human), and independently of whether these rights are violated "humanely" or otherwise'.

The Animal Ethics Reader (Armstrong & Botzler 2008) includes extracts of essays by Regan amongst others. Five of the essays focus specifically on zoos and provide both a philosophical and practical background to the principles underpinning current zoo legislation.

In practice, most zoos are likely to take an ethical stance based on a combination of these positions. They may decide, for example, that (i) it would be absolutely wrong under any circumstances to undertake any actions that caused intense or prolonged harm to animals,

no matter how great the potential benefits might be for species conservation (or some other good cause), but that (ii) they may permit certain procedures which caused only minor welfare infringements if these were highly likely to lead to significant conservation (or other) benefits.

Such combinations of rights and consequentialist frameworks have been adopted by both the Banner Committee, which considered the ethics of the use of animals in science, and the Farm Animal Welfare Council (FAWC) (e.g. FAWC, 1998) which advises the government on the ethics of the use of animals in livestock production.

The latter half of the twentieth century saw the development of two sets of principles or codes, the 'Five Freedoms' and the '3Rs', which have become widely accepted tools in the welfare of farmed livestock and in the humane use of animals in research. The Five Freedoms and the 3Rs are also of relevance in zoos and are described below.

The Five Freedoms

In the SSSMZP the first five sections are organized under headings that are adapted from the Five Freedoms: these are the five guiding principles of animal welfare which were developed by the FAWC (see below) and have been taken up widely around the world. For example, they were used as key principles in New Zealand's Animal Welfare Act 1999.

Following publication of the late Ruth Harrison's book *Animal Machines* in 1964, which drew attention to the mismatch between society's responsibilities to animals as conscious beings and the use of them in intensive farming as if they were machines, the Brambell Committee was set up to look into the animal welfare aspects of factory farming. The Committee recommended the establishment of an independent Farm Animal Welfare Advisory Committee to advise the government, and this evolved into the FAWC. In attempting to summarize the key principles of animal welfare, FAWC developed precursors to the Five Freedoms and, while a FAWC member, John Webster (Professor of Animal Husbandry at Bristol University) drafted the Five Freedoms in their current form (Webster, 1995):

Freedom from thirst, hunger and malnutrition - by ready access to fresh water and a diet to maintain full health and vigour.

Freedom from discomfort - by providing a suitable environment including shelter and a comfortable resting area.

Freedom from pain, injury and disease - by prevention or rapid diagnosis and treatment.

Freedom to express most normal behaviour - by providing sufficient space, proper facilities and company of the animal's own kind.

Freedom from fear and distress - by ensuring conditions which avoid mental suffering.

These 'freedoms', which recognize both physical and behavioural needs, succinctly encapsulate the welfare requirements of animals and also form a framework that can be used in the assessment of animal welfare. They are ideals and it is important that there is some flexibility in their application because they can, at times, be contradictory. It may be impossible in practice to avoid any fear or pain because, for example, diagnosis of disease

in captive wild animals (involving blood sampling etc.) may induce both. Likewise, in social animals, freedom to express normal behaviour may result in fight injuries to cage mates at times. Therefore, judgement has to be exercised in balancing the freedoms.

In the SSSMZP these freedoms have been adopted, in slightly modified form, as the principles under which the Standards in the first five sections are grouped:

- provision of food and water
- provision of a suitable environment
- provision of animal health care
- provision of opportunity to express most normal behaviour
- provision of protection from fear and distress

It would be quite wrong to interpret the use of FAWC's Five Freedoms in the SSSMZP as zoo standards catching up with standards for farm animals. The two have evolved in different ways and zoo standards, at least in the UK, have tended to be higher, in terms of space allowances, environmental enrichment and attention to individual animal care, than those for farm animals. In adopting the Five Freedoms, the SSSMZP has built on the framework developed by FAWC.

The 3Rs

The '3Rs' principles of Russell & Burch (1959) advocate: (i) the **R**eplacement of the use of animals in biomedical research wherever possible; (ii) where no alternatives are available, **R**eduction of the numbers of animals used to the minimum required to meet the objectives; and (iii) **R**efinement of experimental and husbandry techniques to minimise any risks or harm to welfare.

All three 'Rs' are directly relevant to the use of animals in conservation research. They can also have some relevance to the use of animals in zoos for other purposes, such as in conservation or education programmes, or any other circumstances in which, while the purpose for which the animals are 'used' may be worthy and justifiable, the procedures may not be necessarily in the best interests of the individuals involved. While replacement may rarely be applicable, there are often possibilities for refinement and there may also be possibilities for reduction.

Appendix 2 Examples from Edinburgh Zoo

The material in this Appendix is taken directly from the Population Management Policy of the Animal Department at Edinburgh Zoo. The document illustrates the types of issues raised and the reasoning that lies behind the ethical review process at Edinburgh. The examples are purely illustrative and other zoos should not assume that these will exactly suit their particular circumstances.

The Population Management Policy (of Edinburgh Zoo) states:

Summary:

The basis for artificial rearing is that only animals of genetic value to the species breeding program or the individual zoo's animal collection plan would be considered. Once this has been established, a series of criteria would then be considered, including stages of artificial rearing. The criteria include sex, birth interval, absence of genetic defects, and considerations concerning social species.

If the animal does not meet the criteria, culling would then be considered. This is not a step that is taken lightly. There are a series of circumstances that must be considered before a decision to cull is reached. These circumstances include age, sex and genetic representation. Culling would be by a humane method related to the species, age and size of the animal.

Surplus animals that then occur, having followed this policy, would be considered under the draft version of the BIAZA Animal Transaction Policy. Surplus is defined as collection animals that do not contribute to the zoo's animal management program.

The policy refers to all species. That is, no species should be treated differently unless specifically stated otherwise.

Example 1. Artificial rearing

This would apply to offspring, which have been abandoned by the mother or where there is a problem with the facility, and would die unless appropriate steps were taken. If this problem arises, the environment/facility must be reassessed.

Basis: when the individual is of genetic value to the species breeding program or zoo's animal collection plan.

Criteria:

The following flow chart applies to all litter sizes:

Suitable alternative home? Yes → Re-home

|

No

↓

Genetic value?¹ No → Cull individual

|

Yes

↓

Genetic abnormality/defect?² Yes → Cull individual

|

No

↓

Suitable sex?³ No → Cull individual

|

Yes

↓

Suitable birth interval?⁴ No → Cull individual

|

Yes

↓

Social species?⁵ No → Artificially rear

|

Yes

↓

First offspring?⁵ Yes → Cull individual

|

No

↓

Integration likely?⁵ No → Cull individual

|

Yes

↓

Follow stages of artificial rearing:

1. some initial supplementary feeding: if the individual does not respond, consider stage 2.
2. partial rearing: remains with parent(s) but food should be provided until weaned. If this is not feasible, consider stage 3.
3. full rearing: the individual undergoes rearing away from conspecifics, according to specific guidelines approved by the director/curator in consultation with animal staff and vets. Daily visual contact with the family group is vital.
4. adult hand feeding: it should not constitute a long term nutritional solution.

Notes:

¹ see “Basis” above.

² genetic defects or abnormalities: other problems may arise later on, not only as a result of the apparent genetic problem. With a conservation mission and limited resources, individuals should be evaluated for their value to the breeding program.

³ the sex of the individual. For example, a female may be needed for the breeding programme, but not a male.

⁴ in captivity, some individuals become sexually mature before they would in the wild. These individuals may not be fully developed, that is their reproductive function may be working but this may not be matched, for example, physically or hormonally. Similarly, well-fed captive animals may be capable of producing offspring at shorter time intervals between births than they are physically able to sustain.

⁵ it is important for socialisation to take place from birth for a social species.

Parents are often immature or inexperienced when their first offspring does not survive. It was felt that unless the parents experience the result of their parenting, they would not learn valuable rearing skills to be able to rear subsequent offspring.

Should a mother reject the infant completely and show no further interest in rearing the infant, then the infant should be culled if it is the first infant, or artificially reared (see stages) if a subsequent infant.

Individuals should be permitted to gain experience of raising offspring to independence, hence culling at the juvenile phase (see below).

If the situation involves a social species and an individual cannot be integrated without undue stress on itself and the group, then no artificial rearing should take place. If an individual can be integrated without undue stress on itself and the group at a stage between infancy and weaning, then artificial rearing should take place.

Example 2: Culling

The need to cull surplus zoo animals should not be a controversial issue when circumstances warrant (see flow chart) and culling is accomplished by recognised humane methods.

Circumstances:

- sex: as discussed above, the breeding program may not be able to accommodate a particular sex in the population at a given time;
- age: there are three ages to be considered: infant, juvenile and old. At each of these phases, an individual has a greater likelihood of succumbing in the wild than at other phases, through predation, accidents or disease;
- infant: this is a phase in life where an individual in the wild has a great risk of not surviving;
- juvenile: one of the major morality risks in the wild is that prior to weaning;
- old: post reproductive. The breeding program would suggest that the resources should be used for younger animals. An exception would be where an elderly individual plays a role for the stability and survival of the group. Elderly individuals may have underlying illnesses, evidence of which may be hidden despite pain;
- behaviour: individuals that have behavioural problems which do not allow them to behave in a species specific manner with conspecifics;
- genetic representation: the individual may be over represented in the populations or be carrying a genetic defect that would compromise the breeding program;
- surplus: despite management, individuals may be produced which cannot be accommodated in the breeding program.

Associated policy:

- all staff must be involved. In animal management, all aspects must be handled and not only the areas that a person feels most comfortable with;
- infants and juveniles that are to be culled will not be presented to the public through the media;
- an alternation of the infant and juvenile stage of culling may be applied, to mimic loss in the wild.

Surplus: this is defined as a collection of animals that do not contribute to the zoo's breeding management program.

The draft version of the BIAZA Animal Transactions Policy is adopted as policy on surplus animals, with the following proviso on private dealers:

the history of the private dealer should first be checked with The UK Border Agency (UKBA), Department for Environment, Food and Rural Affairs (Defra), BIAZA, local Federation zoo and the Curator.

Education/Communication:

A summary of the policy is provided for interviewing potential staff members and is a part of the induction package for the zoo.

Appendix 3 Organizations/sources that may be able to provide information

Animal Welfare Science, Ethics and Law Veterinary Association (AWSELVA). c/o Professor David Morton, Department of Biomedical Science and Ethics, University Of Birmingham, The Medical School, Edgbaston, Birmingham B15 2TT. www.awselva.co.uk

Born Free Foundation, 3 Grove House, Foundry Lane, Horsham, West Sussex RH13 5PL. www.bornfree.org.uk

British and Irish Association of Zoos and Aquariums (BIAZA), Regent's Park, London NW1 4RY. Email: <mailto:admin@biaza.org.uk>

British Veterinary Zoological Society, c/o the British Veterinary Association, 7 Mansfield Street, London W1M 0AT. www.bvzs.org

European Association of Zoos and Aquaria (EAZA), c/o Amsterdam Zoo, Postbus 20164, 1000 HD Amsterdam, The Netherlands. <http://eaza.net>

Royal Society for the Prevention of Cruelty to Animals (RSPCA), Causeway, Horsham, West Sussex RH12 1HG. www.rspca.org.uk

Universities Federation for Animal Welfare (UFAW), The Old School, Brewhouse Hill, Wheathampstead, Hertfordshire AL4 8AN.

www.ufaw.org.uk

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Chapter 3 Conservation education and research

Executive Summary

The Zoo Licensing Act 1981 (the Act), amended by the EU Zoos Directive, places a requirement upon zoos to contribute to conservation. This contribution may be through research, sharing skills/training and captive breeding, and must also include promoting public education and awareness. This chapter provides examples and information to assist zoos in fulfilling this requirement. The appendices include advice on fulfilling the requirements proportional to the size and type of collection with some suggested benchmarks. Zoos are encouraged to exceed the minimum requirement.

Conservation may be *in situ* (wild) and *ex situ* (in the zoo). Zoos have the opportunity to contribute to both, however, with relevant species *ex situ* they must participate in recognised species management programmes. Such programmes are primarily coordinated by zoo associations such as [EAZA](#) (European Association of Zoos and Aquaria) and [BIAZA](#) (British and Irish Association of Zoos and Aquariums).

In undertaking *in situ* work zoos should recognise that this does not necessarily require work abroad; although there are many examples of an effective contribution from zoos working in many countries. UK native projects may be a very appropriate use of resources and provide added opportunity for local public awareness.

The chapter includes some examples to illustrate how zoos can achieve this.

Research may also be *in situ* or *ex situ*. The Directive indicates that zoo participation in research should accrue conservation benefits for the species. The Secretary of State's Standards of Modern Zoo Practice (SSSMZP), see www.defra.gov.uk/wildlife-pets/zoos/ also outline that research should be conducted within the appropriate legislative framework and ethical review process.

Research should be conducted in a methodologically rigorous way proportionate to the size and type of zoo. Record keeping contributes to research but in itself is not research. Few zoos have internal capacity for an extensive research programme, but many can undertake some projects. However, there are great opportunities to make partnerships with other institutions and to utilise the networks available.

The chapter includes information on how to conduct a research project and where to find additional help and support.

Education is a broad term covering both formal (schools) and informal (public) audiences, and may also be conducted *in situ* and *ex situ*. The Directive requires all zoos to promote public education and awareness in relation to conservation. Such awareness may also benefit through integration with conservation and research projects. The chapter discusses education, including the requirement stated within the SSSMZP for an education strategy and programme, particularly in relation to different audiences and methods to engage with these.

Conservation, research and education are part of the day to day operation of zoos and for many their raison d'être. This chapter illustrates how zoos can implement and develop their contribution whilst also being compliant with the Directive.

Zoos should keep records of their conservation and education activities and put in place measures to evaluate the effectiveness of their contribution to conservation and education by collecting appropriate evidence and/or engaging in research projects to do this.

1. Introduction

This chapter has been written to help zoos comply with the Secretary of State's Standards of Modern Zoo Practice (SSSMZP) and increase their contribution to conservation, education and research.

The chapter also helps local authorities and the general public to appreciate the range of activities and contributions that zoos can make and aids zoo inspectors in advising collections on how they can develop in these areas.

Throughout this chapter the word 'zoo' is used in keeping with the definition of a zoo within the Act, so it encompasses a diversity of collections from aquariums and bird gardens to safari parks and zoological gardens.

Within this chapter some examples are given to assist zoos in developing their own work in conservation, education and research. Most of these examples are presented anonymously, however, some projects are mentioned specific to named zoos to provide context to them.

Zoos are encouraged to learn from one another and to exchange information to assist in development of appropriate provision for conservation (including education and research). Regular opportunities to network are provided through meetings of BIAZA, EAZA and [BALPPA](#) (The British Association of Leisure Parks, Piers and Attractions). Zoo inspector and zoo licensing seminars are also occasionally organised by local authorities, Defra and others.

The chapter has been divided into three sections, namely Conservation, Education and Research, and gives examples of each.

The EU Zoos Directive, which is underpinned by the Convention on Biodiversity (CBD) - see www.cbd.int and Appendix 1 and which has been transposed into domestic law, requires that all zoos implement the following conservation measures:

- *participating in research from which conservation benefits accrue to the species, and/or training in relevant conservation skills, and/or the exchange of information relating to species conservation and/or where appropriate, captive breeding, repopulation or reintroduction of species into the wild,*
- *promoting public education and awareness in relation to the conservation of biodiversity, particularly by providing information about the species exhibited and their natural habitats.*

The SSSMZP touch on these areas but this chapter expands on what zoos might consider doing to take forward conservation, educational and research activities. All zoos can contribute. However, the extent of that contribution need not be more than proportionate to their size and the types of animals kept. It will fall to local authorities, with advice from inspectors, to assess whether the extent of the activities is proportionate and appropriate.

The Zoos Forum (predecessor to the Zoos Expert Committee) produced 'benchmarks' for guidance to assist zoos and inspectors in examining their contribution to conservation and to education (see annexes to this chapter) and the suggestions and examples given are supported by an independent study recording the education and conservation contribution from 100 zoos in England. This study was undertaken by ADAS and commissioned by

Defra in 2010 (see <http://archive.defra.gov.uk/wildlife-pets/zoos/documents/review-zoos-conservation.pdf>). It is recommended that zoos consider these benchmarks in developing their conservation and education outcomes and aim to exceed them.

The modern zoo sees its main roles as conservation, education and research, as well as providing a good quality visitor experience (which is primarily the source of income). This is likely to be reflected in zoo literature and mission statements. For example:

“to be a major force in conserving biodiversity worldwide” (large charity zoo)

“to inspire and excite our visitors with the wonder of living animals and so to promote the conservation of threatened species and habitats” (large charitable society operating more than one zoo)

“to inspire everyone to take action towards sustainability and conservation of the marine environment” (large aquarium)

“to be a proactive contributor to the preservation of the wildlife of the planet” (small charitable zoo).

There are different types of zoo ownership; e.g. private individual, charity, company, college, local authority. It is important to note that the legislation makes no distinction between zoos of different ownership type and so there is the same requirement for conservation, education and research regardless of ownership. However, there is variation in what is required under ‘proportionality’ - largely based upon size defined by visitor numbers, types of animals kept, and the dispensation status of the collection as agreed through the zoo inspection process. If the dispensation status of the collection changes or significant other changes are made then there is likely to be a need to revisit the conservation, education and research programmes and provision, and to revise them accordingly. The benchmarks (referred to above) can be used to indicate some of the general expectations for these areas within different types/sizes of collections.

Zoos are also reminded that conservation, education and research:

- can be UK based or a combination of UK and overseas;
- can occur both within and outside the collection’s premises – including use of the zoo’s own land for native species (note: special consideration should be made if any animals are taken off premises);
- can include on-site and local environmental action such as recycling and reducing energy use and other such initiatives;
- can involve partnerships with other organisations but there should be a named individual with responsibility for each of conservation, education and research within each collection;
- is assessed on a licensed-site basis; so if an organisation owns more than one licensed zoo, there is a requirement for conservation, education and research work to be assessed specific to each zoo, and whilst some of this may be conducted by the parent organisation, evidence is required at each site proportionate to its size and type to fulfil the requirements of the Act;

- under the Act as amended under the EU Zoos Directive, is a mandatory condition on the zoo licence.

2. Conservation

Zoos can participate in conservation activities of benefit to species in a number of ways. These activities can be undertaken in the zoo (*ex situ*) and/or in the wild (*in situ*), which may be in the UK or abroad, and may be species or habitat focused.

This section provides information on different conservation activities, including: conservation research (see also 4 Research); training in relevant conservation skills; exchange of information (see also 3 Education); captive breeding; repopulation (another term for re-enforcement/ supplementation of populations in the wild); and reintroduction of a species. It identifies examples of projects where zoos have taken forward these and other activities and points out issues to consider.

2.1 Definition

There are many definitions of conservation, however the Act does not contain a specific definition. Section 1A of the Act outlines conservation measures for zoos:

www.legislation.gov.uk/ukpga/1981/37

For guidance the definitions below give definitions of ‘conservation’ from within the zoo and conservation communities:

Action that directly enhances the chances of habitats and species persisting in the wild (from a working group on measuring conservation, run by The Zoological Society of London)

Conservation is an action that effectively enhances the survival of species and habitats (from a workshop on producing a conservation handbook, run by the Conservation Breeding Specialist Group (CBSG) September 2000)

Zoos can support conservation both *in situ* and *ex situ*. This might include protecting a woodland or wetland area for native species to initiating large projects in other countries.

The Convention on Biological Diversity www.cbd.int/convention/text/ defines *in situ* conservation as:

The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of some domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

and *ex situ* conservation as:

The conservation of components of biological diversity outside their natural habitat.

2.2 Ex situ conservation programmes – captive management of species

The SSSMZP state:

7.4 Where the relevant species are held, a zoo must be an active participant in recognised species management programmes.

Zoos make their major contribution to *ex situ* conservation through Species Management Programmes (see Appendix 2). These usually involve captive breeding (also referred to as conservation breeding), which is the breeding of species in a captive environment, and this can be within or outside the species' natural habitat.

Note: breeding animals in the collection may not in itself be a conservation contribution, indeed there are examples of zoos using 'baby' animals as "Conservation PR" and care must be taken that conservation contribution through breeding is by being part of managed programmes and working within them.

Some zoos have successfully utilised hybrid and non-breeding animals for public awareness and conservation fund-raising. In so doing zoos should take great care not to suggest that breeding hybrid animals is contributing to conservation in itself.

As well as breeding, the managed programme may require the holding of animals as single-sex groups for future breeding or as designated non-breeding stock. Many programmes control breeding, focusing on the "most important" animals to breed within a given time period. This ensures that zoos do not over-produce and create a problem of unwanted animals, and ensures that genetic diversity within a captive population is maximised. It should be noted that conservation management in zoos may involve use of contraceptives; sterilisation; and/or culling and that a zoo holding some non-breeding stock can still be contributing to the conservation of the species.

Worldwide zoos work within regions, each one with its own coordinated species management programmes, which for many species are globally connected. For instance in Europe, EAZA operates the European Endangered species Programmes ((EEPs), whereas, for example, in the USA this role is undertaken by the American Association of Zoos and Aquariums (AZA).

To facilitate the effective running of these international programmes it is essential that the regions operate under similar structures and criteria. The regional associations operate together within the World Association of Zoos and Aquariums (WAZA) and share data and information via the International Species Inventory System (ISIS), and its record keeping system ZIMS (Zoological Information Management System). See www.isis.org .

The zoo community has worked with other conservation groups, most notably the International Union for the Conservation of Nature (IUCN), to work through mechanisms and systems that connect the captive populations to the overall conservation management plans for species, including in the wild.

A collection maintaining a species with a managed programme must participate in that programme and the relevant Taxon Advisory Group (TAG) at European level, working with Taxon Working Groups (TWG) in the UK & Ireland, overseen by BIAZA.

Larger zoos are also expected to provide staff to take an active part in TAGs (and TWGs); and run studbooks and contribute to other areas of captive management. Smaller zoos, and individuals within any collection, can also be more involved if time and resources allow.

Details of TAGs and EEPs can be obtained from EAZA, email: info@eaza.net and of British and Irish managed programmes from BIAZA, email: admin@biaza.org.uk

Zoos can exhibit animals which are not part of managed programmes, however, over time they are encouraged to increase the proportion of conservation sensitive species they hold and/or species that provide more conservation education opportunities.

With the limitations on available enclosure space in each zoo, the conservation potential is much greater when zoos work together. By doing so they can provide sufficient space to maintain viable populations of each species by keeping them with several collections and exchanging or moving them for breeding purposes – for example, as advised by the studbook, or EEP coordinator.

Zoos should review their animal collection plans regularly with a view to increasing enclosure space to be assigned to conservation sensitive species, and greater involvement in cooperative conservation management. Additionally zoos can share their expertise to contribute further to conservation programmes. The degree to which this is enacted in each collection is dependent on the size and type of zoo. For example a small aquarium may utilise its general collection to raise awareness of marine ecosystems and aim to be involved in one or two conservation sensitive species.

The conservation status of species does change and as we learn more the priorities for conservation action and involvement of zoos also changes. The primary means of connecting collection planning to this is through the EEP programme of EAZA which links into other regional plans such as the Species Survival Programme (SSP) of the American Zoo and Aquarium Association etc. Status of species in the wild is determined after research and reported through the IUCN red list www.iucnredlist.org There is now also consideration of the importance of evolutionary distinct species and their importance for conservation action, with the ZSL initiated EDGE programme www.edgeofexistence.org/

A licensed collection whose main purpose is as a 'rescue centre' has a different collection management plan, based upon housing and/or rehabilitation of rescued animals. However, such a collection must still contribute to conservation and education as defined in section 1A of the Act.

Collection of animals from the wild should only occur, regardless of whether it is to be part of a managed programme, if there is evidence to show that collection will not have a detrimental effect on the population; species as a whole; or its habitat. There may be limited occasions where taking the whole population or most of the survivors of a species into captivity is the best conservation action at a particular point in time, but such action would require careful assessment for the long term survival of that species in the wild after conservation action such as re-population in future. The method of collection and welfare of the individual animal(s) must also be taken into account.

Collection from the wild is not necessarily detrimental. For example, the Marine Aquarium Council has a voluntary certification system that recognizes that a well managed, sustainable trade in marine ornamental species can be a conservation tool to generate viable alternative livelihoods and reduce destructive fishing practices.

Zoos must also be compliant with national and international legislation such as [CITES](#) (Convention on International Trade in Endangered Species), relating to trade in endangered species and the movement and/or trade in livestock.

In addition, collection from the wild may be necessary if there is an imminent risk of extinction in the wild (e.g. Arabian oryx). Such a decision should be part of the Conservation Assessment and Management Plan (CAMP) for the species, and where appropriate in cooperation with the local government concerned. The requisite licences/permits or other legal permission should be obtained (both in the native country and the UK). Any importation of an endangered species is subject to the CITES, and appropriate licences are required for listed species.

In the UK, legislation exists to protect native species and any zoo working with UK native species conservation breeding and projects must also ensure compliance with relevant legislation. This may for example require staff to be licensed to handle native wild species such as all bats and great crested newt.

2.3. Linking captive programmes with wild programmes

The SSSMZP also state:

7.5 Zoos must be able to demonstrate their conservation measures, including research if undertaken. Areas to be considered should include overall conservation policy, and how this relates to the World Zoo and Aquarium Conservation Strategy, and type and level of input into international conservation programmes. [See World Zoo Conservation Strategy revised in 2005 as “Building A Future for Wildlife” www.waza.org/en/site/conservation/conservation-strategies]

The SSSMZP provide some information on how this might be achieved. A zoo will not meet its conservation responsibilities solely by seeking donations to a project (although this may be an integral part of an overall conservation policy). A zoo may fundraise for a project, but the zoo would be expected to provide good interpretation on the project with regularly updated information on its progress. (Also refer to Appendix 3 of the SSSMZP and to the conservation benchmarks).

Some examples of how zoos can contribute to field (*in situ*) conservation within the UK:

- using zoo grounds to provide habitat areas or aids to native species in the zoo (e.g. nest boxes for birds, vegetation mounds for grass snakes);
- restrict the use of herbicides and insecticides on site;
- co-operating with other bodies in the establishment of reserves, the management of habitats (e.g. pond maintenance), and the approved translocation and protection of threatened animals or plants;
- encouraging environmentally responsible behaviour by visitors;
- operating as an environmentally responsible organisation (for example through the ISO14001 standard).

It should be noted that simply carrying out one of the above projects would not, in itself, comply with the legislation that implements the EU Zoos Directive. In order to do this the zoo might, for example, record information and publish the results of the project and/or carry out exchanges of information on the project, such as interpretation boards in the zoo which highlight what the project sets out to achieve and the results of this.

Most zoos are able to support field (*in situ*) conservation overseas as well. The level of this support and involvement will vary with the size and type of collection (refer back to the benchmarks referred to in the introduction). It may be such work is specific species or particular habitat or country focused, and may be in partnership with other zoos or organisations.

An example of how zoos can contribute to field (*in situ*) conservation overseas:

- forging partnerships with foreign zoos and other bodies which are active in areas relevant to the conservation of indigenous wildlife. Assistance can be provided in terms of funding, advice, donation of materials, secondment of staff or offers of provision of training. Potential for involvement will vary with the size of the establishment but no matter how small, at the very minimum, all should consider participating in species management programmes. Such projects can also include local education, including supporting the training and development of local staff.

Most field conservation projects involve partnerships between participating organizations and zoos are in an ideal position for forming such liaisons (see 2.8 for information on choosing partners). Partners may include the national and/or regional government and their environmental and conservation agencies.

Exchange of information (as stated in the Directive) is essential for zoos to carry out their conservation role effectively and it is important that collections publish the results of their work. This can range from writing up husbandry and hand-rearing protocols to preparing community-education materials for field projects. All zoos, irrespective of size, can publish extremely useful materials. Local partners may also be able to translate materials and assist with ensuring that they properly account for cultural and local sensitivities.

There is more information on this important topic Section 4 Research.

2.4. Examples of Linking Ex Situ and In Situ Conservation:

Zoos are in a unique position of being able to link captive populations with field conservation and should take every opportunity to create such links and interpret them to visitors. Some examples of linking projects that are supported by zoos and encompass various aspects of conservation are given below. Most zoos include some information on their website or in annual reports, some publish in journals and newsletters.

Members of BIAZA share information and some also submit conservation projects into annual awards and some of this is publicly available on the BIAZA website.

Ex situ conservation

Dormouse (*Muscardinus avellanarius*). A number of zoos are breeding dormice for Natural England's reintroduction programme as part of the UK Species Action Plan. Trial reintroductions have taken place in Cambridgeshire and Nottinghamshire.

See: www.naturalengland.org.uk/Images/Dormice_tcm6-21704.pdf

Water vole (*Arvicola amphibious*) A similar programme to that for the dormouse is also underway with reintroductions from zoos in England and Scotland.

Amur tiger (*Panthera tigris altaica*) and **Sumatran tiger** (*Panthera tigris sumatrae*). These species are captive bred in accordance with the European Endangered Species Programmes (EEPs). The Programmes, among other things, produce husbandry and veterinary guidelines and make recommendations on which animals to breed together.

Socorro dove (*Zenaida graysoni*). These birds (classified as extinct in the wild) are being bred to provide a self-sustaining captive population for future release back onto Socorro Island, Mexico. This project is a partnership between European and US zoos.

In situ conservation

Dormouse (*Muscardinus avellanarius*). This is the reintroduction phase of the programme and involves: (1) a landowner agencies and local authorities awareness campaign of dormice habitat requirements, (2) ecology and conservation research and (3) dormice population surveys for a national monitoring scheme. (Also similar for **water vole**).

Amur leopard (*Panthera pardus orientalis*) and **Amur tiger** (*Panthera tigris altaica*) – The Amur Leopard and Tiger Alliance (ALTA) is a conservation partnership working in the Russian far-east supported by zoos and others to monitor, study and protect these critically endangered big cats. See www.amur-leopard.org

Socorro dove (*Zenaida graysoni*). This phase of the project encompasses field biology, identifying and restoring suitable wild habitat and implementing management techniques, including pest eradication for the successful reintroduction of the doves to Socorro Island.

2.5. Habitat Conservation

Maintaining, restoring and providing habitat are all important in conservation. Habitats often require management and some examples are set out below. If a zoo wanted to use its habitat conservation project(s) as an example of how it is complying with the legislation implementing the Directive, it could for example, record how the project is contributing to species conservation and/or the exchange of information with others.

Keeping records of all stages of a project (which can be supported by photographs, census data etc), and including statement of the objectives (desired outcomes) at the outset and evidence of monitoring and evaluation, are valuable tools to demonstrate conservation impact and to then feed back into improving activity in future, and share expertise with others.

Some examples are given below:

(i) Removal of invasive species

Eradication of introduced rabbits and goats on Round Island (Indian Ocean) to support the repopulation of the island by native endemic species such as the Round Island boa and gecko. In this case Durrell (Jersey Zoo) led on the project and made appropriate long term partnerships and local links to ensure success.

This provides a model for many small island endemic conservation projects (especially those without continuing human settlement). For example, the Henderson Island Project (Pitcairn Island group) where rat eradication was a key target to support recovery of native endemics such as the Henderson Island rail. In this case the rail was actually bred in

'captivity' on the island (whilst rat eradication was underway) by a keeper from Edinburgh Zoo using skills obtained from working with other bird species in the zoo.

Removal of invasive species may also be UK based. There are for example several notable 'alien' plants, such as Himalayan balsam, Japanese knotweed and ragwort that can have a negative impact on UK wildlife and habitats. Zoos can support removal of such plants from their land and surrounding area, and/or on other UK sites that the zoo is involved with.

(ii) Protecting reserves (habitat areas)

Russian Far East - Amur Tiger and Amur Leopard funded by 21st Century Tiger which largely gains funds from zoos and in particular utilises the support of the Zoological Society London), amongst others, helps to protect reserves by combating poachers. The projects supported are partly determined by the local partners to enable targeting of resources to what is required, including purchase of equipment, training of staff and providing the support of external experts.

Partula snail project in French Polynesia (Society Islands), involving a number of zoos (in conservation breeding and field work). One of the project objectives is to eliminate introduced predator snails so the *Partula spp* can re-establish itself. The project also seeks to find new sites suitable for reintroduction. Field work includes removal of predator snails (*Euglandina rosea*) and establishing small protected 'cleared' reserves for the *Partula* snails.

(iii) Improving habitat

Eelmoor Marsh is a Site of Special Scientific Interest owned by QinetiQ, a private British defence technology company. The site's heathland supports many rare species. A habitat restoration and management plan has been enacted using **Przewalski horses** (from Marwell Wildlife) and Highland cattle, to graze the marsh. This project involves a long term study into the impact of the grazing on the marsh and its biodiversity. After ten years, evaluation has shown tangible improvement in the extent and quality of vegetation communities, including the enhancement of botanical diversity, and dramatic increases in populations of many rare and vulnerable species.

Field crickets (*Gryllus campestris*) in the UK suffered a dramatic decline with available suitable habitat vastly reduced. Efforts to restore habitat led by Natural England were conducted in parallel with a conservation breeding programme in captivity. Since 1992 over 14000 crickets have been reintroduced to sites in West Sussex and Hampshire and by 2010 three new wild colonies of the crickets had been established.

Habitat conservation can take place in the UK and on land that the zoo itself occupies, as well as elsewhere in the UK and abroad. For example, a farm park working to restore native hedgerows and woodland on its land, allowing natural re-colonisation of native species. Zoos can also work with their local biodiversity records office to contribute to data collection and analysis of biodiversity and habitat significance.

(iv) Monitoring habitat and public consultation

Eelmoor Marsh (mentioned above) provides a good example of the annual monitoring of plant and insect life with habitat management planned around the results with the cooperation and involvement of the land-owner.

Golden-headed lion tamarin (*Leontopithecus chrysomelas*) project - as part of the conservation programme for these tamarins, the Federal Environment Agency of Brazil expanded the Una Biological Reserves Bahia – the only protected area for the species – by over 2000 hectares and has undertaken a successful Landowners Environmental-Education Programme in a region neighbouring the Reserve. This project has been strongly supported by zoos and was the focus for the 2002 EAZA Conservation Campaign.

Scottish Natural Heritage (www.snh.org.uk), in response to concern over the potential impact of beaver reintroduction in Scotland, undertook a public-consultation exercise at the outset and the Scottish Beaver Trial (www.scottishbeavers.org), saw the first formal reintroduction of a mammal to the UK in 2009. The beavers have successfully bred and studies into their ecological and socio-economic impact continue until 2014, alongside public engagement and consultation.

2.6. Species conservation

Examples of some species-conservation projects undertaken by zoos are set out below

(i) Ex situ conservation and repopulation as part of a managed programme

Scimitar horned oryx (*Oryx dammah*). This species is managed as a successful EEP. It is important that the captive population is well managed as the species is probably extinct in the wild and has been the focus of reintroductions to Morocco, Algeria and Tunisia.

Water vole (*Arvicola terrestris*). The water vole is identified as a UK Biodiversity Action Plan priority species as its population has declined significantly. A national water vole captive-breeding and reintroduction programme is underway involving a number of zoos and others, and this work is monitored within the BIAZA Native Species Working Group.

(ii) Technology, information transfer and training

Spanish imperial eagle (*Aquila abalberti*). Technical advice on breeding techniques was provided by a UK bird of prey collection to a captive-breeding facility in Spain and the conservation programme has benefited from this sharing of expertise. This, alongside other conservation measures including a small number of reintroductions, has seen a significant increase in the wild population.

The conservation of over 80 species of Mexican fishes has been supported by a group from the Fish & Aquatic Invertebrate TWG collaborating with the University of Morelia and the National Autonomous University of Mexico (UNAM). The group has worked to develop the skills required to establish a well managed captive-breeding programme for these highly threatened endemic freshwater live-bearing fish.

(iii) Provision of equipment

21st Century Tiger (www.21stcenturytiger.org) has, for example, provided a truck, a Maruti jeep and 140 sets of uniforms for the guards, which will be used in the effort to help conserve and protect the tigers and other wildlife in the Sariska Tiger Reserve, India. All zoos can contribute to and help support 21st Century Tiger projects.

(iv) Reintroduction, Re-inforcement/Supplementation/Repopulation and Translocation

Reintroduction is the attempt to re-establish animals in an area that was previously part of the historical range of the species. For example, the last wild Californian condors (*Gymnogyps californianus*) were taken into captivity and a successful captive-breeding programme, and releases, involving Los Angeles and San Diego Zoos have taken place.

Re-inforcement/Supplementation/Repopulation is the addition of individuals to an existing population of conspecifics. The sand lizard (*Lacerta agilis*) and natterjack toad (*Bufo calamita*) programmes use captive-bred animals to reinforce native populations. Such a programme may include research which includes development of veterinary tests and health protocols to ensure that reintroduced animals do not introduce disease or 'alien' factors into the existing wild population. This is especially important with amphibians and the known threat of chytrid fungus.

Translocation is the movement of wild individuals from an existing population of conspecifics. For example, in 1963 Hirola (Hunter's hartebeest, *Damaliscus hunteri*) were translocated to Tsavo East National Park, Kenya, and a further translocation took place in 1996. Elephants (*Loxodonta africana*) have been translocated to safer areas or from areas where they are crop raiding in Zimbabwe and Kenya. One-horned rhinoceros (*Rhinoceros unicornis*) are regularly translocated from Royal Chitwan to Royal Bardia National Park in Nepal. Expertise, including veterinary knowledge, gained in zoos is used to support such translocations, and zoos can also support the costs of such operations.

Programmes that involve reintroduction, translocation or re-enforcement of populations must follow the *IUCN Guidelines for Re-introductions*, available from the IUCN website: <http://iucn.org/themes/ssc/pubs/policy/>. This site contains other relevant policy documents, such as *Guidelines for the Placement of Confiscated Animals* and *Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species*.

(v) Community-based conservation: reducing impact on wild stocks

Project Seahorse (www.projectseahorse.org) works to conserve wild seahorse *Hippocampus spp* populations while recognizing that, if pressure on wild stocks is to be alleviated, the subsistence fishers who depend on seahorses need alternative livelihood(s).

The vast majority of conservation projects should have an element of community engagement – especially where the known threats to species include direct impact of local people through factors such as hunting, habitat degradation or where conservation actions are likely to have a direct impact upon local people, such as exclusion from 'protected areas'. Conservation can also be a positive contribution to the community in providing employment or secondary income, as well as knock-on benefits such as infrastructure.

2.7 Conservation training

Conservation training involves project staff from the field visiting a zoo and/or specialists going out to the field site, resulting in a considerable exchange of information. There are opportunities for wide-ranging, informal training programmes in zoos as well as more formal courses, such as those run by the International Training Centre at Durrell, Jersey, and the MSc in Wild Animal Health run by ZSL and the Royal Veterinary College and the M.Sc. in Zoo Conservation Biology at the University of Plymouth with Paignton Zoo.

In the field, zoo staff can teach practical skills and hold workshops on topics such as feeding and diet, rehabilitation of injured wild animals, incubation techniques, animal management and translocation techniques. Courses can also be in training and facilitation skills, such as those run each year by CBSG (www.cbsg.org).

Whether the course is formal or informal, it needs to have clear objectives, a training programme and a list of expected outcomes.

It should also be noted that zoo staff can benefit and learn from the in situ experience and exchanges with staff and local people in situ – it is a two way process, this also applies to conducting in situ native species projects in the UK.

Practical and technical skills

(i) In-range training with the scimitar-horned oryx (*Oryx dammah*) reintroduction project, Sidi Toui Park, Tunisia. Training has been provided by Southampton University in GIS mapping techniques and by Sparsholt College in radio-tracking. Keepers from Bratislava Zoo and Marwell Wildlife accompanied the animals and trained local staff in management techniques before the release.

(ii) Veterinary training in Nepal. Funded by the Department for International Development and managed by ZSL, the Wildlife and Domestic Veterinary Programme involves the setting up of four clinics in the buffer zone of Royal Chitwan National Park. Local technicians are being trained and will continue the work at the end of the project.

(iii) Rehabilitation of Egyptian tortoise (*Testudo kleimmani*) involving BIAZA Reptile & Amphibian TWG, includes rehabilitation of seized tortoises, habitat recovery, management of tortoises in semi-wild pens, a pilot reintroduction programme and health monitoring. An education and craft programme has also been developed with local Bedouin communities. Zoos have provided training in captive management and provided radio-tracking equipment for use in the pilot release programme. Many collections could become involved with this type of project.

Provision of training and other materials.

Columbus Zoo and Aquarium, Ohio, has developed a marine-conservation education pack that includes puppets, posters, toys and games. The pack can be used worldwide as a practical tool to illustrate marine-conservation messages and educate all ages in an interesting and informative way. For example, it has helped communities in Vietnam understand the goals of conservation and the sustainable management of marine resources.

Community education.

Bristol Zoo through its Conservation & Science Foundation supports a programme with Living Earth Foundation in Cameroon, aimed at reducing the bushmeat trade and environmental impact in the Dja Biosphere Reserve, through community education www.bcsf.org.uk/cameroon.

Whitley Wildlife Conservation Trust (Paignton Zoo) funds two educators and a ranger in the Omo Forest in Nigeria in partnership with Pro-Natura & Nigerian Conservation Foundation (www.waza.org/en/site/conservation/waza-conservation-

[projects/overview/omo-forest-conservation-project](#)) The project raises awareness of the forest ecosystem and highlights elephants within this.

The Royal Zoological Society of Scotland and Oakland Zoo fund community education and environmental awareness in the Budongo Forest, Uganda as part of the work of the Budongo Conservation Field Station (www.budongo.org).

Conservation of resources and sustainability

Zoos promote the sustainable use of resources therefore they should set a leading example. It is useful for zoos to have a statement on Environmental Policy and to carry out an environmental audit. A number of UK zoos have achieved the ISO14001 environmental management standard.

Objectives should be set each year to help realize the aim of a more sustainable use of resources, and could include:

- being more energy efficient in the use of fossil fuels and water e.g. recycling the water from an animal pond through a reed bed, which purifies and clears the water;
- minimizing possible detrimental effects on the environment through appropriate building design, herbicide use and water treatment;
- recycling waste products;
- ethical trade: zoos can help promote Fair Trade products in their shops and restaurants.

Environmental (Countryside) Stewardship:

The Environmental Stewardship Scheme is an agri-environment scheme that provides funding to farmers and other land managers in England to deliver effective environmental management on their land. Some zoos with their own farm land particularly may be eligible. See: www.naturalengland.org.uk/ourwork/farming/funding/es/default.aspx

Local Agenda 21 (arising out of the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992 www.un.org/esa/dsd/agenda21/) aims to involve local people and communities in the design of a way of life that can be sustained, thereby protecting quality of life for future generations. Zoos can promote this initiative through their education and interpretative programmes e.g. provide examples for schools of how children can use their resources in a more sustainable way (see 3 Education).

2.8. Undertaking in situ conservation projects

Conservation projects are complex and require detailed planning. The project cycle involves:

- (1) identification and formulation – establishing desired outcomes;
- (2) funding and resourcing;
- (3) implementation; and
- (4) on-going monitoring and evaluation systems (linked back to the desired outcomes).

Most *in situ* projects involve either scientific research or management implementation and each of these can cover habitat, species and people. Indeed many projects will cover all

these areas. For example, putting aside suitable habitat for conservation of grass snakes would involve both species and habitat implementation alongside a local engagement with land-owners and a public awareness programme.

A zoo needs to identify criteria for deciding which conservation projects/programmes it will support, for example, whether the project involves species related to those in the collection, or a specialization in a particular geographic region or habitat type.

The collection then needs to identify a project(s). Whether the support is for a new or existing project the zoo will most probably need to form partnerships with other organizations. Criteria are again needed to help judge if the project has a good chance of success and also if it is following the correct guidelines and it is important to also consider what 'measures of success' to set for evaluation of the project.

For example, if a reintroduction project, it must follow the guidelines of the IUCN Re-introduction Specialist Group. The project should have the support of the government and wildlife authority/agencies of the country in which it is taking place.

Choosing a partner

Any collection can find a partner with whom to work and there are various ways of going about this:

- join an approved BIAZA or EAZA project or campaign - this has the added benefit of making partnerships and working together with other zoos for a combined achievement of desired outcomes;
- partner a local wildlife agency or a project with their approval;
- partner a non-governmental organization (NGO) overseas;
- respond to the national or regional government wildlife or conservation agencies' needs or requests for support.

When participating in an existing project:

- always check how long the project has been running, what the level of local involvement is, what the long-term objectives (desired outcomes) are;
- check the credentials and experience of the experts who approved the project;
- clearly identify the zoo's role in the project;
- check that the project has:
 - i. written evidence of agreement (Memorandum of Understanding - MoU) with the government of country, or appropriate agency, for approval
 - ii. IUCN Specialist Group approval (if required)
 - iii. TAG / TWG approval (if applicable)
 - iv. agreed and followed accounting procedures
 - v. an annual review process, where outcomes are measured against objectives/ inputs. The project should have indicators (qualitative and quantitative) by which the outcomes can be assessed;
- agree a method of regular communication and check agreed roles and reporting methods for all organizations/individuals involved.

Some questions to ask about the project:

- what is the role of the zoo in the project?

- what is the involvement of other stakeholders? (they should be identified)
- what are the benefits to different stakeholders?
- what attributes of the project are linked to success? i.e. What are the performance indicators?
- what is the duration of project? (or length of commitment expected?)
- what is the funding base/source for the project?
- how does the project link geographically and species-wise with the zoo and/or the zoo's defined policy on project selection?
- does the project comply with the CBD action plans for the country/region?
- are there any possible animal welfare/ethics problems?
- is the project sustainable over time?
- is there a clear exit strategy? (Will the outcomes continue once the project is completed?)
- does the project include a training element with local communities?

The collection should insist that regular project reports are received and that outcomes are measured against objectives.

Examples of resources that a zoo can provide to assist with the project:

- staff (e.g. animal, veterinary, education);
- training e.g. staff with expertise sent to the project and field staff sent to another country/on a course; staff from the project being trained at the zoo;
- facilities or equipment (educational or promotional materials);
- animals for reintroduction programmes;
- funds (direct or indirect to support the programme);
- scientific research support – eg. laboratory work;
- partnerships – eg. links to other partners that can provide additional support/resources (universities, other conservation groups etc).

2.9. Fund-raising for conservation

Zoos have made significant contributions to conservation through raising and donating funds. Indeed, by working together, through projects such as the EAZA campaigns and other projects, UK zoos contribute hundreds of thousands of pounds to conservation annually.

However, important though fund-raising is, zoos should remember that the EU Zoos Directive does not directly account for this contribution within zoo licensing, and instead looks for practical action:

participating in research from which conservation benefits accrue to the species, and/or training in relevant conservation skills, and/or the exchange of information relating to species conservation and/or where appropriate, captive breeding, repopulation or reintroduction of species into the wild,

promoting public education and awareness in relation to the conservation of biodiversity, particularly by providing information about the species exhibited and their natural habitats

2.10. Output, monitoring and evaluation

Zoos have enormous potential to contribute more to conservation but it is important that this contribution is monitored and measured (evaluated).

Good project management is essential to oversee, co-ordinate and monitor the implementation of all project activities. Indicators should be designed so that they can be monitored and measured to determine if the project is addressing its objectives: the actual outputs need to be compared and evaluated against the desired outcomes for the project.

The performance indicators may measure progress in securing project inputs and delivering project outputs against set targets, as well as project interventions, such as capacity building for biodiversity management.

Monitoring and evaluation for biodiversity projects will tend to include both environmental and socio-economic impact indicators. A report of the project must be produced: this is a vital part of information exchange. Depending upon the nature of the project there are various routes to dissemination and publication of the information, e.g. on website; in a journal; through BIAZA and the TWGs.

Some ideas for appropriate evaluation measures can be seen in published papers from successful completed or continuing projects, as well as winners of BIAZA and other awards and funding from external agencies. Using KPI or Key Performance Indicators – including the ‘SMART’ approach also helps frame evaluation – making goals: Specific, Measurable, Achievable/Attainable, Relevant and Time-bound.

A monitoring process may include SMART targets that are annual or over a period of a few years at appropriate stages during a project, and can be used to modify the project to achieve the desired outcomes, or make appropriate modification of the desired outcomes based on the experience to date.

Zoos are encouraged to share and publish results of projects – including when things haven’t worked as expected as this can help others with their conservation work.

3. Education

The SSSMZP applying to education state that:

7.8 The Directive requires that zoos must promote public education and awareness in relation to the conservation of biodiversity, particularly by providing information about the species exhibited and their natural habitats. The measures required should be proportionate to the size and type of the zoo.

7.9 A zoo must have a written education strategy and an active education programme.

7.10 Suitable facilities, commensurate to the size of the zoo, should be available for education purposes.

7.11 Accurate information about the species exhibited must be available. Generally, this should include, as a minimum, the species name (both scientific and common), its natural habitat, some of its biological characteristics and details of its conservation status.

7.12 The zoo should be able to demonstrate:

- *the educational role of the zoo as set out in any mission statement;*
- *how the written education plan applies to different types of people who visit the zoo.*

Education is one of the core objectives of zoological collections.

Initially education developed focusing upon responding to the public's curiosity about the live wild animals they were seeing for the first time. The experience of seeing, hearing and smelling wild animals is still important today. In the latter half of the 20th century zoo education departments were established, primarily focusing upon schools, but at the turn of the 21st century, and implementation of the EU Zoos Directive, more zoos and aquariums developed educational programmes and activities targeted at diverse audiences – from schools to general visitors.

The zoo visit enables:

- introduction to the wonder of nature, developing enthusiasm and excitement, and inspiring people to action;
- opportunity for humans to be put into perspective as part of the natural world;
- broadening the appreciation, knowledge and understanding of nature and the environment;
- illustration of biodiversity;
- highlighting conservation issues affecting both wildlife and wild places.

Zoo education is a holistic discipline that should cater for a wide audience and is closely related to the philosophy and practice of environmental education.

It is important to recognise that education is not exclusive to focusing upon children; everyone can be the target for 'learning' experiences, which can be formal and informal. Therefore, whilst education may be promoted and largely delivered within a zoo or aquarium by 'the education department', all members of staff can contribute to this, and there is a particular role for keepers. The learning environment (facilities), design of enclosures, interpretation, animal collection plan and even the commercial activities within the zoo are all factors which impact upon education.

The education potential for zoos is more than information and amazement at seeing and learning about wild animals; it is also to support conservation and enrich the experiences and heighten the awareness of visitors, creating an empathy and support for wildlife and the natural world.

Appendix 3 of the SSSMZP states:

3.12 The Zoos Directive requires zoos to promote public education and awareness in relation to the conservation of biodiversity, particularly by providing information about the species exhibited and their natural habitats. Inspectors, zoos and local authorities should be familiar with the Zoos Expert Committee Handbook Chapter on Conservation, Education and Research which provides detailed guidance on the types of measures that can be taken to comply with the Directive's requirements.

3.13 A modern zoo must contribute in as many ways as possible to the education of visitors. They can, for example, use graphics and other devices to provide information and raise awareness.

3.14 Inspectors, zoos and local authorities should be familiar with the education standards expected in member zoos of the British and Irish Association of Zoos and Aquariums

3.15 In addition to written education plans, points to consider include:

- *that zoo education is broader than in schools and should be targeted at all visitors;*
- *educational material should, where possible, be linked to National Curricula;*
- *methods of interpretation for visitors to the zoo should include signs, graphics, activities, interactive displays and demonstrations;*
- *zoos should be encouraged to participate in zoo education networks.*

3.1 Education strategy

The education strategy should facilitate the translation of educational aims and objectives into policy and practice.

Educational aims that may be featured in the strategy include:

- to excite, enthuse and interest people in the natural world;
- to encourage public understanding of conservation issues;
- to develop public support and action to address conservation concerns;
- to provide experiences for visitors to enable them to make choices about their impact upon the environment (both positive and negative).

The strategy document should clearly state areas of policy for achieving these aims:

- all education projects should comply with relevant legal and health and safety requirements;
- the welfare of animals should not be compromised to achieve educational aims;
- education projects and programmes should be undertaken by appropriately trained staff;
- education programmes and projects should be evaluated using appropriate and quantifiable means;
- the educational effectiveness and opportunities of new/modified exhibits should be discussed at the design stage.

The strategy may be developed further to discuss aspects of implementation, for example, the provision of staff, facilities, graphics, talks, publications and special events.

3.2 Education Programme

An active education programme is one that is responsive to the needs of users and is available for the majority of the time. The programme can be developed for specific target audiences, e.g. schools; although there are good opportunities to develop programmes targeted at general visitors, adults, and post-16 learners.

The programme should be developed to help meet the requirements of the target group as well as promote the educational objectives of the collection. A school/college programme should take account of the curriculum or syllabus and be available during the academic year.

3.3 Education Facilities

Education facilities do not need to be classrooms as such. Many of the large zoos with high level of school group visitation have invested in purpose-built education centres and developed learning programmes accordingly (e.g. Bristol, Marwell, Paignton and Edinburgh). In fact the furnishings and programme content are often more important than the building design. A variety of buildings can therefore be used for education purposes.

All rooms designated for education should be designed and equipped in line with health and safety regulations and the needs of users e.g. suitable hand-wash facilities; low-level equipment if used by children; well maintained chairs, benches or carpet; and up to date specification for fire safety. For school classes, the room should accommodate around 35 people comfortably or classes could be split into two groups.

However, it is important to remember that the whole zoo is an educational facility. Depending upon the nature of the collection, a classroom may be impractical and an existing arena or display area could be used or large aquarium tank with viewing area can be equally appropriate.

3.4 Education and animal welfare

High standards of animal welfare facilitate the expression of natural behaviours thereby enhancing the educational role of zoos.

Animal welfare is, in itself, a subject for all visitors to learn about. By highlighting good practice within the zoo, visitors can be taught good pet care and a positive attitude towards animal care in general: this might include explaining that exotic species are normally not suitable pets.

3.5 Target audiences

Zoos appeal to a wide cross-section of society and their educational mission should be to provide educational experiences for all visitors. However, it is appropriate to distinguish between the needs of two major groups:

- school/college visitors, usually referred to as the **formal** sector
- other visitors, referred to as the **non-formal** sector

Traditionally, the style of education for the two groups has differed with a greater 'control and manipulation' within the school environment through lessons, activities and examinations. However, zoo education for the formal sector can be more flexible, and activities designed for schools can be available to other visitors, and vice versa.

Indeed, good environmental education (and hence good zoo education) should be relevant, engaging, span all curricula and, with suitable adaptation, appeal to all ages and abilities.

Many educationalists argue that a significant amount of learning takes place outside school; the zoo as a whole provides excellent learning opportunities, as well as through the provision of dedicated facilities. (See also the *Learning Outside the Classroom* initiative www.lotc.org.uk/ and Curriculum for Excellence for *Outdoor Learning* programme in Scotland

www.ltscotland.org.uk/learningteachingandassessment/approaches/outdoorlearning/index.asp)

Rooms for zoo education benefit by being much less formal than school classrooms: children can sit on benches, the floor or chairs and there is little or no need for desks unless more specialized teaching is carried out. Such rooms also lend themselves to a public education function or use as an exhibition area.

Formal education

Although there tends to be a common division of children in schools by age, the formal education system differs across the UK, and there are significant differences between the devolved administrations.

Information on the curriculum may be obtained by consulting local schools or the local education authority and is available online via:

National Curriculum in England: <http://curriculum.qcda.gov.uk/>

Curriculum for Excellence, Education Scotland:
www.educationscotland.gov.uk/thecurriculum/

Curriculum in Wales:
<http://wales.gov.uk/topics/educationandskills/schoolhome/curriculuminwales/arevisedcurriculumforwales/?lang=en>

Curriculum for Northern Ireland: www.nicurriculum.org.uk/

There are many good examples of the provision made by zoos for schools and colleges. Most zoos with full-time Education Officers use some or all of the following approaches.

Education sessions/classes:

Interactive, discovery learning, hands-on and question and answer sessions for groups/classes which are tailored to the particular needs of the group and the curriculum but which also include a conservation message. For example, using a selection of live animals for discovery, demonstration and hands-on, as well as 'biofacts', such as skins and bones. These sessions may have sound effects with appropriate lighting and room design.

In some collections a demonstration, such as a bird-flying display or aquarium tank feed, is used as the main 'teaching opportunity' and this is adapted for different age groups. Demonstrations should always be based on natural behaviours, and consideration given to the message(s) and perceptions associated with this approach.

Zoos can also use visual aids, such as powerpoint presentations. Care should be taken in creating such resources. Using this method may be more relevant for older students unless it is primarily used as a way of showing pictures and some use of video, which can

be for any age group. These methods can be effective for illustrating in situ examples and for critical analysis of issues.

It is worth remembering that learning stems much more from experiences, and the zoo, with its live animals, sights, sounds and smells, provides a unique learning resource not available in the classroom.

Provision for the over 16-year olds, college and university students is often determined by exact syllabus requirements. Some zoos have developed specific programmes for this sector by offering tailored days or events with a range of presentations, case studies, activities and discussions that meet syllabus requirements and advance the issues of conservation, sustainability and animal welfare.

The provision for nursery and primary school pupils can be flexible and, if based upon a 'discovery approach', can meet the needs of the curriculum relatively easily.

The core skills of the science curriculum as well as numeracy and literacy can be addressed, while introducing elements of environmental education, citizenship, raising awareness and looking at possible actions.

For 11-year old pupils and beyond, the 'discovery approach' is still central to learning but a more critical analysis of issues can be advanced through discussion, highlighting real examples/experiences from within the zoo.

A talk/lecture alone has limited educational value. The aims of zoo education/environmental education cannot be met by providing information alone. Offering opportunities for questions as well as providing information, experiences and leading by example is good educational practice. Awareness, understanding and action can result.

Zoo education has an important role in turning young people into conservationists. As expressed by Baba Dioum, a Senegalese conservationist:

*In the end we will conserve what we love and respect.
We will love and respect what we understand.
We will understand what we are taught or allowed to experience.*

The staff involved in education should be given relevant training and their work evaluated regularly, particularly through feedback from the schools themselves.

Education staff do not need to be qualified teachers, but it is important that they are good communicators and facilitators. Being an expert in their field, which could mean being a qualified aquarist, animal presenter or biologist, is an advantage. However, there are also benefits to having qualified teachers on staff not least in being able to gain professional credibility and develop curriculum-linked activities and work easily with schools.

In larger zoos consideration should be given to the range of staff specialisms that can be covered, and recognition that nursery needs are very different to tertiary needs.

At the same time, in all zoos, continuing professional development is required for zoo 'education' staff/those responsible for education, to ensure that they are up to date with educational developments.

Zoos should also look at providing resource materials for schools for use (i) in school (pre-visit); (ii) in the zoo; (iii) back at school (post-visit). These may be developed with/by a local teacher. It is important to review their use and evaluate outcomes and modify accordingly. Producing these as online web-based / downloadable resources enables easy access, cheaper production and quicker editing/up-dating ability.

Resource packs need to meet clear objectives and have desired outcomes. They can be designed to relate the zoo visit to the curriculum, and aspects that may help in meeting curriculum requirements can be highlighted. However, the suggestion that they definitely meet specific attainment targets should be avoided. The packs provide factual information that can be used back in the school environment to consolidate learning and understanding. Preparation of the packs is time-consuming and may have a cost implication: sharing information among zoos and getting students, teachers, etc. to help can minimize this. However, a process of consultation with teachers in the development stages is advised to avoid wasted effort and production of ill-prepared or poorly executed resources that therefore don't get used.

Worksheets were popular in the second half of the twentieth century but have been widely criticized (e.g. too general or not relevant, too much reliance on closed questions, testing knowledge that can be found in the classroom) and to some extent are discredited, although they are still popular with some teachers. The best approach is to provide ideas and give teachers the flexibility to design their own sheets for their class. Stress that at the zoo it's a good idea to concentrate on "observation recording" rather than answering questions that can be done anywhere.

Observation recording Observation exercises and open-ended questions are educationally much more useful than the old style of worksheet. For example, recording animal behaviour over a specified period, making sketches of enclosures, animals, plants and asking questions such as 'Why do you think that...?'. There is still a place for slightly closed questions, for example, 'What endangered species do they keep at the zoo?' 'Why are they endangered?' which require making lists during the visit and can also lead to more informed answers to closed questions back at school, such as 'What is an endangered species?'

Other types of resources in the zoo Various 'activity' approaches can utilize the best aspects of worksheets and observation exercises. For example, "Zoolympics" activity trails have been designed so that many pupils do not realize they are actually doing mathematics, and this can be followed up in school. A 'treasure hunt' trail is another approach, as is provision of audio-guides/posts, sensory trails, brass-rubbing signs, etc. Use of QR codes (see non-formal education below) and other mobile phone technology such as Bluetooth may be useful to some formal education groups. Importantly, these activity trails also provide a resource for other visitors not just schools and therefore are probably more cost effective.

Non-formal education

School groups are also zoo visitors therefore materials prepared for other visitors can help with schools provision (and vice versa with some adaptations). A few examples of visitor education (that can also benefit schools) are given below.

It is important that the person(s) running these activities is given adequate training and is monitored and evaluated regularly.

Smartphone QR codes – additional resources can now be made accessible via mobile internet access. For example a video clip of a particular behaviour or animal in its natural habitat can be saved on a website. Then a QR code (QR = Quick Response) generated; it's a little like a bar-code but is a pattern of black & white. This can then be printed onto a sign and smartphone users can then use their own phone to recognise the QR code and be directed straight to the relevant website link/video.

Animal encounters/demonstrations may take the form of a marquee/room/dedicated display area in which visitors are shown certain animals, given a talk and given the opportunity to ask questions. Close contact with the animals may also be possible (in accordance with close-contact guidelines such that animal welfare is not compromised).

Talks given at feeding times by a keeper, other staff member or volunteer can provide information about the animals, any enrichment techniques and be linked to environmental issues e.g. a talk on penguins or seals could include oil-spills, over-fishing, etc. Depending upon visitor numbers, a sound system may be required.

Interpretation/graphics The EU Directive/ SSSMZP requires that information about a species is provided. One way of fulfilling this is to provide a label for each species in the collection and this may include category of threat using the IUCN red list, threats faced in the wild and some interesting facts. It is now possible to produce signs in-house at low cost and replace them regularly. All that is needed is a printer and laminator. However, devising templates for signage and having a consistent style can enhance the visitor experience and educational effectiveness.

In multi-species exhibits, such as a large aquarium tank, it may be appropriate to use a flat-screen monitor and scrolling display of species information if budget will allow. Alternatively providing an identification sheet for each species and highlighting habitat information and conservation issues is an appropriate approach.

Exchange of information between zoos is also useful: signs in one zoo should not contradict those in another. Zoos with no graphics facilities of their own may be able to purchase signage from other zoos or share the services of a local designer/sign company.

Special events A focused day or week(s) allows certain issues to be highlighted. The EAZA (and BIAZA) annual campaigns illustrate the many ways of raising awareness and funds, and working cooperatively as part of the wider zoo community. This could also involve putting up a display, running a colouring/art competition, having a collection box and talk, etc. Additionally, there are also opportunities to highlight specific days or events that are national or international, for example, Vulture Awareness Day, Earth Day and International Year of the Forest.

Printed resources/leaflets Advertising literature can be used for education by incorporating information, mission statements etc. There are many opportunities to provide literature within the zoo e.g. fact sheets on animals in the collection or leaflets to accompany specific campaigns. These can also be prepared at little cost and can be made available as pdf files to download from the zoo website as well as actually printed papers.

Media and public relations Zoos have an enormous opportunity to further their educational objectives through contact with the media e.g. a birth, arrival or departure provides an opportunity to talk about cooperative breeding programmes. Promoting conservation and the environment by building these issues into press releases ranging

from special events, to birthdays and even negative stories, such as the death of an animal, can be important in raising the profile of zoos. It should become commonplace for the media to ask zoos for comments about wider conservation issues e.g. impact of climate change, or an oil-spill.

Exhibit design The design of an animal exhibit can have a significant effect upon the message that visitors take away. Animal welfare and needs should take precedence and if this compromises the ability to provide a certain story-line it may be appropriate to explain this e.g. the difficulty in exhibiting a herbivorous animal in an enclosure with live plants, unless the plants are fenced off. An 'immersion' approach to exhibit design, where animals and visitors are in the appropriate context of habitat, allows other aspects, such as conservation, to be highlighted and absorbed/reflected upon.

Practice what we preach Surprisingly, zoos are not yet at the forefront of environmental practice in the UK. Some of the strongest environmental educational messages are reinforced through experience, therefore zoos should provide examples of 'living sustainably' in their day-to-day operation (e.g. low-energy lighting, use of FSC timber, reuse of waste including grey water) and they should be highlighted. While there are serious financial and practical operational issues in 'going green', there are also benefits in long term savings. Over time the zoo can become greener by adopting the philosophy that any new build and replacement is more sustainably achieved and this can be used to encourage visitors to do likewise. Furthermore there are associated retail opportunities, eg. selling low energy light bulbs, FSC certified paper/wood products etc.

Actions speak louder than words Education/awareness should be followed by action. Many zoos provide information but few provide possible solutions or give visitors the opportunity to act upon that information. Special events and campaigns come closest to bridging this gap but zoos could also introduce a range of 'choices' for visitors, allowing success of the messages to be tested. For example, charging for car parks and providing privileged/fast entry for people arriving by public transport/bicycle, allowing visitors to donate a portion of their entry fee to a specific project/cause and offering Fair Trade coffee/tea as the standard offering.

3.6 Outreach: education for non-visitors

While the zoo visitor is the primary target audience of zoo education, the non-visitor can also be reached through the website, media, leaflets/publications and outreach visits/activities. The use of animal close contact, as in school sessions, is effective out of the zoo but extra care is required with animal welfare and health and safety issues. Choice of species used for such work is something that requires careful consideration. This is an opportunity to stress that exotic animals require specialist care and should not be acquired as pets by anyone who does not have the necessary expertise. Zoos and welfare societies increasingly have to deal with unwanted and 'problem' exotics. There are also conservation and welfare concerns regarding the supply of wild animals for the pet trade.

Outreach may also reach sectors of the public with no access to conservation/environment messages as well as those who, for whatever reason, do not visit zoos.

A further aspect of outreach is advocacy and promoting the conservation ethic in society in general. For example: following up media reports/TV programmes by contacting programme makers, companies, etc; contacting MPs and MEPs; and talking to the business community. Zoo staff with relevant experience may become involved in regional,

national and international committees that advise others (e.g. government) and formulate policy for the future.

Outreach may involve a dedicated team of staff or volunteers, or use of other staff from the zoo. It may also be something that is done occasionally or regularly as part of the education programme. A dedicated, converted or suitably equipped car or van (or even a bus) alongside the allocation of staff resource can facilitate an outreach programme which can be provided at a charge or free. It is worth drawing up a protocol for all outreach activity, to include the distance to be travelled, charges, animal welfare checklist (if animals are used).

NB. Animals taken out of the collection for outreach remain subject to the Act and SSSMZP, and there is additional guidance relating to category 1 animals. See Annex Q of the Zoo Licensing Act 1981: Guide to the Act's provisions on the Defra website at the following link: www.defra.gov.uk/wildlife-pets/zoos/

3.7 Staff/volunteers: internal education

If the full potential of zoo education is to be achieved, there has to be an understanding and commitment to the issues throughout the organization. Therefore all staff and volunteers, no matter what their background or job role, should have a good appreciation of nature, the environment and conservation to support the achievement of public educational objectives.

All staff and volunteers need to understand the purpose of the organization and be given the opportunity to act upon it in their role. For example, if retail staff are aware that income generated is used to support the conservation programmes, they can highlight this to the customers.

Each member of staff should be adequately trained, and appraised, for the tasks required of them, including visitor engagement. Training can usually be provided on the job or, for specific reasons, through courses or workshops. Additionally the messages regarding the role of the zoo can be reinforced through staff meetings, events, newsletters, emails etc.

3.8 Other educational opportunities

Website Of particular relevance to non-visitors and the world community (as well as in encouraging visitors and providing a post-visit follow up opportunity). Web sites can be developed as an educational resource, a marketing opportunity and, with links to other sites, an interactive encyclopaedia.

Inter-zoo co-operation The exchange of educational ideas and resources is in keeping with the philosophy of environmental education and education for sustainability and provides a way for smaller collections to offer good quality education. Participation at regional meetings and conferences also helps fulfil the training and development needs of the staff involved.

Direct field support All conservation projects should include an element of education/awareness at both the collection and the site *in situ*. This is important to garner local support as well as to engage with the local community.

Research Many research projects in zoos are conducted by undergraduate and postgraduate students and are therefore integral to their education; research findings should be shared, published and disseminated to the general public as appropriate. Some aspects of research impact directly upon future plans and research is an important part of establishing conservation projects, new education initiatives, etc.

Design and exhibit planning The enclosure design can be sympathetic to an agreed story and message and reinforce it by for example exhibiting animals within a habitat or ecosystem style exhibit and/or a themed area.

Business/management Education is now recognized as part of a zoo's *raison d'être* and this should be acted upon in business planning, development and ongoing operation. Education should be properly represented at management level, particularly in the larger zoos which employ staff specifically for this purpose.

3.9 Zoo Education Networks

British & Irish Zoo Educators (BIAZA)

BIAZA's education and training committee meets three times a year and works to enhance education within the Association and its members. The committee helps to organise national and regional networking events.

BIAZA holds an annual three-day conference for zoo educators and those involved in marketing and communications in the UK and Ireland. The conference, which is usually held in November, is open to all (an attendance fee is charged). A different zoo acts as host each year and usually takes the bookings. Contact BIAZA for details.

BIAZA regional education (day) meetings are also held across the country; they are open to non-members (a charge may be made). There is also an email group open to BIAZA members only.

International Association of Zoo Educators (IZE)

The International Association of Zoo Educators (IZE) is a membership organization that is open to anyone involved in education within the world zoo community. IZE is affiliated to WAZA, IUCN and CBSG and has an elected committee to promote the development of zoo education worldwide. There is an annual membership fee per individual. Institutional membership is also available in which a zoo can enable support for the work of IZE and in particular educators from developing nations.

IZE organizes a conference every two years, rotated between a host collection in the Americas, Europe and Asia/Australasia. Conference proceedings are produced and a members' journal is produced annually.

There is an IZE email group open to anyone involved in zoo education. For more details on IZE see website: www.izea.net

European Zoo Educators (EZA)

A European Zoo Educators Conference (EZE) is held in Europe every two years, alternating with the IZE conference. It is organized by the EZA education committee and the host collection. See www.eaza.net

3.10 Evaluating Conservation Education

Measuring success

There are many examples of education initiatives within the UK zoo community which have some evaluation evidence to show how well the intended outcomes were achieved, although there are few published studies. Any type or size of zoo can undertake evaluated projects; best practice is often seen where staff are available for implementing ideas.

Measures of success have largely been subjective and based on hearsay, such as the comments of teachers and visitors. More empirical evidence is needed to demonstrate the educational value of a zoo's work. A feedback form could be provided, with responses analysed on a regular basis, or a more detailed questionnaire may lead to a better appreciation of how successful educational messages are with the target audience, and how successfully the original desired outcomes have been met.

Further evaluation exercises, such as monitoring the time visitors spend at various enclosures/events, conversations, opinions and their use of graphics, can be carried out – and this may be achieved with the help of university or other students.

It is difficult to evaluate the effectiveness and impact of zoo education. This is largely the nature of education or 'learning' as it is a cumulative process. Change in attitude, behaviour or knowledge may be as the result of several experiences (in different places and/or through different media) over a long time period. Zoos can undertake some studies such as questionnaires pre and post visit, visitor-tracking exercises, and interviews, however, there are great opportunities for collaborative research projects involving students and researchers.

Regular monitoring/evaluation of staff and volunteers provides a check on the messages that are going out to the public. This can be formal, through a staff appraisal where actions are observed, recorded and assessed, or informal by way of conversations, meetings or training events/talks.

Research on effectiveness

Visitors come to animal collections with an existing knowledge and understanding of the natural world, as well as emotional responses to certain issues. These have been acquired from their earliest years through family, friends, the media and from formal and non-formal education. The collection needs to have some perception of, and take into account, the level and emphasis of public knowledge and understanding in all age groups and categories of visitor, especially in relation to conservation issues. This, together with different methods of teaching and learning, all needs to be researched so that the education strategy will help visitors to become more knowledgeable and have a greater understanding (and a more objective and informed view) of issues such as conservation biology and associated conservation management decision making.

Research into conservation education is a vital part of the work of animal collections and can be carried out in association with university science and education departments.

4. Research

The SSSMZP encourage zoos to carry out research. For many collections the main questions will be what this actually means and how research projects can be carried out in zoos. The following information should help to answer these questions and provide a framework for carrying out useful research in zoos. It is aimed at helping non-scientific staff who need to know what is involved, who to ask for help and why scientific training is necessary to carry out research.

Research can be carried out *ex situ* or *in situ* (see 2.2 Conservation). Although this section deals mainly with *ex situ* research, the same criteria and methodology apply to field (*in situ*) projects. Conservation projects *in situ* depend upon research. The research techniques and data collection largely have their foundation in *ex situ* development and application. Research can be pure (for knowledge and information) or applied (where the results are for specific application such as improved species management).

Research is the careful search or inquiry for new facts by methodologically rigorous study of a subject, through a course of critical investigation. Research can improve animal management, husbandry and welfare as well as conserve animals and lead to the development of new techniques for scientists. It can extend to research into conservation-education techniques and visitor appreciation of conservation issues (see 3.2 Education). Research can constitute collecting and collating information for statistical purposes, for academic projects (including graduate and post-graduate student projects) – for example, collecting breeding and feeding data on a colony of penguins over a period of years. However in the zoo licence context it is good to be able to demonstrate application of research results/outputs. For example, using the penguin breeding and feeding data to improve husbandry year by year.

The SSSMZP state:

7.6 Zoos should generally be able to demonstrate that they encourage research. Research can be developed through forging links with Higher Education Institutions.

7.7 In any research carried out, care must be taken to comply with all relevant legislation and be subject to ethical review.

Appendix 3 of the SSSMZP provides some information on who might carry out the research and some subject areas:

3.4 Many modern zoos carry out research. Participating in research from which conservation benefits accrue is one of the options to meet the Directive's requirements.

3.5 Participating in research should be within the scope of any collection. At the minimum this need constitute no more than collecting and collating information for statistical purposes. Record keeping should therefore be comprehensive and carried out in a systematic way. Where possible, zoos should use standard protocols for data collection to enable analysis. Data collection will usually be carried out by zoo staff, but there may be scope to involve volunteers, research workers or students. Data on specimens can be made available to outside projects.

The ethical and animal welfare issues of undertaking any research are also an important factor to consider, and in some cases, although not often within a zoo situation, research is covered by specific legislation that must be complied with. This is also highlighted within Appendix 3:

3.6 Most zoo based research causes no harm to the animals involved, forms part of the routine management and requires no intervention with the animals in order to collect data. However, even apparently harmless research (e.g. dietary manipulation, blood sampling) requires careful thought and planning and should be subject to independent assessment.

3.7 The Animals (Scientific Procedures) Act 1986¹ (ASPA) specifies that a regulated procedure (i.e. one required to be carried out under licence), is “any experimental or other scientific procedure... which may have the effect of causing the animal pain, suffering, distress or lasting harm.” The performance of such research requires licensing of the project and the person carrying out the work and is subject to periodic visits to the establishment by a Home Office inspector.

3.8 Few zoos in the UK carry out research covered by the ASPA. But because the Act is very broad in its scope, zoos should be aware that even relatively harmless studies on animals might be subject to such controls. Visiting scientists need to be advised about the legislation before embarking on research work. If there is any doubt the zoo operator should consult the Home Office.

See: www.homeoffice.gov.uk/science-research/animal-research/

Research may conjure up visions of invasive procedures but within zoos most research is carried out through observational techniques and is non-invasive. A minority of scientific investigation is invasive and calls for a Home Office licence under the Animals (Scientific Procedures) Act 1986 (see footnote 1). Invasive research entails ‘*any experimental or other scientific procedure applied to a protected animal ... which may have the effect of causing that animal pain, suffering, distress or lasting harm*’.

Zoos should contact the Home Office for advice, guidance and a licence, if necessary, if it is thought that the research might be classed as invasive. There is a clear opportunity here for partnership with a university and utilising external expertise alongside that within the collection and use of veterinary expertise is also likely to be necessary.

In considering the welfare of ‘study animals’ it is also useful to refer to The Animal [The Animal Welfare Act 2006](#). This states that *An animal is a “protected animal” for the purposes of this Act if—(a) it is of a kind which is commonly domesticated in the British Islands, (b) it is under the control of man whether on a permanent or temporary basis, or (c) it is not living in a wild state.* The Act further also states that it applies to vertebrates other than man, and excludes foetal and embryonic stages. However, advice should be sought before undertaking any such project.

¹ The Animals (Scientific Procedures) Act 1986 transposed EU Directive 86/609 into UK law. The Directive was replaced by Directive 2010/63/EU in September 2010; the aim of which was to strengthen the protection of animals used in scientific procedures. As well as vertebrate animals the new Directive extends protection to all live cephalopods. The 1986 Act will be amended on 1 January 2013 to implement the new Directive into UK law

Ringling, tagging or marking of an animal or any other humane procedure for the sole purpose of enabling an animal to be identified is not a regulated procedure if it causes only momentary pain or distress and no lasting harm. Procedures carried out for the purposes of recognized veterinary, agricultural or animal husbandry practices are not regulated. For example, taking blood or other tissue samples for diagnosis and giving established medicines by injection are recognized veterinary procedures, if carried out for the benefit of the animal. Husbandry practices that may cause pain, such as castration, are not regulated procedures unless they form part of a scientific study.

Further advice, information and guidelines on research are available from the BIAZA website.

4.1 How to carry out a research programme in a zoo

(i) Define the area of research

At the outset, the focus, subject or area of study must be defined. This may involve a simple situation and be written in a paragraph or one page, or it may be more complex (e.g. if it involves a multidisciplinary approach) and require more explanation. It should be possible to state the argument in one sentence, which can be elaborated with a few more sentences. Details of the argument are then given through, for example, constructing the situation or a model and observing how it works, measurements or demonstrating improved results from a system. There needs to be a schedule for the project so that it has a specific duration and deadlines. This would ensure that time was not lost by failing to have a report at the end of the study by, for example, a researcher running out of time.

Important sources for relevant research projects can be found through a review of the animal collection plan; from discussion with the curator and/or keeping staff; the mission statement of the zoo; discussion with university lecturers on university courses; and by consulting the BIAZA Research Group for their list of research projects and guidance.

Some examples of how suitable research projects can be identified are:

- keeping staff may suggest a species that has not been breeding that would be valuable to study for possible causes;
- university courses may need projects on environmental enrichment and may have resources to fund study and the devices needed;
- the BIAZA Research Group may suggest a problem that is being studied collaboratively by zoos and recommended by a Taxon Working Group;
- existing zoo records are also a valuable source of information for analysis. For example, relating breeding records of a species to diet, environmental enrichment or improvements in husbandry techniques are a few examples of valuable information that can be gleaned from records.

When developing a research plan for the zoo, a clear agreement on what can be achieved must be reached with the zoo staff responsible, for example, the curator or director, at the outset of the research programme/study.

A research study can be initiated through a pilot project, which is a short version of the main project, allowing the testing of ideas to see which should be included in the main study. For example, taking data for a month on feeding in a group of antelope where some individuals seem to have lost body condition. The pilot study could take data to see

whether there is a problem with, for example, the number of feeding troughs. If this, or other issues, appeared to be the problem, a study could then be designed to see where solutions could be found.

(ii) Expertise and liaison with zoo staff

There is a need for the person responsible for the research to be trained in appropriate research methods as the work should be methodical and rigorous. In a small collection it may be appropriate to have a staff member assigned as a liaison with external researchers, veterinarians, university/colleges, but they should be capable of record keeping and recording.

If the researcher is from outside the zoo, such as a student (which can include college, undergraduate and postgraduate), their level of responsibility and what access they will be given to the collection and resources needs to be made clear in the agreement at the outset. Topics for the agreement include health and safety, ordering equipment, change of animal husbandry and management techniques, enrichment devices and welfare considerations.

Potential challenges of carrying out research in zoos need to be discussed with the researcher before carrying out a study. For example, a student may not realize that the study animals cannot be seen out of zoo opening hours, separated for individual feeding trials or captured for taking body weight. In addition, changes to animal husbandry or management, an exhibit or species may be planned that might affect how the research is carried out: e.g. a change in the time of feeding for a group of animals could mean that the researcher would miss vital data; e.g. when individual animals are removed from a group for transfer to another zoo in the middle of a research study. This action could mean that the research study would not be continued and that the information collected so far was of no use.

(iii) Finance

A budget is needed to fund staff and equipment. These resources may come from the zoo itself or from an outside organization. This needs to be discussed and set within the initial agreement for the research programme. The research cannot run without knowing what resources will be available. Basic equipment and resources needed could include:

- stopwatch to time observations, clipboard to take notes (a PDA may be used);
- computer to write report, build and analyse database, computer software such as text, spreadsheet, statistical programmes;
- access to reference literature such as books, journals and interlibrary loan;
- access to the collection and facilities such as office space, equipment and desk space for writing and analysing data;
- resources such as material for building devices for environmental enrichment, particular food to improve diets (e.g. insect or new pellet), change in enclosure (e.g. perches of a different diameter), planting to increase density and complexity of environment;
- interpretation material / public engagement activity to ensure that visitors are aware of what is happening and methodology and results can be shared with them at an appropriate stage

(iv) Methodology

The research needs to be methodologically rigorous so that an approach is taken that clearly outlines the focus of the study and enables analysis and reporting on results obtained. The study should have defined hypotheses (i.e. questions resulting from the need for the study) to be tested. Without this basis, time will be wasted if, for example, the research has already been carried out elsewhere.

If research is being carried out by an outside person or organization, ensure the project has the support of the curators/managers, the co-operation of administration and keeping staff, and possibly veterinary and other staff (if they are likely to be involved). This is crucial for successful research to be carried out. Clarification as to who is responsible for health and safety of both animals and staff is necessary, for instance: advice from maintenance staff on how to put together an automatic device for feeding; permission to work with an animal without interfering with the keeping schedule; clearance for safe working if a researcher needs to enter an animal enclosure or is working on rubbish for an environmental audit.

All research carried out by a zoo should be reviewed under its ethical review process (see separate Chapter on ethical review). Zoos need to note that any captive animal is subject to the provisions of the Animal Welfare Act 2006 (there is separate legislation in the devolved authorities). Research therefore must be carried out within the provisions of this legislation.

Data collection takes time and effort and yet may be of little value if it is not collected in a meaningful consistent way for a well thought out purpose. e.g. taking data on only feeding in the antelope example given above might show that feeding is not the problem but being excluded from shelter through dominance bullying was the main cause of loss of body condition.

What to include in the report

It is important to keep records of work performed, who was involved, which species, when it was carried out and results. These should be written in a report together with any recommendations that may arise from the study.

A written report of the research carried out is essential for reference. Without a report, resources of time, effort and finances will be wasted and the knowledge gained from the research will be lost in a short period.

The report can be a simple internal document, student report, thesis and/or a published article (preferably in a peer-reviewed journal). The report can also be used as a basis for an article, for instance, in the BIAZA Research Group newsletter; general public interest and/or the local newspaper; or an addition to zoo signage. Sharing the study and its results with others is very important.

The most useful report includes information that would allow another person to follow the same study on different animals or in different situations. The report should include:

- the background of the study and why it was done;
- the methods used to carry out the study, such as observations made, changes to the diet or housing;

- what the results were, which would include information on what happened before and after the experiment, or a description of behaviours; and
- a discussion of what the results meant, such as a decrease in stereotypy, better body condition, more interest in the environment.

Details of the research should be sent to the BIAZA Research Group for inclusion on the database to provide information to all zoos.

Who might be involved and pre-research checks

The people involved can include:

- research officer, animal department/section staff, including curator;
- keeping staff to provide expert knowledge on animals;
- students and their supervisors (college/university);
- scientists;
- zoo veterinarians;
- other zoo staff such as maintenance, horticulture, education and volunteers
- other zoos

Potential assistance with research can be found among undergraduates, graduates, keepers, zoo assistants, school classes and volunteers.

Research may be undertaken by keepers for example, as part of the daily routine. Some may be undertaking training and some doing a formal course of study such as the Diploma in Zoo Animal Management which has the requirement for them to undertake a study, so it is possible for pilot studies and larger projects to be undertaken by the zoo's own staff, even in small collections.

If research is being carried out by an outside person or organization, they need to know conditions for access to the zoo and the animal collection. The status and identification of researchers is also important in relation to zoo visitors – will researchers be uniformed? have badges? be expected to answer visitor questions? Relevant staff also need to be informed. For example, gate staff where the researcher will be entering, keeping staff whose animals are being studied and administrative staff for health and safety and insurance issues.

Where to find help

There are many resources available to provide help:

- the BIAZA Research Group is there to advise on research, provide a list of possible projects and names of contacts. They can issue a copy of the Sampling Guidelines for conducting research in zoos, a published bibliography of husbandry guidelines and advice on where to find information on collections in BIAZA. The Research Group regularly shares information on projects in other zoos and holds an annual symposium dedicated to zoo research through presentations and workshops. This is an excellent way to make good contacts for help and advice;
- BIAZA maintains databases on all research projects in British and Irish collections and on *in situ* programmes that are supported by member collections;

- local universities, colleges and research institutes have expertise and good library facilities, the use of which can usually be negotiated for in collaboration on student and research projects;
- other zoos may have projects of interest to collaborate on, or they may have species needed for a comparison or to increase the sample size of the data;
- the Home Office can be consulted if there is a need to check on whether a licence is required under the Animals (Scientific Procedures) Act 1986 (see footnote 1);
- the Internet has information on a wide range of subjects and searched for specific requests e.g. EAZA (www.eaza.net), AZA (www.aza.org), IUCN (www.iucn.org) and individual zoo and university sites;
- collaboration is a good way of achieving research results and can provide a good introduction on how to run a project, as well as making useful and potentially valuable contacts.

4.2 How to carry out research in the wild (in situ research)

There are many opportunities for research in the wild, and zoos may directly support or be involved in studies into factors such as habitat and ecology, behaviour, and population status of many species. However, there is also a good opportunity to link the *in situ* and *ex situ* conservation work through a carefully considered research programme.

Often the public assume that any surplus animal could readily be reintegrated into the wild, in reality this is unlikely for most zoo animals. Without suitable habitat, neither the animals in the wild nor those reintroduced from captivity will survive there. Knowledge about the species gained from studying animals in the wild can help in practical issues and population management in captivity and vice versa. What is lacking for many species, however, is information on what constitutes a suitable and viable habitat and whether local people would accept conserving the habitat for animals in the future, and addressing the challenge of why species are threatened in the first place. This is the area where *in situ* research is vital and zoos can and need to play an important role. The question then is how to go about this and what is needed.

In situ research does not have to be overseas as there are many research needs and projects that can and do take place in our backyards: the effect of escaped American mink on the small mammal population, on water voles in particular, and on our riverbanks; the effect of introduced hedgehogs on the bird population of small Scottish islands; and the disappearance of wart-biter crickets from meadows.

As stated in Section 2, collaboration is often the best way to begin and to continue this type of research. This allows costs in time, effort and funding to be shared.

4.3 Some examples of research projects

The suggestions below indicate some of the sorts of research project that may be undertaken in zoos.

- (i). To find the optimum diameter range of branching for a species of monkey or cat to climb by providing different branch diameters.

- (ii). To assess the effect of giving a new pellet to desert antelope species, where observations are made on the animals eating the normal pellet, the new pellet and any beneficial or adverse effects. Data need to be taken over an extended period to cover a gradual change in diet, allowing time for changes in the gut to accommodate the new pellet; faeces samples taken before, during and after the change to analyse for content, assessing the amount ingested. The results are then compared across species, and before and after a diet change. It is advisable to discuss changes in diet with your named vet or with a member of the zoo's ethical review group (see separate chapter on ethical review). However, zoos should note that scientific comparisons of diets where effects may be adverse would almost certainly come under the Animals (Scientific Procedures) Act 1986 (see footnote 1).
- (iii). To measure nutritional needs. High protein levels in ungulate diet not only lead to obesity but also hoof and horn overgrowth. Obese animals often have difficulty breeding as well as various ailments brought on by being overweight, such as joint degeneration. Research on nutrition could result in a less protein-rich diet while providing complete nutritional requirements and encouraging the performance of natural feeding behaviours.
- (iv). To discover bedding/nesting preferences within a social group and enable individual choice and improved welfare.
- (v). To evaluate standard values for individual species, such as lions, which have to be anaesthetized on occasion in zoos and the type and amount of anaesthetic used has been tried and tested over time. This information is vital for field workers who may have to anaesthetize lions in the wild and would have access to expert knowledge from zoo research.
- (vi). To analyse animal parts after death. If an animal dies or has to be culled or is euthanased, the body can provide lots of information. The bones of a bear that has lived beyond its expected lifetime could show severe degeneration, which suggests that the animal had been kept alive in pain and suffering. This information would help decisions regarding the quality of life for other bears. Post-mortem results can provide information on the ailments that might be prevalent in a particular species. (This type of project may be undertaken by a university or museum and the zoo supplies the carcass).
- (vii). To study the effect of introducing new individuals and/or a new species into a mixed exhibit. This could for example, be in an aquarium tank. Baseline data taken before the introduction would be required to compare with after the introduction.
- (viii). To study the type of browse used by species and the effect it had on the species. This research would be conducted across the many zoos that co-ordinated such information.
- (ix). To investigate the dwell time and attitude of visitors to different species at the zoo through observational study and questionnaire.
- (x). To study the impact of visitors upon behaviour of a named species. This could for example be a study to investigate if any changes occur when a species is moved from one exhibit to another. The outcomes could be measured in terms of animal welfare but also visitor response, depending upon what the desired focus is.

4.4 Research in zoos and training of students

The education and training of young scientists in zoological research techniques is an important contribution to conservation, research and education. It increases awareness of what research is about and would be used in further education, and for research/careers in areas such as *in situ* and *ex situ* conservation. For example a young scientist studying the behaviour of small-bodied marmosets and tamarins in the zoo would have a greater understanding and image of what to expect in the field, when studying tamarins under conditions of poor visibility.

NOTE:

The information given in this chapter is for guidance. Zoos should take care to refer to the requirements of the Zoo Licensing Act 1981 and use the examples and benchmarks to assist development of their own conservation, education and research work. By being part of appropriate networks zoos can keep up to date and share their activities with one another to improve practice and continually strive to exceed minimum standards.

Appendix 1 Convention on biological diversity

In a response to Earth's diminishing biological resources and the increase in species extinction caused by human activities, UNEP (United Nations Environment programme) convened a working group of biological diversity in 1988. The agreed text of the Convention on Biological Diversity (CBD) was adopted in 1992 and was opened for signature on 5 June 1992 at the United Nations Conference on Environment and Development (the Rio *Earth Summit*). It remained open until the 4 June 1993, by which time it had received 168 signatures, and came into force at the end of 1993.

For further information and updates please refer to the convention's website: www.cbd.int/

The Convention was inspired by the growing worldwide commitment to sustainable development. It represents a dramatic step forward in the conservation of biological diversity, the sustainable use of components and the fair and equitable sharing of benefits arising from the use of genetic resources. As at March 2002, the Convention had 183 Contracting Parties (by October 2012 this had risen to 193 parties), including the EU Member States. In the UK the CBD is being implemented through Action Plans (Department for Environment, Food and Rural Affairs) and each county is producing its own Biodiversity Action Plan.

Ex situ conservation is defined in the CBD as: the conservation of components of biological diversity outside their natural habitat.

In situ conservation is defined as: the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of some domesticated or cultivated species, in the surroundings where they have developed their distinctive properties. The obligation to carry out these conservation actions is reflected in the Conservation, Education and Research Standards (Section 7 and Appendix 3) of the Secretary of State's Standards of Modern Zoo Practice.

Article 6. Each contracting party shall...:

- develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies...
- integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

In its Biodiversity Strategy, the European Commission notes that gene banks, captive-breeding centres, zoos and botanical gardens can play a very valuable role if their activities are integrated in the framework of co-ordinated reintroduction or integrated conservation schemes. The Community shall encourage zoos, aquariums, botanical gardens, gene banks and collections to keep species, crop varieties and domestic animal breeds under satisfactory standards that guarantee their conservation and integrate their work in co-ordinated action plans which aim at the restoration of the species to a

satisfactory *in situ* conservation status. The Community should therefore encourage the development of programmes for public information education and awareness-raising on conservation and sustainable use of biodiversity.

Article 8. *In situ* conservation. This is the primary approach for biodiversity conservation and one where zoos are playing increasingly important roles.

Article 9. *Ex situ* conservation. This includes 'captive breeding of animals and artificial propagation of plants with possible reintroductions into the wild' and 'collecting living organisms for zoos, aquaria and botanic gardens for research and public education'.

Ex situ measures are to primarily complement *in-situ* measures.

Each Contracting Party shall...:

- adopt measures for the *ex situ* conservation of components of biological diversity preferably in the country of origin of such components;
- establish and maintain facilities for *ex situ* conservation of and research on plants, animals and micro-organisms, preferably in the country of origin of genetic resources; [This also points out that Parties need to ensure that these important collections are operated under high standards of protection and management.]
- adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions; [it should be remembered that the Guidelines of the Re-introduction Specialist Group must be followed in the case of proposed reintroductions. This also acknowledges that effective recovery of many threatened species needs an integrated approach, involving both *in situ* and *ex situ* conservation techniques.]
- regulate and manage collection of biological resources from natural habitats for *ex situ* conservation purposes so as not to threaten ecosystems and *in situ* populations of species, except where special temporary *ex situ* measures are required... [This essentially means that collecting samples of species and genetic resources for *ex situ* conservation should not endanger those species and genetic resources, nor should other species and genetic resources be harmed nor the ecosystem concerned damaged.]
- cooperate in providing financial and other support for *ex-situ* conservation...

Article 13. Public Education and Awareness

The Contracting Parties shall:

- promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes; and [This requires a fostering of the understanding of biological diversity and the measures required for its conservation.]

- cooperate, as appropriate, with other States and international organizations in developing educational and public awareness programmes, with respect to conservation and sustainable use of biological diversity.

As all EU states are signatories to this Convention, zoos will have to play their part in carrying out the relevant Articles as detailed above. This highlights the importance of managed breeding programmes, education and research, and the conservation role of zoos.

The CBD Strategic Plan for 2011-2020 includes specific targets, known as the Aichi Biodiversity Targets, supporting the five strategic goals:

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Zoos are encouraged to refer to these in detail when undertaking their conservation projects and programmes. See: www.cbd.int/sp/targets/ for details.

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www.cbd.int/

Appendix 2 Managed breeding programmes

Modern zoos have an important role to play in the conservation of biological diversity and this role is increasingly important in the twenty-first century.

Zoos are distributed worldwide and with an estimated 700 million visitors annually zoos have a unique opportunity to influence conservation on a global scale (Building A Future for Wildlife, the World Zoo and Aquarium Conservation Strategy, WAZA 2005). A significant role for zoos is captive breeding (*ex situ* conservation) and the careful management of threatened species as part of coordinated conservation programmes.

In 1987 IUCN-The World Conservation Union produced a policy statement on captive breeding (IUCN, 1987). This was the first official recognition of the important role of *ex situ* conservation – the role of captive breeding and zoos in species conservation. The Convention on Biodiversity (CBD) (UN 1992) that resulted from the Rio 'Earth' Summit made specific recommendations for *ex situ* conservation that have been incorporated into the World Zoo & Aquarium Conservation Strategy (WAZA 2005).

However, there has been criticism that while zoos play an important role in maintaining threatened species, they have not been carrying this out effectively enough. For example, the numbers of individual animals in most threatened species in maintained programmes is too small, and the genetic diversity within populations is unknown or too narrow.

The zoo community is working to rectify this situation. Responsible collections realize that by joining co-operative programmes for species management they can maintain healthy self-sustaining populations for the future (de Boer, 1993). The latest scientific methods are used for species management together with extensive networking among zoos, within and between regions, alongside integration into species conservation management programmes that incorporate *in situ* (wild) and *ex situ* (captive) needs.

The zoo world is divided into regions, each one co-ordinating its own Species Management Programme (Fig. 1). To facilitate the effective running of these programmes it is essential that the regions operate under similar structures and criteria. This is achieved through the global network of zoo associations, such as WAZA, EAZA, BIAZA, and conservation management groups such as CBSG.

See Table I for a list of common acronyms.

Conservation Breeding Specialist Group (CBSG) www.cbsg.org

CBSG (formerly the 'Captive' Breeding Specialist Group) is a Specialist Group of the Species Survival Commission of IUCN-The World Conservation Union. Its mission is "to save threatened species by increasing the effectiveness of conservation efforts worldwide".

CBSG has developed a series of tools and principles to enable conservation decision making. This includes: Population Habitat Viability Assessment (PHVA), Conservation Assessment and Management Plans (CAMP) and modelling programmes such as VORTEX. (See www.cbsg.org for details).

Not all zoos are equipped to deal directly with these tools, however, the global, regional and national zoo associations share expertise and enable all zoos to work within the conservation framework for the programme species.

Structure within the British Isles

In the British Isles species-management programmes come under the umbrella of EAZA (www.eaza.net). The programmes that manage all of these animal populations are known as the EEPs (European Endangered Species Programmes) and ESBs (European Studbooks). EEPs are the most intensively managed type of breeding programme.

In order to enable breeding programmes through EEPs zoos work together using Taxon Advisory Groups (TAGs) that develop Regional Collection Plans (RCPs) to prioritise which species should be part of managed breeding programmes and to make recommendations on which species and individuals are kept in zoos. This process is supported in the British Isles through BIAZA with its Taxon Working Groups (TWGs).

TAGs, TWGs, EEPs and ESBs rely on the input and support of zoo staff to manage and develop them, and in turn these connect to the global plans of other regions and to CBSG and IUCN priorities.

TAGs loosely follow taxonomic guidelines (e.g. felids, penguins) and each has a chairperson plus working or advisory groups. The groups comprise species co-ordinators and studbook keepers as well as taxonomic, scientific and other advisors: the whole group comprises the TAG and members are responsible to the TAG chairperson.

A TAG examines all species (taxa) under the taxonomic heading and species are prioritised for the region. Conway (1986) was one of the first to address the question of how many taxa could be saved (taking space limitations into account) through captive breeding. This space concept is an important one and is now part of the regional collection planning process.

The stages in the work of a TAG are to:

- assess holding space in the region and the current situation regarding species maintained and number;
- consider the CBSG CAMP recommendations for the taxa;
- examine other criteria, such as educational importance;
- identify priority species, recommend species to maintain, increase numbers, decrease numbers, bring in new species;
- target the population size required for each species for the region;
- identify any husbandry and management problems and research requirements;
- prepare a Regional Collection Plan.

For example, regional Primate TAG members use the CBSG Primate CAMPs, the Primate Specialist Group Action Plans and advice from field workers to select the species that are most in need of captive programmes as an aid to their conservation. These priority species become the main focus of the TAG, which then identifies which species are in need of co-ordination within the region.

Species may be maintained for reasons other than conservation: they may be taxonomically distinct, of high educational or research importance or, as a flagship taxon, have potential to contribute to broader conservation goals. This exercise may result in recommendations to bring new species into the region and/or phase out some species.

Institutions and collections within the region are expected to commit some of their enclosure space to species recommended by the TAG. Welfare considerations are paramount and species should only be recommended when their husbandry is sufficiently well understood to ensure their survival and a suitable captive environment can be provided. Thus the production of husbandry guidelines is an important part of the work of the TAG, as is the identification and resolution of management problems that may occur.

Regional Collection Plans, CAPS and GASPS

After a TAG has prioritised species for the region and analysed details of available captive space, a decision is made on how many of each species should be maintained. To do this effectively, it is necessary to calculate how many captive animals are required for a self-sustaining population. The goal of any captive-breeding programme is to retain 90% of the original genetic diversity for 100 years: for high-intensity species a studbook is needed to achieve this. Sophisticated tools for population management (Wilcken & Lees, 1998) are available to generate regional masterplans that help ensure demographically and genetically healthy populations into the future. Management and record keeping programmes such as ZIMS (and ARKS/SPARKS) from ISIS (International Species Information System www.isis.org) are used to facilitate and support the management of conservation breeding programmes.

Once the planning exercise has been carried out for all species in the taxon, a Regional Collection Plan (RCP) can be drawn up. The RCP is the set of recommended regional objectives for specific taxa based on conservation and other priorities. Thus, the TAG results in the production of a RCP (Fig. 2).

When RCPs are available for several regions, a global Captive Action Plan (CAP) can be produced.

A CAP requires considerable preparation followed by a meeting of TAG members from different regions. A CAP ensures that regions are cooperating fully in species management and can partition their captive space to allow for the conservation of as many species as possible. The CAP should make recommendations for the present and include predictions for the future. After preparation of the CAP, each region may then need to modify its targets and goals slightly.

The final stage of the management programme is the Global Animal Survival Plan (GASP). This is carried out for a single species and involves a detailed demographic and genetic analysis, and management planning between regions. To allow for sufficient analysis to be carried out, an international studbook is required or, at the very least, studbooks from each region. See Fig. 2 for the relationships between the stages.

No part of this process can function without a commitment from each institution that they will give over some of their space to species recommended in these programmes. Thus, as shown in Fig. 3, the CAP works with the RCPs but the institutions need to have compatible Institution Collection Plans (ICPs) for the process to work. Most zoos now have

their own collection plans and it is a condition of membership of the American Association of Zoos and Aquaria (AZA) that such a plan is produced. ISIS issues REGASP software to help with collection planning on an institutional and regional basis.

Networking

Regional programmes have to work together to form an international network of captive-conservation programmes, liaising closely with field programmes. Therefore it is important that regional zoo organizations exchange publications and maintain regular contact. One of the responsibilities of TAG chairs is to communicate with the appropriate TAG chairs in other regions.

This work requires a considerable amount of staff time and skill, particularly as the role of zoos in species conservation increases in importance with the reduction of wild habitat. This is also a side that the public is not always aware of when they visit their local zoo and one that the zoo community needs to publicize more.

We are rapidly approaching the stage where it will be difficult to justify keeping a species in captivity if it is not part of a managed programme. It is already becoming difficult to obtain permits for moving primate species between European countries unless they are being moved as part of a regional programme. This is to be welcomed and should help to reduce illicit and unnecessary trade in wildlife.

Useful Addresses

British and Irish Association of Zoos and Aquariums (BIAZA) Regent's Park, London NW1 4RY. admin@BIAZA.co.uk

European Association of Zoos and Aquaria (EAZA) European Endangered Species Programmes (EEPs) c/o Amsterdam Zoo, Postbus 20164, 1000 HD Amsterdam, The Netherlands. info@eaza.net

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Captions to Figures

Fig. 1 World map showing some regions which have regional programmes

EEP	European Endangered Species Programme
SSP	Species Survival Programmes of North America
ASMP	Australasian Species Management Programmes
AMAZOO	Association of Mesoamerican Zoos (Central America)
SZB	Society of Zoos of Brazil
SSCJ	Species Survival Committees, Japan
AAP	African Propagation Programme
SEAZA	South East Asian Zoological Parks Association
SAZARC	South Asian Zoo Association for Regional Cooperation

Fig. 2. Flow chart showing the interrelationships between global and regional captive-breeding programmes.

Fig. 3. Collection planning showing the process from CAMP to Institutional Collection Plan.

Table I Common acronyms

CAMP	Conservation Assessment and Management Plan
CBSG	Conservation Breeding Specialist Group
EEP	European Endangered Species Programme – run by the European Association of Zoos and Aquaria (EAZA)
GASP	Global Animal Survival Plan
CAP	Captive Action Plan
IUCN	The World Conservation Union
RCP	Regional Collection Plan
ICP	Institution Collection Plan
TAG	Taxon Advisory Group
WAZA	World Association of Zoos and Aquaria (formerly International Union of Directors of Zoological Gardens/World Zoo Organisation)
ISIS	International Species Information Systems – responsible for release of ZIMS
ARKS, SPARKS, REGASP,	MedARKS Software
SSC	Species Survival Commission

Table II Carrying capacity

Generation time	11.77
Annual growth rate (λ)	1.00
Diversity retained	98%
Effective population size N_e	78
N_e/N ratio	0.35
Current year	0
Length of programme	100 years
Heterozygosity to retain	90%
Effective population size required	47
Actual population size required	134

This example is for the Diana monkey (*Cercopithecus diana diana*). Generation time is calculated using DEMOG and SPARKS software. Effective population size is calculated from the studbook data.

Figure 1 World map showing some regions which have regional programmes



Fig. 2. Flow chart showing the interrelationships between global and regional captive-breeding programmes.

The CAP results from the CAMP process and addresses species, from this GASPs can be identified. Regional TAGs need to take these into account when formulating their RCPs. Regional implementation is essential for the process to work.

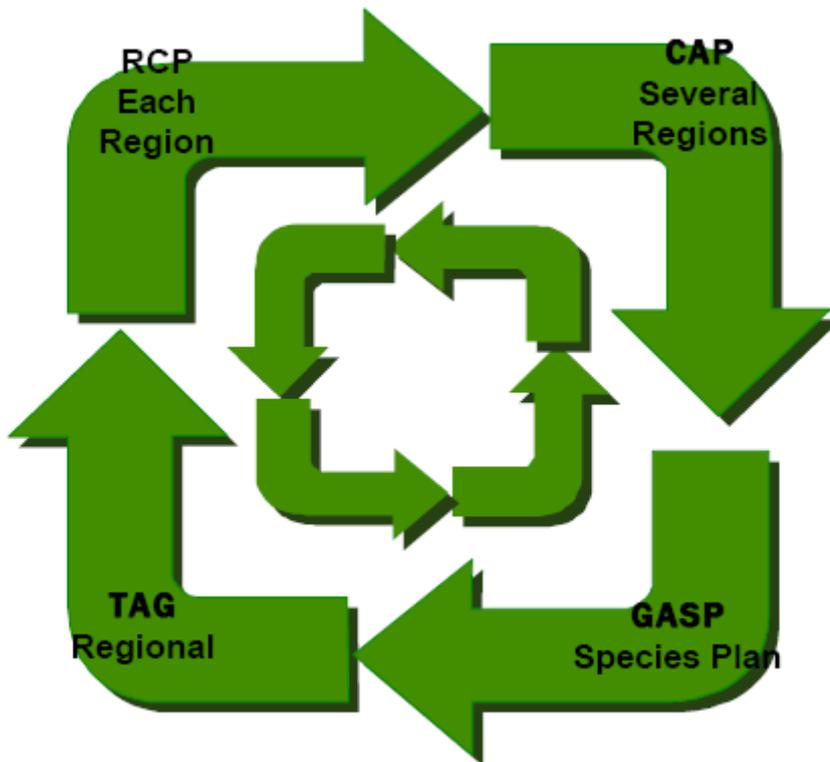
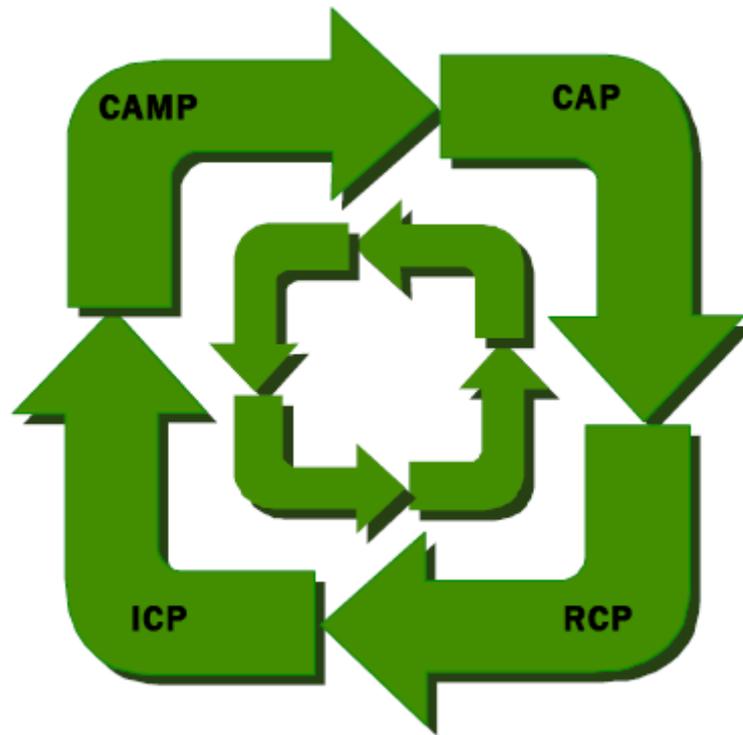


Fig. 3. Collection planning showing the process from CAMP to Institutional Collection Plan

The RCPs will not work without institutional participation. Institutions need to take RCPs into account in their collection-planning process.



Appendix 3 Education theory

This appendix provides background information and some of the theoretical and philosophical considerations associated with the development and application of ‘zoo education’.

While each animal collection has its own opportunities and limitations, zoo education should aim not only to be about the animals on display but also to provide a broader message; link to relevant curricula; and facilitate development of environmental awareness and action.

What is zoo education?

Zoo education is a holistic discipline targeted at zoo visitors, staff and the wider community, aiming to:

- promote an understanding of, and concern and respect for, biodiversity, animals and the natural world;
- encourage action for a sustainable future

Zoo education incorporates the principles of environmental education and the evolving field of education for sustainability. It goes beyond provision of information via graphical interpretation and direct personal contact, and the education experience is influenced by, for example, the species exhibited and zoo layout, exhibit design, gardens, animal behaviour, retail and catering environments and transport/parking issues.

Education programmes should acknowledge that the captive environment is unnatural. Enclosure design can simulate a ‘natural’ setting but there are limitations: zoos should acknowledge this and use it as a building block to illustrate ecological principles.

There is a growing realisation that we cannot divorce the problems of the environment from those of development and economics...our form of education is directed towards a social end – we want to bring about change in human behaviour resulting in sustainable use of Earth’s resources. ...learning should be fun... but... also be very seriously based upon clearly defined education principles and concepts.
Doug Hulyer, WWT, 1990

Zoos have the potential to instigate environmental education programmes that motivate people to action. ...Zoo educators are faced with numerous target audiences with whom to develop concepts, refine skills and nurture attitudes...
Malcolm Whitehead, WWT, 1995

Environmental education

The classic definition of environmental education from IUCN in 1970 is:

Environmental education is the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and

appreciate the inter-relatedness among man, his culture and his biophysical surroundings.

Good zoo education is a specialized form of environmental education.

Environmental education should provide experiences of problem solving, decision making and participation, with consideration of ecological, political, economic, social, aesthetic and ethical issues. It is also about promoting changes of attitude and behaviour.

Environmental education is not simply about 'saving the whale' but about developing an appreciation of the wonders of nature and a sense of wanting to save them. It is about touching people's belief and attitudes so that they want to live sustainably. A zoo is an appropriate environment to facilitate and promote this.

Real things engage all the senses not just the intellect

Professor David Orr, 1993

International co-operation for conservation and education

World Conservation Strategy

The need to conserve natural resources and biodiversity has been increasingly recognized by the international community and through the work of non-governmental organizations (NGOs). In 1977 a UNESCO-UNEP meeting at Tbilisi produced a declaration upon the provision of environmental education. As a result of intergovernmental meetings in 1980, a *World Conservation Strategy* (WCS) was drawn up to provide a framework for individual countries to develop national conservation strategies and policies. The WCS stated:

Environmental education has the task of transforming the attitudes and behaviour of entire societies if a new conservation ethic embracing plants and animals as well as people is to become a reality.

The WCS was revised in 1990 with the World Commission on Environment and Development conference, resulting in the Bruntland Report *Our Common Future*.

World Zoo Conservation Strategy

The zoo community responded to this increased awareness and action with the World Zoo Conservation Strategy in 1993.

The World Zoo Conservation Strategy emphasises that the use of a wide variety of educational techniques, facilities, and considerations, together with knowledge, creativity, and inventiveness can make zoos highly interesting, attractive and effective places for environmental, conservation, and holistic life system education.

United Nations Conference on Environment and Development – Rio Summit

The 1992 UNCED *Earth Summit* in Rio de Janeiro produced a range of 24 declarations and reports, including the CBD (see Appendix 1) and Local Agenda 21. The Agenda was designed to provide a framework for the 21st century for local communities to contribute to national strategies and achievements, and subsequently to global action.

Agenda 21 1992 states:

To improve sustainable development education, nations should seek to:

- make environment and development education available to people of all ages;
- work environment and development concepts, including those of population, into all educational programmes, with analyses of the causes of the major issues. There should be a special emphasis on training decision makers;
- involve school children in local and regional studies on environmental health, including safe drinking water, sanitation, food, and the environmental and economic impacts of resource use.

Tackling the issues internationally: globalisation and rich versus poor

Quality of life for the majority of people differs significantly between the developing and the developed nations, and this has an impact upon educational needs. Zoo environmental education should consider the issues of inequality around the world and within different environments. For example, tackling the illegal trade in wildlife is as much about social issues as conserving wildlife. The dominance of large multinational or transnational companies (and some governments) in world trade also influences the environment. The issues of:

- globalisation
- genetic engineering
- conservation of natural resources
- sustainable development

are all relevant to, and can be incorporated into, the educational work of zoos.

Challenges for educators

The greatest challenge of both our time and the next century is to save the planet from destruction. It will require changing the very foundations of modern civilisation and relationship of humans to nature.

Mikhail Gorbachev, 1994

Paradoxically, the developed nations are viewed as more conscious and respectful of environmental limits than the developing nations, when all the evidence shows the environmental crisis has been precipitated almost exclusively by the wasteful and excessive consumption of the developed nations. All environmental and conservation-education programmes should address this issue.

Much of what has been labelled environmental education in developed nations has actually reinforced some of the problems by not revealing their true causes, or complexity. For example, simplistic conservation messages take no account of the local situation and the underlying reasons for endangerment (e.g poor wages for the available work, often supplying the multinationals that sell the goods to developed countries).

...it is my firm belief that most members of environmental organisations do not yet understand that radical social change is needed ... we need to rethink our priorities.
T. Trainer (Wall, 1990)

Analyses of global issues, their impact and their origins suggest that unsustainable population growth is the single most important cause of environmental damage. While this is true in simplistic terms, the imbalance between developed and developing nations in terms of resource use clearly shows that a stable 'consumer' population in the developed world causes significant environmental damage. Increased longevity in developed nations also means a larger population and a significant increase in demand for consumer goods: more than that resulting from higher population growth in developing nations.

***In situ* conservation and education**

In situ projects to save and rehabilitate natural resources will not succeed unless local people are included in land ownership and rights to water, timber, fuel, etc. Education is a critical part of building community support for the conservation work.

Field projects provide opportunities for education programmes at home and abroad e.g. working with the local community on causes of habitat loss and species endangerment, and with zoo visitors on how their lives may be impacting upon the region (e.g through trade or consumerism) and what they can do to counteract this.

Education for sustainability

Sustainability is now a feature of school curricula. Educators should be aware that the understanding, ideas and attitudes concerning sustainability differ between nations: in particular, its use by developed nations and multinationals may not concur with that of developing nations.

Sustainability can be defined as:

the ability of human society to coexist in balance with the environment such that there is a reliance upon renewable resources, utilization of waste and emphasis placed upon meeting local community needs which are not to the detriment of other communities and the environment

Stephen Woollard, Bristol Zoo Gardens, 1998.

Education for sustainability draws upon the strengths of environmental and development education and is much more than the sum of the two. It is ideally suited to 'in the environment' and informal approaches, and exploring links between the environment/wildlife, trade and people. Zoo education can play a central role in the 'delivery' of some aspects of education for sustainability.

Back to basics: teaching and learning

Environmental education aims to encourage pupils to express their own views, listen to those of others, form reasoned opinions, work co-operatively, make decisions and take action for the environment. These outcomes can be encouraged in many ways and the zoo environment provides an extra stimulus.

Education can be:

- participatory
- co-operative
- enquiry based

It can include:

- **Action and problem solving:** practical activities involving care and action for the environment; setting a problem and providing a solution based upon experience and ideas e.g. how to stop poaching?
- **Discussion of views and beliefs:** encourage pupils to say what they think in a non-threatening way, raise controversial issues and get pupils to think through their feelings (e.g. animals in captivity, the hunting debate, Fair Trade, globalisation or local issues, such as a village pond, housing estate, motorway)
- **A positive approach:** to enjoy and appreciate the environment and wildlife, highlighting the wonder of the natural world rather than taking the 'doom and gloom' approach.
- **First-hand experience:** enquiry and investigation are key skills that can be developed in the zoo visit. Direct contact provides opportunities to develop various areas of learning and action (note animal welfare/health issues).
- **The local community:** the zoo is part of the community and can demonstrate how the local environment is important, and how the local fits into the national and international. Meeting a keeper, gardener or education officer in the zoo is, in itself, a valuable experience for all visitors.
- **Real issues:** use what is really happening and relevant, keep up to date with environmental news and use it as well as examples from the pupils/visitors own experience e.g. the impact of foot and mouth disease on farmers versus zoos/tourism. Do not shy away from controversial issues.
- **Sources of information:** provide visitors with information or direct them to where they can get it, to aid informed choices and decisions. Written requests for information may be time-consuming/expensive but they provide another opportunity to promote conservation and 'market' the collection and work of the zoo.
- **Equality:** discrimination (e.g. by race, sex) is to be avoided. Worldwide interrelationships, (e.g. through economic dependence and consumerism) and the support of international treaties/laws by developed nations because of vested interests can all impact on the environment. These factors may be kept in mind when developing new graphics, talks or education programmes.

Further information

Within the UK, BIAZA operates a strong zoo educators network and leading, experienced, zoo education staff are often happy to help others with advice and support. There is also a vibrant European and International network of zoo educators sharing practice and experience.

International Zoo Educators Association www.izea.net

BIAZA www.biaza.org.uk

EAZA www.eaza.net

Annex on guidance on the Zoo Licensing Act's requirement for zoos to participate in conservation measures

Suggested benchmarks for minimum standards

1. Introduction

Under the provisions of the Zoo Licensing Act 1981 (the Act) and Amendments resulting from the EU Zoos Directive, zoos are required to participate in conservation measures. This reflects their particular potential to inspire the public interest in nature and also to play a role in breeding endangered species and other conservation work and research. Defra's guidance, The Secretary of State's Standards of Modern Zoo Practice (SSSMZP), sets out that the contribution to conservation is expected to be proportionate to the size and type of the zoo. This guidance document therefore aims to expand on Defra's statutory guidance and sets out, through a series of hypothetical examples, the level of participation in conservation measures which the Zoos Expert Committee suggests as the minimum contribution that should be required from different sizes and types of zoos. Note, this annex is complemented by a similar annex highlighting suggested benchmarks for education.

It should be noted that this guidance focuses on minimum standards, whereas the Zoos Expert Committee encourages all zoos to aim to greatly exceed the minimum level and make the maximum contribution they can to conservation.

It is expected that this guidance will be useful to local authority officers and zoo inspectors in administering the zoo licensing regime, and also to zoo operators in understanding the minimum contribution that will be expected of them in order to meet the requirements of the zoo licensing regime and in auditing their own zoos' work.

2. General principles

The Act provides for a range of different options for conservation measures, enabling each zoo to decide for itself how it wishes to contribute and to determine what particular conservation activities are most appropriate for it to be involved in. Zoos must undertake at least one of the options in the Act, although more commonly they will be involved in a range of activities which all contribute. (Note: education is one of the requirements for contributing to conservation and suggestions for zoos contribution in education is covered in the 'education annex').

Conservation activities are not limited to those given as examples in this guidance. The conservation, education and research chapter provides further guidance on the options for the types of conservation activities which zoos might choose to participate in.

Extracts from the Zoo Licensing Act 1981

Conservation measures for zoos

1A. The following are conservation measures to be implemented in zoos in accordance with this Act –

- (a) participating in at least one of the following –
 - (i) research from which conservation benefits accrue to species of wild animals;
 - (ii) training in relevant conservation skills;
 - (iii) the exchange of information relating to the conservation of species of wild animals;
 - (iv) where appropriate, breeding of wild animals in captivity; and
 - (v) where appropriate, the repopulation of an area with, or the reintroduction into the wild of, wild animals;

Periods and conditions of a licence

5(2)(a). A licence under this Act shall be granted subject to conditions requiring the conservation measures referred to in 1A to be implemented at the zoo.

The key point is that the legislation requires zoos to participate in conservation but leaves it open to zoos themselves to decide how best they can do so. Zoos are therefore free to make their own decisions on, for example:

- how to fund their conservation activities (e.g. through budgets or fundraising);
- the kind of projects to be undertaken;
- whether participation is through financial support, or ‘in kind’ such as through expertise, staff time or facilities/equipment;
- how to target efforts (e.g. whether to put all resources into one major project or into a large range of smaller projects);
- where the work is carried out (e.g. locally or internationally);
- to work alone or in partnership

The focus of the legislation is therefore on encouraging zoos to be active in undertaking what conservation work they can, rather than setting out detailed requirements in terms of total financial contributions or particular number of projects or research studies.

Each zoo should be able to demonstrate to regulators that it is fulfilling its conservation obligations. It is generally not practical for regulators to attempt to assess the effectiveness of particular conservation projects or other activities in detail so the focus for regulators is more on simply checking that zoos are participating in conservation activities and that the broad level of overall contribution appears proportionate. When inspecting and licensing zoos, local authorities and zoo inspectors are able to exercise discretion as to what is proportionate in a particular case, also taking into account the amount and

quality of work on promoting public education and awareness of biodiversity issues. All activities which make a positive contribution should be taken into account.

Zoos should also be aware that specific requirements apply under CITES legislation where CITES Annex A specimens are held under an Article 60 (formerly Article 30) certificate. These focus particularly on the animals concerned. If in doubt then zoos should consult Defra for advice on this issue.

3. Using the guidance

It is important that this guidance is set in the correct context. It is not binding nor does it form part of Defra's statutory guidance on the Act, but rather it provides the views of the Zoos Expert Committee on interpretation of the requirements of the legislation. It therefore helps develop the framework for the zoo licensing regime.

The guidance takes the form of hypothetical examples of different types and sizes of zoos, outlining the sorts of conservation measures which are considered to be the minimum standard for each hypothetical example.

There is no perfect measure of the 'size and type' of the zoo. For the purposes of this guidance, this is described in terms of the annual visitor numbers and the dispensation status of the zoo (which is itself based on the size and type of the collection of animals held, taking account of factors such as the number of animals and whether they are conservation-sensitive). This utilises information which is already easily available as part of the licensing process to give a reasonable indication of the size and type of the zoo. It is intended that the information in these hypothetical examples can be scaled up or down as appropriate to give an indication of the minimum level of contribution which should be required from any particular real zoo.

It is acknowledged that this is a crude measure of the size and type of a zoo and other factors are likely to need to be taken into account. For example, where a zoo collection is part of a bigger leisure attraction then the visitor number will be higher than you might otherwise expect and hence give a misleadingly high impression as to the size of the zoo and its capacity to undertake conservation activities. There is such great diversity in the type of establishments covered by the Act that it is not practical to put together guidance covering every situation. Common sense should be applied.

The guidance is therefore intended to give an indication only. It is not a rigid checklist of requirements and is not intended to be used to dictate a list of particular activities that should be undertaken, as zoos are able to design their own programmes of conservation activities. Zoos are therefore not required to undertake the exact same measures as those outlined in these hypothetical examples, but rather to undertake an equivalent amount of conservation work. For example, a zoo might put all of its conservation efforts into a single major project, rather than make a comparatively smaller contribution to a range of activities. The guidance is intended to give an indication of the sort of broad level of contribution measures which the Zoos Expert Committee considers to be the minimum.

REMEMBER: All the examples below are hypothetical, each doing just the minimum necessary for a zoo of that size. The focus is really on describing the level of participation in conservation, rather than the detail of the particular measures themselves. This is not a

rigid checklist of requirements and zoos are able to determine their own programme of activities, including whether to focus on a range of issues or a greater emphasis on a narrower area.

4. Suggested benchmarks for minimum standards of conservation requirements

Six hypothetical examples are provided. The table below gives a summary of each example and is followed by the detail on the conservation requirements for each example in turn.

	Example 1 very small collection eg Farm Park	Example 2 small aquarium	Example 3 zoo with small collection	Example 4 zoo (low visitor numbers)	Example 5 zoo (medium visitor numbers)	Example 6 major zoo (high visitor numbers)
Visitor numbers per year	Circa 80,000	Circa 30,000	Circa 80,000	Circa 80,000	Circa 200,000	400,000
Type of collection and dispensation status	Farm park, dispensation in place	Small aquarium, dispensation in place	Generalist or specialist zoo collection, dispensation in place	Generalist or specialist zoo collection, no dispensation	Generalist or specialist zoo collection, no dispensation	Larger zoo collection, no dispensation
Comment on size and type of zoo	Holds very small numbers of wild animals, all non-conservation sensitive (eg species such as wallabies, deer, rhea, meerkats etc). The wild animal exhibits are just a small part of the attraction and are set alongside domesticated species and other non-zoo country park attractions.	This small aquarium holds small wild species, although only a relatively small number of conservation sensitive species hence the 14(2) dispensation. Visitor numbers are relatively low.	Holds primarily wild exotic species, but relatively small number of conservation sensitive species and so therefore has a dispensation (eg a small general zoo collection also similar to a specialist collection such as a larger bird of prey centre).	Holds primarily wild exotic species, including conservation sensitive species (eg a small general zoo collection or a specialist collection).	Medium sized zoo with a collection including conservation sensitive species.	Large sized zoo with a collection including significant numbers of conservation sensitive species.

Example 1: Farm park, with a very small collection of wild animals

Annual visitor numbers: Circa 80,000 Dispensation status: Section 14(2) dispensation

Comment on size and type of zoo: falling at the lower end of the 14(2) dispensation category, this zoo comprises very small numbers of wild animals, all non-conservation sensitive (e.g. species such as wallabies, deer, rhea, meerkats etc). The zoo therefore just falls within the zoo licensing regime. The wild animal exhibits are just a small part of the attraction and are set alongside domesticated species and other non-zoo country park attractions. The high visitor numbers are therefore influenced by the wider attraction, rather than just the zoo element. The type of the zoo must therefore also be taken into account to reach a proportionate view.

As an aside, there are a small number of zoo collections with 14(1)(b) dispensations (thereby providing for a lower level of regulation than section 14(2) dispensations) on the basis of the minor nature of the collection of animals. In these cases, the requirements are minimal and it may be considered sufficient to concentrate entirely on promoting public education and awareness in relation to biodiversity.

Example of suggested minimum requirements for conservation measures:

In terms of conservation measures, this is very much towards the minimum end of the scale of requirements.

The hypothetical establishment is undertaking the following measure:

- contributing towards local habitat management and maintenance for the benefit of biodiversity. This can include simple measures such as sensitive farming practices, bat and bird boxes, maintaining a wildlife pond or hedgerows for the benefit of local wildlife.

For this type of establishment, this alone is sufficient to meet the minimum requirements, provided the organisation explains to visitors what it is doing in such fields. Undertaking these measures with involvement of local wildlife groups/schools would add further value to public education and awareness-raising.

Other alternative suggestions for an appropriate level of participation, which could be undertaken instead of the above measure, include:

- sensitive habitat management and maintenance under agri-environment schemes such as Defra's Environmental Stewardship scheme (delivered through Natural England) www.naturalengland.gov.uk/ourwork/farming/funding/es/default.aspx which provides grants for land managers who deliver effective environmental management on their land;
- participating in rare breeds conservation programmes if appropriate;
- involvement with native species or habitat monitoring schemes;
- financial contributions to conservation activities, alongside other measures.

Example 2: small aquarium with a small collection of species

Annual visitor numbers: Circa 30,000 Dispensation status: Section 14(2) dispensation

Comment on size and type of zoo: this small aquarium holds wild species, although only a relatively small number of conservation-sensitive species hence the section 14(2) dispensation. In terms of conservation measures, collections with dispensations should have rather lower requirements than those without. Visitor numbers are relatively low.

Example of suggested minimum requirements for conservation measures:

In terms of conservation measures, this collection is towards the lower end of the scale of requirements as it has both a dispensation and low visitor numbers (meaning that it is likely to generate lower revenue to have available for allocation to conservation work).

This collection is well placed to promote public education and awareness in relation to conservation activities, and therefore focuses largely on educational measures such as making links to local marine and freshwater environments, and the associated conservation issues. The relatively strong input on educational activities can be taken into account in considering requirements on the practical conservation side.

The hypothetical establishment undertakes the following activities:

- occasionally contributing staff time or resources to relevant local conservation projects or activities such as beach clean-ups and wildlife pond management;
- where conservation-sensitive species are held then the collection participates in appropriate captive-breeding species management programmes and provides data to studbooks.

Example 3: Zoo with a small collection

Annual visitor numbers: Circa 80,000 Dispensation status: Section 14(2) dispensation

Comment on size and type of zoo: holds primarily wild exotic species, but relatively small number of conservation-sensitive species and so therefore has a dispensation (e.g. a small general zoo collection, also similar to a specialist collection such as a bird of prey centre). In terms of conservation measures, collections with dispensations should have lower requirements than those without. Although the dispensation status is the same as example 1, the collection is considerably larger and including some conservation-sensitive species, hence the requirements will be greater than in that case.

Example of suggested minimum requirements for conservation measures:

Often zoos of this size and type will be making a contribution to conservation through a small number of focussed measures.

This hypothetical example zoo is undertaking the following measures:

- the zoo is involved with one conservation project for threatened species/habitats. A member of the zoo staff contributes their expertise and a proportion of their time. The zoo also supports this project and other campaigns through fundraising;
- the zoo also participates in several managed breeding programmes, helping ensure that the zoo's captive-breeding programme contributes effectively;

- the zoo facilitates occasional research opportunities for students from a local college and helps publicise the outcomes;
- the zoo also seeks to operate sustainably and has a basic environmental policy.

It is stressed that zoos are not limited to these few options, or required to deliver these exact measures, and may wish to think creatively about other ways to contribute.

Example 4: Zoo (low visitor numbers)

Annual visitor numbers: Circa 80,000 Dispensation status: No dispensation

Comment on size and type of zoo: holds primarily wild exotic species, including a number of conservation-sensitive species (e.g. a small general zoo collection or a large specialist collection). No dispensation is in place, so the conservation requirements will be proportionately greater.

Example of suggested minimum requirements for conservation measures:

Zoos of this size and type should be making a reasonable contribution to conservation, most likely through a small range of measures.

This hypothetical example zoo is undertaking the following measures:

- the zoo participates in a field conservation project, to which zoo staff contribute their time and expertise. The zoo also supports this project and other campaigns through fundraising;
- the zoo also participates in managed breeding programmes and provides data to studbooks (such as International Studbooks, EEP's and ESB's). This helps ensure that the zoo's captive-breeding programme contributes effectively;
- the zoo regularly facilitates research for students and has good links with the local college. It therefore undertakes and facilitates a small number of research projects.

It is stressed again that zoos are not limited to these few options, or required to deliver these exact measures, and may wish to think creatively about other ways to contribute.

Example 5: zoo (medium visitor numbers)

Annual visitor numbers: Circa 200,000 Dispensation status: No dispensation

Comment on size and type of zoo: 'Medium' sized zoo, with a collection including conservation-sensitive species.

Example of suggested minimum requirements for conservation measures:

Zoos of this size and type should be making a significant contribution to conservation, most likely through a wide range of measures.

This hypothetical example zoo is undertaking the following measures:

- the zoo participates in several conservation projects, providing some funding and for which zoo staff contribute their time and expertise (to the value of in the region of several thousand pounds per year). The zoo also supports this project and other

campaigns through fundraising. On occasion this involves captive-breeding for release projects;

- the zoo also participates in managed breeding programmes and provides data to studbooks (such as International Studbooks, EEP's and ESB's), including holding the EEP studbook for a threatened species. This helps ensure that the zoo's captive-breeding programme contributes effectively;
- zoo staff participate in Taxonomic Working Group meetings within the UK for several species groups, and relevant Taxon Advisory Groups in Europe, helping contribute their expertise and also exchanging information to assist in conservation);
- the zoo regularly facilitates research students and has good links with the local college. It therefore undertakes and facilitates a number of research projects;
- publication of research results in appropriate journals;
- the zoo also seeks to operate sustainably and has an environmental policy which regularly assesses its own environmental impact.

It is stressed again that zoos are not limited to these few options, or required to deliver these exact measures, and may wish to think creatively about other ways to contribute.

Example 6: Major zoo (high visitor numbers)

Annual visitor numbers: 400,000 Dispensation status: No dispensation

Comment on size and type of zoo: 'large' sized zoo, with a collection including significant numbers of conservation-sensitive species.

Example of suggested minimum requirements for conservation measures:

Major zoos with high visitor numbers should be expected to make a significant contribution to conservation, probably through a wide range of measures.

Active participation in captive-breeding and species management programmes for threatened species must be required, where relevant species are held. Support for, or active participation in, field conservation projects should be expected. Such support may be financial support and/or through providing husbandry and management skills, staff and equipment for habitat and species conservation and/or essential material for local education and awareness programmes overseas. Alternatively, zoos may actually be running such programmes rather than supporting someone else's efforts.

Participation in research projects should also be expected, either undertaking research themselves or collaborating with academic or research institutions. Efforts should be made to share such information in the form of newsletters, reports, talks and seminars and publications (peer-reviewed and grey literature). Zoos should also be participating appropriately in maintenance of species studbooks.

A light contribution in one area can obviously be offset by a particularly strong contribution in another, but overall a significant contribution should be expected.

The hypothetical example zoo is undertaking the following measures:

- participation in a range of conservation projects contributing funds, time and expertise of zoo staff (to the value of in the region over ten thousands of pounds per year). Equally, this could consist of participation in a smaller or greater number of projects but at a similar overall level;
- participation with local wildlife groups in managing an area of local habitat for biodiversity conservation;
- the zoo also participates in managed breeding programmes and provides data to studbooks (such as International Studbooks, EEP's and ESB's), including holding the EEP studbook for several threatened species. This helps ensure that the zoo's captive-breeding programme contributes effectively;
- active involvement in species management programmes for threatened species through Taxon Working Groups and Taxon Advisory Groups in Europe. This involves staff contributing their expertise and also exchanging information to assist in conservation;
- captive-breeding of a rare native species to assist a reintroduction programme in partnership with Natural England and several non-governmental organisations. Opportunities to participate in this kind of work may be rare but zoos are well placed to play an important role;
- undertaking several research projects. Collaborating with a local university and college on research, facilitating opportunities for research;
- publication of papers and notes each year on the results of research and field conservation work;
- fundraising for a field conservation project sometimes undertaken by outside organisations and sometimes by the zoo itself;
- the zoo also seeks to operate sustainably and has an environmental policy which regularly assesses its own environmental impact.

REMEMBER: All the above are hypothetical examples, each doing just the minimum necessary for a zoo of that size. This is not a rigid checklist of requirements and zoos are able to determine their own programme of activities, including whether to focus on a wide range of issues or to place a greater emphasis on contributing substantially to a narrower area.

Glossary

EEP – European breeding programme for endangered species, managed by the European Association of Zoos and Aquaria.

TWG – Taxon Working Group of BIAZA (linked into supporting TAGs in Europe). Groups of zoo experts supporting species programmes and management.

TAG – Taxon Advisory Group. Groups of zoo experts who help determine the species that are most in need of captive programmes as an aid to their conservation and draw up collection plans.

Studbook - Studbooks are primarily a compilation and source of genealogical data of individual animals which make up a particular population to aid in its management.

ESB – 'European Studbook', managed by the European Association of Zoos and Aquaria.

Annex to guidance on the Zoo Licensing Act's requirement for participation in 'education and public awareness'

Suggested benchmarks for minimum standards

1. Introduction

Under the provisions of the Zoo Licensing Act (the Act) 1981 and Amendments resulting from the EU Zoos Directive, and as stated in the Secretary of State's Standards of Modern Zoo Practice (SSSMZP) see www.defra.gov.uk/wildlife-pets/zoos/ zoos are required to participate in conservation and education measures:

- (a) participating in research from which conservation benefits accrue to the species and/or training in relevant conservation skills, and/or the exchange of information relating to species conservation and/or where appropriate, captive breeding, repopulation or reintroduction of species into the wild (section 1A(a) i – v of the Act) and...
- (b) promoting public education and awareness in relation to the conservation of biodiversity, particularly by providing information about the species exhibited and their natural habitats (section 1A(b) vi of the Act).

The Zoos Forum (predecessor to the Zoos Expert Committee) produced a non-mandatory checklist for 'education' to assist zoos, zoo inspectors and local authorities in auditing this role. However, the SSSMZP indicates that a zoo's contribution to both conservation and education is expected to be proportionate to the size and type of zoo. This guidance outlines benchmarks for education and awareness.

Note that this guidance is illustrative of **minimum standards** for a range of different sized zoos, and it would be expected that most zoos will exceed the requirements. The education checklist can be used to complement and support consideration of whether a zoo is meeting or exceeding the suggested benchmark.

2. General Principles

Under the Act it is a statutory requirement for zoos to promote public education and awareness in relation to the conservation of biodiversity.

Education activities are broad and focused on wide audiences. (It is important to recognise that education is more than working with schools and school children). This guidance gives general examples but is not comprehensive, so other educational activities may be undertaken. The chapter on conservation, education and research' and the Education Annex (the checklist) provides further guidance.

The legislation allows zoos, to a large extent, to decide themselves on how best to meet the statutory requirement and what activities and resources to put into education and

awareness activity. However, the SSSMZP does indicate the basic minimum standard required:

7.9 A zoo must have a written education strategy and an active education programme.

7.10 Suitable facilities, commensurate to the size of the zoo, should be available for education purposes.

7.11 Accurate information about the species exhibited must be available...

Each zoo should be able to demonstrate that it is fulfilling these obligations and is actively contributing to education and raising awareness. Inspectors and licensing authorities cannot be expected to assess each individual element of a zoo's education work, so their focus is upon checking that the education activities taken as a whole are proportionate to the size and type of zoo. Inspectors are able to exercise their discretion in each case, for example, by taking account of the quality of work as well as diversity or quantity of activity.

3. Using this guidance

This benchmark document and the education checklist are for **guidance only and do not form part of any statutory guidance under the Act**. It provides the Zoos Expert Committee's interpretation of the requirements and helps develop the framework for the zoo licensing regime.

This guidance takes the form of hypothetical examples of different types and sizes of zoos and outlines the education measures that are considered to be the minimum standard for that example.

There is no perfect measure for the size and type of zoo. For the purposes of this guidance, this is described in terms of annual visitor numbers and dispensation status. This utilises information which is easily available. It is intended that the information in these hypothetical examples can be scaled up or down to give an appropriate measure of the requirement from any particular real zoo. Common sense and judgement should be applied, for example, in recognising if a 'zoo' is part of a bigger leisure complex, or has a particular area of specialism that is reflected in the educational approach and facilities (e.g. bird flying display or aquarium).

This guidance is intended to give an **indication only and does not dictate what is required** (except for that which is specified in the legislation). Zoos are therefore not required to undertake the exact measures given in these hypothetical examples but to meet at least the minimum standard, and where possible to exceed it.

It is expected that inspectors will use their informed judgement and discretion in examining a zoo and the following benchmarks are designed to assist them in interpretation of the requirements for different types and sizes of zoos. Inspectors and operators are reminded that these benchmarks are **non-mandatory** and other actions than those listed may be undertaken by zoos to fulfil the legal requirements which are proportionate to the size and type of zoo.

Note on status of the Zoo – charity, private, local authority etc.

The legislation does not make a distinction between zoos funded by the different means available. Therefore, the benchmarks are for use equally in all zoos no matter what their funding. Zoos are all encouraged to exceed the minimum requirements.

4. Size and type of zoo

This guidance is developed using six hypothetical examples of sizes and types of zoo, and follows the examples developed for the conservation benchmarks. The definition of a zoo in this context is that which is outlined in the Act, and therefore, for example, applies to aquariums, bird gardens, safari parks and traditional zoos.

	Example 1, very small zoo, eg. Farm park	Example 2, small aquarium	Example 3, zoo with small collection	Example 4, zoo with low visitor numbers	Example 5, zoo with medium visitor numbers	Example 6, zoo with high visitor numbers
Visitor numbers per year	80,000	30,000	80,000	80,000	200,000	400,000
Type of collection and dispensation status	farm park	small aquarium	general or specialist zoo	general or specialist zoo	general or specialist zoo	larger zoo collection
	dispensation	dispensation	dispensation	no dispensation	no dispensation	no dispensation
Comment on size and type of zoo	Holds very small numbers of wild animals all non-conservation sensitive (e.g. species such as wallabies, deer, rhea, meerkats etc). The wild animals are just a small part of the attraction and are set alongside domesticated species and other non-zoo country park attractions.	This small aquarium holds wild species although only a small number of conservation sensitive species, hence the 14(2) dispensation. Visitor numbers are relatively low.	Holds primarily wild exotic species but relatively small number of conservation sensitive species and so therefore has a dispensation (e.g. small general zoo or collection such as bird of prey centre)	Holds primarily wild exotic species including conservation sensitive species (e.g. a small general or specialist collection).	Medium sized zoo with a collection including conservation sensitive species	Large sized zoo with a collection including significant numbers of conservation sensitive species.

Education Provision

The education provision in all zoos (no matter what their size) must meet the requirements of the Act and detailed in the SSSMZP. Specifically zoos must:

- promote public education and awareness in relation to conservation of biodiversity;
- have a written education strategy and active education programme;
- have suitable facilities, commensurate to the size of zoo for education purposes;
- provide accurate information about the species exhibited.

These benchmarks offer some interpretation of the requirements, however, a zoo may follow other options than those stated as long as the legal requirements are met. Zoos are therefore strongly encouraged to keep detailed records of all of their educational activities as evidence.

Example 1. Farm park with a very small collection of wild animals

Visitor numbers: c. 80,000 annually: Dispensation 14(2).

Size and type of zoo: a farm park with a 14(2) dispensation, having small numbers of wild animals (e.g. wallabies, rhea, deer) which are part of a larger attraction, alongside domesticated species and other non-zoo attractions which explains the relatively high visitor numbers.

Example of suggested minimum standards for education measures

The establishment is undertaking the following measures:

- the zoo has a simple written education strategy outlining key target audiences and methods;
- the wild animal species have basic identification labels – featuring name, scientific name, range/natural habitat;
- staff are able to answer general questions about the animals and their care, e.g. diet;
- visitors are informed, for example by signs, leaflets, or staff, about environmental issues and actions, such as efforts to manage local habitat for the conservation of biodiversity and efforts to operate sustainably. Visitors are thereby encouraged to find out more about local and global environmental issues and given information to enable them to act more sustainably. (For example, waste management, recycling, energy saving, putting up bird boxes, gardening for wildlife).

Other activities and actions might be undertaken than those stated, some suggestions of what these might be are included in the 'additional actions' section of this document and also in the chapter on conservation, education and research.

Example 2. Small aquarium with a small collection of species

Visitor numbers: c. 30,000 annually: Dispensation 14(2).

Size and type of zoo: small aquarium with wild species, only a few of which are conservation sensitive, hence the 14(2) dispensation.

Example of suggested minimum requirement for education measures.

The establishment is undertaking the following measures:

- the aquarium has a simple written education strategy outlining key target audiences and methods;
- each exhibit has basic identification labels – featuring species and range, and habitat type. Conservation sensitive species are specifically highlighted;
- information is provided (e.g. through signs, leaflets, guidebook) on the marine habitat highlighting threats and conservation. For example, illustration of the interdependence of species and impact of environmental disturbance such as pollution;
- staff are able to answer general questions about the animals and their care, e.g. diet;
- when projects such as beach-cleans and wetland habitat management are conducted local groups and/or visitors are involved and/or informed about them.

Other activities and actions might be undertaken than those stated, some suggestions of what these might be are included in the ‘additional actions’ section of this annex and also in the chapter on conservation, education and research.

Example 3. Zoo with a small collection

Visitor numbers: c. 80,000: Dispensation 14(2).

Size and type of zoo: zoo with primarily wild animals, relatively few conservation sensitive (for example, could apply to a small zoo or a bird of prey centre).

Example of suggested minimum requirement for education measures.

The establishment is undertaking the following measures:

- the zoo has a written education strategy outlining key target audiences and methods;
- each exhibit has basic identification labels – featuring species name and range and habitat. Conservation sensitive species are specifically highlighted;
- information is provided (e.g. through signs, leaflets, guidebook and talks or demonstrations) on species, habitats and related conservation issues;
- staff are able to answer general questions about the animals and their care, e.g. diet, and tailor this information to different audiences (including schools/children).

Other activities and actions might be undertaken than those stated, some suggestions of what these might be are included in the ‘additional actions’ section of this annex and also in the chapter on conservation, education and research.

Example 4. Zoo with low visitor numbers

Visitor numbers: c. 80,000: No dispensation.

Size and type of zoo: zoo with primarily wild animals including a number of conservation sensitive species, e.g. a small general zoo or a larger specialist collection.

Example of suggested minimum requirement for education measures.

The establishment is undertaking the following measures:

- the zoo has a written education strategy outlining key target audiences and methods;
- each exhibit has identification labels – featuring species name and range and habitat. Conservation sensitive species are specifically highlighted;
- information is provided (e.g. through signs, leaflets, guidebook and talks or demonstrations) on species, habitats and related conservation issues; and upon the conservation work undertaken by the zoo;
- staff are able to answer general questions about the animals and their care, e.g. diet, and tailor this information to different audiences (including schools/children);
- a dedicated area or room/building is provided to enable public presentations and/or schools programmes;
- there is a trained member of staff to undertake the education programme*. (*This staff member may have other duties as well. Their training may be through recognised qualification and/or through attendance at appropriate meetings and conferences, shadowing at other zoos etc). If a schools programme is operated the staff involved should be familiar with the curriculum and needs of the target age/ability groups focused upon.

Other activities and actions might be undertaken than those stated, some suggestions of what these might be are included in the 'additional actions' section of this annex and in the chapter on conservation, education and research.

Example 5. Zoo with medium numbers

Visitor numbers: c. 200,000: No dispensation.

Size and type of zoo: medium sized zoo with a number of conservation sensitive species.

Example of suggested minimum requirement for education measures.

The establishment is undertaking the following measures:

- the zoo has a written education strategy outlining key target audiences and methods; and this incorporates consideration of education in exhibit design;
- each exhibit has identification labels – featuring species name and range and habitat. Conservation sensitive species are specifically highlighted. Some have additional interpretation (e.g. graphics and/or audio point, video etc);
- information is provided (e.g. through signs, leaflets, guidebook and talks or demonstrations) on species, habitats and related conservation issues; and upon the conservation work undertaken by the zoo;
- staff are able to answer general questions about the animals and their care, e.g. diet, and tailor this information to different audiences (including schools/children);
- an area or room/building is provided to enable public presentations and/or schools programmes. A programme of talks or lessons is available for different target groups, e.g. nursery, primary, secondary and adult groups;
- there is at least one trained member of staff to undertake the education programme*. (*This staff member's primary duty is 'education'. Their training may be through recognised qualification and/or through attendance at appropriate meetings and conferences, shadowing at other zoos etc). If a schools programme is

operated the staff involved should be familiar with the curriculum and needs of the target age/ability groups focused upon.

- an education section on the zoo's website;
- visitors are encouraged to get involved / to take action that is beneficial to conservation.

Other activities and actions might be undertaken than those stated, some suggestions of what these might be are included in the 'additional actions' section of this annex and in the chapter on conservation, education and research.

Example 6. Zoo with high visitor numbers.

Visitor numbers: c. 400,000+: No dispensation.

Size and type of zoo: large zoo with a collection including a significant number of conservation sensitive species.

Example of suggested minimum requirement for education measures.

The establishment is undertaking the following measures:

- the zoo has a written education strategy outlining key target audiences and methods; and education is one of the elements considered in other strategies and operations, e.g. enclosure design; species selection etc;
- each exhibit has identification labels – featuring species name and range and habitat. Conservation sensitive species are specifically highlighted. Many exhibits have additional interpretation, such as extra graphic panels, audio, interactives, video etc. In large multi-species aquaria (tanks) key species are highlighted with identification information, other species are listed;
- information is provided (e.g. through signs, leaflets, guidebook and talks or demonstrations) on species, habitats and related conservation issues; and upon the conservation work undertaken by the zoo; and encouraging public involvement in conservation;
- staff are able to answer general questions about the animals and their care, e.g. diet, and tailor this information to different audiences (including schools/children);
- an area or room/building is provided to enable public presentations and/or schools programmes. A programme of talks or lessons is available for different target groups, e.g. nursery, primary, secondary and adult groups, tailored to the curriculum;
- there are at least two trained members of staff to undertake the education programme*. (*One of these staff member's sole duty is 'education'. Their training may be through recognised qualification and/or through attendance at appropriate meetings and conferences, shadowing at other zoos etc). Education staff are supported by other staff having education roles (e.g. keepers, graphics, presenters giving talks). If a schools programme is operated the staff involved should be familiar with the curriculum and needs of the target age/ability groups focused upon;
- educational resources are available and designed for target groups of visitors, e.g. trails, fact sheets for families, for primary school children etc;
- educational elements are incorporated into at least some of the zoo's conservation in situ projects and might be the main focus of some in situ conservation work;

- an education section on the zoo's website, with additional information on some species/habitats;
- visitors are encouraged and given ideas or opportunities to get involved / to take action that is beneficial to conservation.

Other activities and actions might be undertaken than those stated, some suggestions of what these might be are included in the 'additional actions' section of this chapter.

Additional actions that a zoo might take in meeting the requirements for education.

This list includes some of the other activities that zoos might be doing as part of their educational activity:

- providing talks for local groups and schools (this can be in the zoo or at the group/school's own facility);
- open days involving other local conservation groups / organisations;
- pamphlets/ fact sheets/ trails on species in the collection and/or environmental issues;
- adult education classes;
- links with local colleges;
- teacher placements;
- information centre and/or larger general information graphics;
- touch tables (might be staffed by volunteers);
- visitor interactives (might include touch screens, computers, audio points etc);
- audio guide or commentary (for example in drive-through exhibits, but also general use);
- specific education 'in situ' projects; support for overseas education/educators;
- practical conservation activity, e.g. beach clean, involving local people/schools and thereby raising awareness of local and global issues affecting the marine/wetland environment;
- student training – for example, Vllth form and undergraduate 'research' projects.

Note on interpretation of terms:

Active education programme: inspectors should look for daily events/talks programme; schools programme (and actual classes taking place); guidebook (and date of printing); signage/graphics (incl. state of repair / updating); website etc.

Appropriate facilities: this links to what the education programme/provision is. In many cases this will mean having a 'teaching/presentation area', however, this is not always required. An arena for bird-flying; or graphics; or a talks programme at enclosures etc., may be the means of education, thereby negating the need for other facilities. Reference should be made to the zoo's education strategy.

Species information signs – they should be present for all publicly available enclosures. However, in some instances it may be appropriate that this doesn't include every species, e.g. in a large mixed species aquarium tank with many species in the same tank, the identification may be more general with some species highlighted. Inspectors should use their discretion.

Animal demonstrations/presentations – if these are part of the zoo's public education provision, they should include positive conservation or educational messages in addition to any 'entertainment' function. The welfare of animals should not be compromised to provide these 'shows'.

Accurate information – information that is provided to the public has been sourced from reputable references, e.g. good encyclopaedia, journals etc. The internet may be used to source information with the proviso that zoos should cross check facts. Inspectors would not be expected to check accuracy of information, but could legitimately ask for what sources are used, and question any facts they notice to be inaccurate from their own knowledge.

Education staff – all collections (no matter what size) should have a named person with responsibility for education. In smaller zoos this person may well have other responsibilities as well and in many collections 'education' may be part of several staff roles. The named education staff should be trained to enable them to implement the education strategy. Evidence of training can be: formal qualification; on the job training from someone with experience in this field; attendance at regional and/or national and/or international zoo education meetings; training visits to other zoos/museums – to learn from them. Some zoos utilise the term 'presenter' for staff involved in public education.

Education programme – this term is used to encompass all the educational activities, talks, signage, guide books, presentations etc. Many zoos, particularly those in examples 5 and 6 will have a 'schools programme' as part of their overall education programme.

Zoos and inspectors are reminded these benchmarks are illustrative and non-mandatory. Zoos are strongly encouraged to exceed the suggested benchmarks.

Checklist guidance on the Zoo Licensing Act’s requirement for zoos to promote public awareness and education in relation to conservation of biodiversity

Under the Zoo Licensing Act, zoos are required to promote public awareness and education in relation to conservation of biodiversity, commonly referred to as ‘education’ or ‘conservation education’ work. This checklist is intended to assist zoos in self-auditing this conservation education work and for zoo inspectors in assessing such work. The degree of education facilities and activity should, of course, be in proportion to the size of the zoo.

The checklist is not intended as a mandatory part of the zoo licensing inspection process, although it may be useful to refer to as an aide memoir for zoo operators and zoo inspectors. Zoo inspectors, in the main, will not be able to evaluate teaching but they should see evidence of some sort of an evaluation system. Should the zoo have animal shows efforts should be made for the inspecting team to see at least part of one of the shows.

Please note - some of the information referred to should have been provided in the Pre-inspection Audit (PIA) and there is useful information in this chapter.

A. Zoo Education Mission and Strategy	Yes	No	Notes
Does the mission statement include a stated educational role? (Information should have been provided in the PIA)			
Is there a written education strategy, stating components, intended audiences and methods (this is mandatory under the Act)?			
Does it include elements of education (and training) for: General Public Primary School Secondary Schools Higher ed and Post Grad Adult Zoo Staff			
What evidence is there that the programme is active (brochures, daily education events programme, feedback, observation, etc)? This can be taken into account where there is seasonal variation.			

B. Staff						
Who is the staff member with responsibility for education? (Information should have been provided on the PIA).						
Name:						
Position/title:						
If they have another job role within the organisation as well, what proportion of their time is dedicated to education? Information should have been provided in the PIA.						
How many staff in each category below are involved in the education programmes? (Information should have been provided in the PIA).	Full time	Part time	Seasonal			
Education officers Presenters Graphic staff Curators Keeper Marketing staff Gardens staff Volunteers Others (state who)						
C. Facilities						
What facilities are available for delivery of the education programme and are these appropriate?	Number	Capacity	Disabled access	Schools only	Seasonal only	State of repair or other notes
Lecture theatre Classroom Exhibition space Presentation arena/theatre Animal show/talks at enclosures Touch tables Other						

D. Species information/graphics	Yes	No	Notes
Are species information signs/labels present on all (publicly			

available) enclosures? If not, why not? (This is also part of the zoo inspection)			
Are the labels accurate, with scientific and common names, natural habitat, some biological characteristics and conservation status?			
Is it highlighted on signs when the animals are part of a coordinated breeding programme?			
Who is responsible for the content of the signs/labels?	Name: Job title:		

E. Animal demonstrations/shows/presentations	Yes	No	Notes
Does the zoo provide animal demonstrations/presentations?			
Are they available throughout the year?			
Do the demonstrations include positive conservation (or other education) messages?			
Are the staff carrying out the demonstrations proficient in animal handling, training and husbandry, as well as presentation skills?			

(It would seem reasonable for the inspectors to see a demonstration in action during their inspection)

F. Other educational animal use	Yes	No	Notes
Are live animals used in other education sessions/presentations?			
If yes, are they touched/handled by the public?			
If yes, what hand-washing facilities are available?			
Is there a written protocol and associated risk assessments for public close contact with animals, including health screening?			
Is there a protocol for ensuring good animal welfare for handling sessions?			

Are full records kept for these animals, on frequency of use as well as husbandry issues?			
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G. Exhibit design	Yes	No	Notes
Is the design and presentation of the zoo's animal exhibits concordant with positive conservation messages?			
Are education staff involved in exhibit design and does the design reflect the stated educational message?			

H. Reference library	yes	No	notes
Does the zoo have an appropriate reference library? (Information should have been provided in the PIA)			
Does it have subscriptions to relevant journals?			
Is the library available to staff?			
Is it available to the public?			
Is internet access available to staff?			

I. Off site education activities	Yes	No	Notes
Does the zoo offer outreach sessions/talks in the local community?			
If yes, what department carries them out?			
If yes, where are they held?			
Are live animals taken out? (This should be covered in the main inspection)			
If so, what is the protocol/provision for animal transport?			
Does the zoo use its website to support off site education?			

J. Resource material	Yes	No	Notes
Is resource material available, such as information sheets, trials or worksheets? (Information should have been provided in the PIA). (Examples of these to be available to inspectors)			

K. Formal education	Yes	No	Notes
Do the programmes available incorporate local and global conservation issues?			
Do these programmes link in with curricula and key stages?			
What data is available on numbers taught, split by age and topic, for the previous 12 months? The zoo should be able to provide data on this.			

L. Networking/staff development - CDP	Yes	No	Notes
(Much of this information should have been provided in the PIA)			
Are staff given the opportunity to attend training? Do education staff attend zoo education conferences/meetings? Regionally? Nationally? Internationally? Have you links with university/museum groups?			
Which appropriate meetings were attended in the previous 12 months?			
To which relevant list servers do education staff subscribe?			
How do staff keep up to date with: Trends in zoo education Trends in formal education Trends in visitor education and research			

The latest biological/wildlife/conservation information/data and thought Museums, schools and science education and research
Does the zoo have any educational partnerships with other organisations? If so, which ones?
Does the zoo have links with local LEAs? Does it receive any grants to assist with education programmes?

M. Health and Safety	Yes	No	Notes
Does the zoo have H&S policies, procedures and risk assessments specific to education activity (eg animal contact)?			
Does the zoo have a child protection policy/statement?			

N. Other educational provision	Yes	No	Notes
What other educational opportunities are available? Guided tours? Lectures? Information stations Biofact touching Interactive displays Data collection exhibits Is there provision for those with learning difficulties and/or visual and other impairments?			

O. Evaluation	Yes	No	Notes
Does the zoo have any evaluation/evidence of the efficacy of its formal education work? Does it have any evaluation for its informal education work? Does the zoo carry out any educational research? Does the zoo carry out any visitor studies research? List publications by education staff List conference talks given by education staff			
Is there any external audit of educational provision and effectiveness?			

In either case give examples:

Examples: (please note that more detailed examples are given in Chapter 3).

- A small bird-of-prey establishment would reasonably carry out most of its education through appropriate signage and flying displays.
- A small zoo may carry out most of its education through appropriate signage and keeper talks or similar and most of the education may be carried out by keeping staff.
- Class rooms are not a pre-requisite of good education – but can assist in this.
- Medium and large zoos/aquariums would be expected to have a member/s of staff allocated solely for educational work and be qualified and undergo continuous CPD.

Chapter 4 Animal Welfare and its assessment in zoos

Executive Summary

The EC Zoos Directive (1999/22/EC) provides that animals must be accommodated under conditions which aim to satisfy the biological and conservation requirements of the individual species; and, in England the Secretary of State's Standards of Modern Zoo Practice (SSSMZP) set out guidance as to how this should be achieved. The SSSMZP can be viewed on the Defra website at the following address: www.defra.gov.uk/wildlife-pets/zoos/

This Chapter aims to assist zoos, and to a limited extent, zoo inspectors evaluate the welfare of zoo animals and, in so doing, to help promote high standards of animal husbandry in line with the requirements of the Directive.

The central concern of animal welfare is that animals should feel well and the best approach to ensuring this, and thus good welfare, is to provide an environment that as fully as possible meets their immediate needs and those for their future welfare.

This chapter outlines various methods or indices – a toolbox - of evaluating welfare, identifying their respective strengths and limitations of each group of methods.

The toolbox of methods for investigating welfare are broadly grouped into behavioural, physiological, and health indicators. In many instances, there is a need to cross-reference between different welfare indices.

The importance of all staff engagement in the assurance of high welfare standards is recognised; and the roles of each type of staff member is described and discussed. It is extremely important that keepers, curators and veterinarians all understand their respective roles and how they complement each other. The link between welfare audit and ethical review is outlined as well as placing welfare assessment in the context of the zoo inspection.

Our knowledge of animal welfare has developed considerably during the past 20 years. Consequently, there is a clear need for continuing training at all levels. The final section of the chapter identifies key areas of staff education and training; it also suggests possible directions for future research, particularly emphasising the need for collaborative projects.

1. Introduction

The zoo community considers animal welfare to be a matter of great importance. The EC Zoos Directive (1999/22/EC) provides that animals must be accommodated under conditions which aim to satisfy the biological and conservation requirements of the individual species and, in Great Britain the SSSMZP set out guidance as to how this should be achieved. Although there is extensive literature on welfare assessment methods, especially for farm and laboratory animals (e.g. Webster & Main (2003), practical guidance on the assessment of welfare of zoo animals appears scant (but see Kirkwood, 1999; Wielebnowski, 2003; Smith, 2004).

This Chapter aims to assist zoos, and to a limited extent, zoo inspectors evaluate the welfare of zoo animals and, in so doing, to help promote high standards of animal husbandry in line with the requirements of the Directive.

1.1 What are the concerns for welfare about?

In contrast to the term 'cruelty' the meaning of 'welfare' has not been explicitly defined in British law (Radford, 2001). The term arose in society (Fraser, 2008) and is one of those that, at least in common use, can represent any one of an assortment of notions: these may be to do with health, pleasant feelings, pastoral harmony or other concepts. The first is ethics. Fraser et al (1997) defined three distinct (if overlapping) ethical concerns that have been encompassed by some in their use of the term:

- (1) *'that animals should lead natural lives through the development and use of their natural adaptations and capabilities,*
- (2) *that animals should feel well by being free from prolonged and intense fear, pain, and other negative states, and by experiencing normal pleasures, and*
- (3) *that animals should function well, in the sense of satisfactory health, growth and normal functioning of physiological and behavioural systems.'*

Therefore, when discussing and assessing animal welfare, it is important to be clear what precisely we mean, i.e. which of these, or other, ethical frameworks are being referred to and why.

The second of these concerns, the quality of subjective feelings, is the central issue. The problem with this, however, is that feelings cannot be measured directly but can only be inferred based on our knowledge of the biology of the animal and its physical state and behaviour. Of course, both state of health and the nature of the environment can affect how animals feel and therefore affect welfare.

Suboptimal health often causes poor welfare but not always. Although many diseases cause pain, discomfort and other unpleasant feelings, not all do. For example, a small, benign and static lipoma (benign tumour of fat) beneath the skin is a defect of health (a lipoma being a type of disease) but it is unlikely to cause any harm to how an animal feels.

Concern that an environment should be natural is often more to do with aesthetics or education than a welfare concern. If animals feel well and are healthy, but are in an environment that does not meet the expectations of some human observers about

naturalness, this may be relevant to the feelings of these human observers but is not necessarily relevant to the feelings of (i.e. the welfare of) the animals.

The central concern of animal welfare is that animals should feel well and the best approach to ensuring this, and thus good welfare, is to provide an environment that as fully as possible meets their immediate needs and those for their future welfare (See Box 1 for discussion of feelings in the animal kingdom). On the face of it, it sounds simple and straightforward. However, some aspects of the issue of what an animal's needs are for its welfare have been the subject of considerable dispute. It has been argued, for example, that mink that are farmed for fur do not need water in which to swim. That, although they are adapted to a river bank environment and swim frequently in the wild, they can be maintained in good health in captivity without having access to swimming water. This argument has been dealt a very serious blow by work which showed that not only were captive mink prepared to work hard to gain access to swimming water but that, denied access to it, their urinary cortisol levels (an index of stress) increased in a way comparable to that seen in mink denied access to food (Mason et al, 2001). The implication being that mink value swimming water very highly and that their welfare should not be considered good without it.

It is to be hoped that there will be much more research of this kind, aimed at helping us to gain insight into what animals themselves rank as important, in the future. Although the results of such work are not the only information we need to make sound judgements for animal welfare (because animals, including humans, do not always make choices that are in their best long-term interests), they can be very helpful – they provide a way of enabling the animals to 'tell' us their own views.

However, it is not yet realistic to think that such detailed scientific approaches can be used to help establish the needs of the animals of all the many wild species maintained in captivity (at least for a very long time). In the meantime, we suggest that a good guiding principle is that, as far as possible animals should be provided with habitats and management strategies that enable them to perform most behaviours that they have evolved to perform commonly in their daily lives in the wild, particularly where the behaviours are of long duration or the animal is motivated to perform them. Animals should be offered a range of behavioural opportunities and given the choice of establishing their own activity patterns where possible. Where there is uncertainty with regard to the behavioural needs of an individual, we should, where we can, err on the side of giving them the benefit of the doubt. This is in line with one of the five key principles set out in the SSSMZP: '*provision of an opportunity to express most normal behaviour*'.

Box 1 Do all animals have feelings?

The animal kingdom is very diverse. It includes species with very large and complex brains and species that have no nervous systems at all. We know, from personal experience, that humans have conscious awareness of feelings and thus the capacity to suffer but it seems very reasonable to doubt that our earliest, unicellular ancestors did. It is very unclear, however, at what point along the way, the capacity for conscious awareness of feelings evolved and which extant taxa have it (Kirkwood & Hubrecht, 2001). The Animals (Scientific Procedures) Act 1986², gives protection to vertebrate animals (and just one invertebrate, the common octopus), reflecting the view that, with few exceptions, the capacity for conscious awareness of feelings is probably limited to vertebrates. However, it has been argued that there is no clear scientific case for drawing the line at this point (e.g. Sherwin, 2001).

As far as possible, it is right to give all animals the benefit of the doubt and to care for them as if they do have the capacity to suffer. But, even in zoos, there are limits to how far this approach can be taken: it would not seem reasonable, for example, to favour the well being of parasitic nematodes in the gut of, say, an elephant over that of their host.

1.2 The purpose of this chapter

The purpose of this chapter is to provide information about the assessment of animal welfare in zoos for zoo personnel and others who may be interested. Some measures may also prove useful to zoo inspectors.

The provisions relevant to animal welfare in the Zoo Licensing Act 1981 (the Act) require zoos to be:

- 1A. (c) accommodating their animals under conditions which aim to satisfy the biological and conservation requirements of the species to which they belong, including-
 - (i) *providing each animal with an environment well-adapted to meet the physical, psychological and social needs of the species to which it belongs; and*
 - (ii) *providing a high standard of animal husbandry with a developed programme of preventative and curative veterinary care and nutrition;*

(Specific sections are included also in the Act (in Section 16E) about 'Welfare of animals following closure of zoo' but these do not define or discuss what is meant by welfare.)

² The Animals (Scientific Procedures) Act 1986 transposed EU Directive 86/609 into UK law. The Directive was replaced by Directive 2010/63/EU in September 2010; the aim of which was to strengthen the protection of animals used in scientific procedures. As well as vertebrate animals the new Directive extends protection to all live cephalopods. The 1986 Act will be amended on 1 January 2013 to bring the new Directive into UK law.

The inspection system under this Act provides a mechanism for formal inspection and auditing of standards relating to these and other subjects. However, although the SSSMZP set out various provisions relevant to the welfare of animals in zoos (based loosely on the Five Freedoms drawn up for livestock by the Farm Animal Welfare Council), they include little information on how welfare should be assessed. A central aim of this chapter is to provide more information about this and, specifically, to outline a ‘toolkit’ of methods for welfare assessment.

Assessment of welfare and auditing the quality of animals’ environments for their welfare, usually involves checking a combination of ‘resource-based indices’ and ‘animal-based indices’, also known as ‘outcome-based indices’. Resource-based indices are features of the environment, for example: presence of a constant supply of fresh water; presence of suitable bedding; and provision of an appropriate thermal environment etc. Animal-based indices are welfare-related characteristics of the animals themselves, such as: presence or absence of pain-causing disease or injury or of behavioural or other signs that may be indicative of poor welfare (see Table 1.1).

Resource-based indices are easy to check, easily measurable and quantifiable but provide no direct information about an individual animal’s welfare. Animal-based indices tend to be inherently more difficult to obtain, because, for example, it is quicker and easier to check that drinking water is provided than that the animal is drinking it. Furthermore, using animal-based indices in some cases may involve making subjective judgments about, for example, whether or not certain behavioural or other signs are indicative of compromised welfare.

Table 1.1: Examples of resource-based and animal-based indices that are or could be used in assessing zoo welfare standards

Animal-based indices	Resource-based indices
<p>The SSSMZP include none at present</p> <p>The inspection includes only one question of this kind:</p> <p><i>‘3.1 Do all animals on display to the public appear in good health?’</i></p> <p>Various questions could be included in future, for example:</p> <p>Do the animals appear to be well-fed and in good body condition?</p> <p>Do any animals show signs of untreated disease or injury?</p> <p>Do the veterinary records indicate unacceptable incidence of any welfare or health problems?</p> <p>Is there a high incidence of abnormal behaviour in any particular species or</p>	<p>The SSSMZP specifies many resource based indices, for example:</p> <p><i>‘1.3 supplies of food and drink to be kept and prepared under hygienic conditions...’</i></p> <p><i>3.7 a comprehensive programme of (veterinary) care must be established...’</i></p> <p><i>4.4 enclosures should be equipped in accordance with the needs of the animals...’</i></p> <p><i>5.5 suitable, separate if appropriate, accommodation for pregnant animals and animals with young should be available.... ‘</i></p>

<p>evidence of such behaviour such as worn pathways or self-induced injuries.</p> <p>What do records indicate relating to intraspecific or interspecific aggression?</p>	
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1.3 Welfare goals in zoos

What animal welfare goals should zoos strive to achieve? The welfare of free-living animals is often very poor. In the ‘struggle for existence’ conditions that probably cause severe pain, stress, fear and other unpleasant feelings are commonplace and routine. Thus the welfare of free-living wild animals can range from good to extremely bad. The goal of zoos must be to emulate the good end of this spectrum and to ensure that, as far as possible, the risks of bad welfare are minimised.

It is not possible to prevent all welfare risks. For example, even under ideal conditions, painful spontaneous diseases can occur. A zoo’s goal should be to carefully manage and minimise those risks that can be managed, to detect and deal promptly with the unavoidable welfare problems that inevitably arise and to provide opportunities for animals to experience positive emotional states rather than simply avoiding negative ones. In addition, zoos should strive to contribute to research and developments aimed at advancing the welfare of wild animals in captivity.

In short, zoos should aim to:

- minimise risks of poor welfare;
- recognise and deal promptly with welfare problems;
- provide animals opportunities to experience positive emotional states; and
- play a role in advancing and disseminating knowledge of zoo animal welfare.

Zoos need effective strategies, procedures and management in order to ensure effective deployment of their resources in pursuit of these objectives.

1.4 Euthanasia as a management tool

Providing it is carried out humanely, euthanasia does not compromise the welfare of the individual concerned. When carried out with respect and for a proper purpose (e.g. welfare or conservation benefit), we believe it is a legitimate part of managing a well-run zoo. In fact, a reluctance to euthanase animals can lead to unnecessary suffering. It is, however, an ethical issue and so should be considered within the ethical review process (see the chapter on the Ethical Review Process). We believe it important to set this out clearly as the subject is one about which there is often confusion (see Föllmi et al, 2007).

1.5 Breeding management

The breeding of animals in captivity has to be controlled. Where all their needs for breeding are met, animal populations increase geometrically. In the wild, population sizes

are regulated by factors such as limits to food or territory availability or the effects of predation and disease. There are two ways by which captive populations can be regulated once the zoo community's carrying capacity for the species has been reached: (i) by preventing breeding and (ii) by euthanasing surplus stock. The decision as to which approach to adopt is not an easy one for zoos.

There may be welfare advantages in allowing animals to breed and euthanasing surplus animals produced, providing euthanasia is done without causing fear or pain to the animal itself or to other animals. This is because:

- (i) breeding provides the opportunity for animals to display a wider range of behaviours that may have welfare benefits and
- (ii) because it avoids the need for contraceptive methods such as keeping males and females apart, castration, vasectomy, and the use of hormonal implants all of which may present some welfare risks. However these are sensitive issues with zoo staff and wider society and need to be discussed carefully (WAZA, 2003).

1.6 Transport

In order to maintain genetic diversity, zoo animal populations are typically managed at national or international level with individuals being moved between zoos for breeding. Transport of animals is an integral part of zoo animal management. Transport is a likely stressful experience for animals and it is important that it is carried out to high welfare standards. The legal framework providing protection for the welfare of animals during transport is established in Europe by the Council Regulation EC 1/2005 of 22nd December 2004 on the protection of animals during transport and related operations (EC Regulation, 2005). Valuable guidance on animal transport is provided by IATA (2011).

It is beyond the scope of this chapter to deal specifically with zoo animal transport but, in any review of zoo animal welfare, the methods and standards of the transport procedures employed should also be taken into consideration.

1.7 Some general comments about assessing welfare

Generally, challenges that cause unpleasant feelings (e.g. fear or pain) that are brief, relatively mild and which are not repetitive, or at least not repeated often, are not considered to have a significant impact on lifetime welfare. Such challenges are often unavoidable side effects of procedures undertaken for animals' benefits, such as vaccinations by injection or being moved to a new and better enclosure. In fact, for those animals, captive or free-living, that have the capacity for unpleasant feelings, such feelings are to some extent unavoidable side effects of the very business of living.

Welfare becomes a matter of concern when unpleasant feelings are more severe, and/or of longer duration or of high frequency, and when the animal is unable to react to limit them, either because it is prevented from doing so by its circumstances or because it lacks the capacity to do so. For example, the mild discomfort that an animal may feel in cold weather when it goes outside despite having the choice of staying in heated indoor accommodation cannot be construed to be a welfare problem. On the other hand, having to endure a colder environment without respite than that to which it is adapted and with which it is unable to cope certainly would be. In assessing welfare, therefore, it is clearly important to consider the severity, duration and frequency of the effects on the animal.

In prioritising the tackling of welfare problems it is appropriate to consider the capacity for animals to suffer and the numbers of animals affected. All else being equal, it makes sense to address problems that affect the largest numbers of animals with the greatest capacity to suffer first. See Box 2 for discussion of how welfare needs may vary with sensory and cognitive capacities between species.

1.8 What kinds of problems may threaten the welfare of zoo animals?

Adequate welfare is dependent upon meeting animals' needs for: food; water; thermal environment; lighting; space; environmental features (for foraging, resting, sleeping, exercise, escape from disturbance, etc); social interactions; and for the maintenance of good health (Companion Animal Welfare Council, 2003). As with other animals, domesticated or wild, that are dependent upon humans, welfare problems may arise through either a lack of knowledge of these needs or how they can best be met, or through the absence or application of the resources with which they may be met. See Box 2 for discussion of how welfare needs may vary with sensory and cognitive capacities between species.

Lack of knowledge may be absolute, that is, unknown to anyone (e.g. the required dietary concentration of the species for vitamin A may be unknown) or, in other cases, it may be that the knowledge exists somewhere in the world but is not accessible, understood, or applied where it is needed. These issues are discussed in the Companion Animal Welfare Council's (2003) Report on *The welfare of non-domesticated animals kept for companionship* (at pages 28-29 in the CAWC Report).

Box 2 Variation between species in sensory and cognitive capacities and how this may affect welfare needs

It is widely accepted that there exists significant variation among animals in their capacity for conscious awareness; in other words the capacity for feelings, emotions and cognitive processes of which the animal is aware. The capacity for feelings of pain and fear may, for example, have arisen early in evolution and be widespread, whereas other feelings may be associated with sensory systems or cognitive abilities that are not widespread.

In the words of the Companion Animal Welfare Council's report on the welfare of non-domesticated animals kept for companionship:

'amongst those species that share our capacity for conscious awareness, there are...likely to be differences in the ranges of sensory or cognitive phenomena which they are able to experience, and which might therefore cause suffering. For example, animals belonging to species which do not possess eyes cannot suffer photophobia; those which are non-territorial are less likely to be stressed by the close proximity of conspecifics; and it is likely that only those which can perceive ultrasound will be at risk of mental discomfort from exposure to high intensities of it.

In a recent review of the use of primates in scientific procedures, the Boyd Group (2002) considered that there was strong and clear evidence that great apes have complex mental abilities similar in some important ways to those of humans including: 'a sense of self and insight into their own thoughts and feelings, a developed sense of time and purpose, so that they can think about the future and reflect on the past, and an ability to empathise with the thoughts and feelings of other members of their own species. The Group concluded that these mental abilities are likely to enhance the capacity of these animals for suffering to such an extent that it is unethical to confine them in laboratories for research or testing. It would seem reasonable to take this enhanced capacity for suffering into account whenever these animals are maintained in captivity, regardless of where or the reason for which they are kept.

To summarise, there are grounds for believing it likely that differences exist between species in their capacity to suffer when kept in less than ideal circumstances..... Animals with greater cognitive powers may be able to suffer in ways that others with simpler minds cannot. The needs of all animals should be met as fully as possible and, as a general proposition, there may be a greater risk of failing to meet the psychological needs of those with more complex minds.'

1.9 The development of animal welfare in zoos

Since the early 1800s, when interest in zoological collections began to develop internationally, attitudes as to what constitute acceptable and good standards of animal care have changed a great deal. Systems of animal keeping in zoos, on farms, in laboratories, and as pets in the home have been subject to scrutiny, re-evaluation, and re-development in the light of growing knowledge of animal biology and the ethical implications of the deeper understanding of welfare needs that this has brought about

(Kirkwood, 2003) as well as the development of new equipment and facilities design or management systems.

Developments in animal welfare law reflect these changes in attitude. The aim of the first animal protection legislation in the 1800s was merely to prevent cruelty, whereas modern laws (e.g. the Zoo Licensing Act and the EC Zoos Directive 1999/22/EC) require that animals are accommodated under conditions which aim to satisfy their biological requirements. The Animal Welfare Act 2006 requires that animals do not suffer unnecessarily and that persons responsible take all reasonable steps to ensure that they meet the following animal needs, which are set out in that Act as follows:

- (a) its need for a suitable environment;
- (b) its need for a suitable diet;
- (c) its need to be able to exhibit normal behaviour patterns;
- (d) any need it has to be housed with, or apart from, other animals; and
- (e) its need to be protected from pain, suffering, injury and disease.

Many factors have played a part in stimulating the great emphasis now given to animal welfare and zoos have contributed to this. There is little doubt that, as a result of the growing interest in animal welfare science in zoos and elsewhere, there will be many further developments for the improved welfare of captive wild animals in the coming years.

It is perhaps worth noting that attitudes to animal welfare have changed over time but are also subject to regional variation. Even within 'western' cultures there are distinct regional approaches, for example North American zoos tend to have a greater veterinary health emphasis in their approach to zoo animal welfare compared to British and Irish zoos which tend to take a more biological and behavioural approach to achieving zoo animal welfare.

1.10 Dealing with situations in which the use of animals for conservation, research or education may not be in the best interests of the animals involved.

There can be occasions when the use of animals in conservation programmes may not be in the best interests of the welfare of the animals involved. For example, where animals are translocated from the wild or released from captivity to re-stock habitat from which the species had become extinct, this may be very important from the perspective of preserving biodiversity but a welfare risk factor to the translocated/released animals. Such conflicts can occur also with the use of animals in research and education, and whenever animals are held in captivity.

Ethical dilemmas like these or similar to these cannot be avoided in zoos or in any other circumstances in which we are responsible for animals. Dealing properly with these dilemmas is an important matter. However, it is not addressed in this chapter as the matter is covered by the chapter on the ethical review process. The use of animals in any scientific procedure that may have the effect of causing pain, stress or lasting harm is regulated under the Animals (Scientific Procedures) Act 1986 (see footnote 2).

2. The 'toolbox' of welfare assessment methods

2.1 Approaches to assessing welfare

This section outlines three general approaches that can be used to assess welfare in a zoo setting. The relevance and practicality of each approach to zoo personnel and zoo inspectors are discussed.

Methods used to assess welfare are discussed in section 2.2.

2.1.1 Hands-off visual inspection of animals as a tool for assessing welfare

Regular (typically at least daily) visual inspection of animals is the mainstay of good stockmanship and is a requirement under the SSSMZP. It involves observing the animals and identifying those that are either behaving differently or look different from the norm and noting changes over time that may have a relevance to welfare.

Extensive knowledge and experience of the species and individuals concerned, during all its life stages and in different situations is required to pick up some of the more subtle changes but others, such as a broken leg, should be obvious to all.

Differences from the norm are often indicators of underlying health problems and their identification forms the first part of any veterinary examination. Assessments may take the form of recording general clinical observations or using 'score sheets' (e.g. Hawkins 2002). This method is probably best suited to keepers and vets but inspectors can review records from the zoo and/or a series of inspections.

Signs of psychological and other chronic stressors might be better identified using other techniques such as those described under Behavioural Indicators (2.3) and Physiological Indicators (2.4).

2.1.2 Inspection of health, husbandry and demographic records as a tool for assessing animal welfare

All zoos must keep basic health, husbandry and demographic records under the SSSMZP. These include animal inventories, births, deaths, movements, results of post mortem examinations, clinical findings etc. Simple analysis of these data (looking for differences from the norm – see Section 2.2 for a discussion of what constitutes the 'norm') can yield information that may indicate an underlying animal welfare problem.

Systematic analysis of records should be undertaken by zoo keepers/curators to highlight any welfare problems, for instance during annual welfare audits (see section 3.4). This should include a review of mortality and breeding rates, any reproductive problems, any persistent health issues and significant post mortem findings. Results of such analyses can then be reviewed by zoo inspectors.

Interpretation of demographic data must be treated with caution; there has for example been a tendency for zoo animal life expectancy to be measured against wild maximums and zoos have responded in boasting about longevity records for specific taxa. However, half of all animals born in zoos will die at ages younger than the average, and to compare each individual's longevity with a wild maximum is clearly flawed. Furthermore, it is just not possible but probable that in many cases the life time welfare of shorter lived animals

may have been higher than those animals kept alive well beyond any wild norm where degenerative health conditions become prevalent which ultimately compromise welfare. Thus a zoo that euthanizes animals at a species specific prescribed age to limit exposure to age related welfare compromises may be able to safeguard higher welfare standards than a zoo that embraces geriatric animal care as a principle and in doing so has a much higher life expectancy amongst its animals.

2.1.3 Scientific research as a tool for assessing animal welfare

Systematic, scientific study can yield valuable information on the welfare state of individual animals. Deviations from the 'norm' (see Section 2.2 for a discussion of what constitutes the 'norm') in behavioural and/or physiological welfare measures can indicate a problem and comparisons between groups subject to different conditions (e.g. enrichment regimes) can provide insight into factors associated with good and poor welfare and suggest ways to make improvements. Such systematic studies can vary in form from observational studies with little or no impact on a captive animal's life, to experimental where elements of the animal's environment, diet, social situation etc are manipulated through to investigative medical procedures typically requiring restraint and possibly invasive elements. The methodology of the assessment must be proportional to the welfare return for the animal, thus the threshold for considering an invasive veterinary procedure with the inevitable risks associated with the procedure and stress for the animal should be greater than the threshold for an assessment based on sampling faeces collected from an animal's enclosure. Such cost-benefit comparisons should be subject to the ethical review process (see the chapter on the ethical review process). The use of invasive investigative techniques should be considered under the Animals (Scientific Procedures) Act 1986 (see footnote 2).

Scientific studies are far more labour intensive than the other methods discussed above and require scientific expertise. Conducting rigorous scientific studies in a zoo setting can be problematic in terms of generating sufficient sample sizes and attaining statistical independence but these can be overcome, at least to some extent, with careful design and collaboration with other collections (Plowman 2006).

Results of scientific studies published in peer-reviewed journals also help zoo keepers, curators and inspectors keep up to date with advances in knowledge (see Section 3).

2.2 Welfare 'tools' or indices

In the following sections a variety of 'tools', or indices, are described that can be used in reaching an assessment of the welfare status of animals. As far as possible each section includes the following (as appropriate):

- a brief description of the tool and why it can be useful in welfare assessment;
- approach(es) required to use the indicator, from those discussed in section 2.1.1 to 2.1.3 above.
- caveats and limitations in its use;
- where necessary, mention of what other measures would help in interpreting the results that this tool yields; and
- example(s) showing clearly how the tool can be used in practice.

We cannot know how another animal feels, we can only make inferences about this based on our assessment of its physical state and behaviour, taking into account our knowledge of its neural capacities and in the light of our own experiences (Kirkwood, 2004). In view of the obvious difficulties, it is appropriate to be cautious about making such inferences. In the sections below various methods used in the assessment of physical state and behaviour relevant to this process are outlined.

Some of these 'tools', used alone, can enable reliable welfare assessment. For example, if a review of disease prevalence reveals that a high proportion of individuals of one species have been chronically and severely lame, there is little to be gained by looking for subtle physiological indices of compromised welfare also. In other cases, it is important to use more than one method or approach in making an assessment of welfare. Behavioural observations are often crucial in being able to properly interpret physiological measurements. For example, heart rate may be raised when animals are playing or when they are fearful and trying to escape. Without behavioural observations, the welfare significance of an elevated heart rate could be wrongly interpreted.

Some tools address different facets of the same underlying problem (e.g. behavioural observations may identify excessive licking and observations of physical state may identify skin wounds due to excess licking).

Judgment has to be exercised in deciding which of these tools, or which sets of them, should be used. The most appropriate combination will depend on the species and individual circumstances. The sections below will hopefully be helpful in providing guidance about which are the most applicable in various situations.

For all the tools discussed below, the observed level or value must be compared with a baseline to determine how normal or abnormal it is, and by inference, the degree to which the animal's welfare is impacted. Behaviour that differs quantitatively from the 'norm' can indicate welfare is poor. For example, depressed activity or over-eating and -drinking can indicate a problem, as can high levels of mortality.

The question is what benchmark should be used as the norm? For some measures, captive conspecifics considered to be in good mental and physical health may suffice, but healthy wild animals in well-protected, well-provisioned populations provide a benchmark for animals unaffected by captivity itself and may often be more valid.

Most welfare studies focus on assessing whether animals experience poor welfare; but well-being is not just the absence of suffering but also the experience of positive emotions. More recently, attention has turned to indices of positive emotional states, such as play and social contact (Boissy et al 2007).

As noted above, some of the tools expanded upon in this section can give instant feedback as to whether an individual is suffering from poor welfare (e.g. whether the animal has a broken leg). Others may reveal signs of a history of welfare problems (e.g. some stereotypies) but require other information before it can be determined whether the welfare problem is ongoing or historical. Other tools involve proactive sample collection and may be particularly useful in comparisons of how different husbandry practices affect welfare (e.g. cortisol levels).

Some lend themselves for use in initial or preliminary assessments, others to deeper, more detailed or specific assessments that may be useful, particularly, where simpler measures have indicated that there may be a problem.

Some lend themselves for routine use in monitoring welfare. Other tools cannot be readily used in this way (because of technical challenges or because data on normal parameters and the factors affecting these have not yet been established) but may be valuable in research into specific welfare issues, for example, to investigate the impact of particular changes to husbandry practices or changes to the environment.

Three categories of welfare assessment tools are outlined below. These are:

- behavioural indicators of welfare;
- physiological indicators of welfare; and
- clinical and pathological signs as indicators of welfare.

Whilst it is useful here to categorise the tools under these three headings, there is in many cases some overlap between them. For example, observations of an animal's demeanour and behaviour may provide information both on its psychological state and on whether it is suffering from disease or injury.

Each measure has its own strengths and weaknesses, some of which are highlighted in the '*Caveats and limitations*' section and so it is recommended that several measures are used when trying to assess welfare.

2.3 Behavioural indicators of welfare

2.3.1 Approach/avoidance behaviour

Background and why this tool can be useful

Approach and avoidance behaviours generally indicate stimuli that cause positive or negative emotional states, respectively.

Strength of preference can be measured by asking animal to 'pay' for access to resources (e.g. push weighted doors: Mason et al. 2002; climb ramps: Nicholls 2003) and comparing 'price paid' for a resource with that for known preferred resources like food. This can give an indication of what resources are important from the animal's perspective.

Evidence includes results of neuroscience research, showing that signals of emotional value play key roles in selecting behaviour (e.g. Rolls, 1999); humans' reported feelings while performing preferred or non-preferred behaviours (e.g. Cabanac, 1971; Small et al., 2001); and data from preference studies in mink, which showed that they have elevated cortisol outputs when denied strongly preferred resources, but not when denied less preferred ones (Mason et al., 2001). Approach and avoidance are thus potentially useful for assessing the value of enrichments, or the aversiveness of e.g. crowd noise.

Caveats and limitations

There are several 'cautions' in the use of approach and avoidance in welfare assessment. For example: (i) animals may sometimes approach stimuli that elicit aggression or fear (e.g. when inspecting predators or rivals); (ii) the cause of approach/avoidance may not be what is first assumed so potential confounds should be controlled for in experiments, (iii)

simple measures of time spent with a stimulus does not reveal the strength of preference (cf. e.g. Mason et al. 2002) - an important point when evaluating environmental enrichments; and (iv) some measures of preference can be affected by cues from resources on offer (Warburton and Mason 2003) and so care must be taken if extrapolating results to animals without such cues.

Example of use

If observations of an animal (of a sort that we believe likely to have conscious feelings) reveal that it persistently avoids certain parts or features of its environment or another individual animal, then it is possible that this aversion is associated with unpleasant feelings (e.g. fear, apprehension). More careful study will be needed to verify the specific cause of such avoidance. Judgment about the welfare consequences will depend upon whether or not the animal appears to be able to distance itself sufficiently from the aversive feature and the intensity of the aversive behaviour shown. The use of other welfare indices will help make an assessment.

Conversely, if animals show no signs of apprehension in approaching features or parts of their environments that might be suspected to cause aversion (e.g. fence lines where they may be in close proximity to humans), then there is no reason to infer that they are aversive. Clearly, in drawing such inferences all the circumstances need to be taken carefully into account.

Approach/avoidance has been used in several zoo studies (e.g. Ogden et al 1993; Ludes-Fraulob and Anderson 1999; Meller et al 2007). Few have employed methods of strength of preference in zoos (although see Nicholls 2003 for an example) but such techniques have been successfully employed in other captive settings to investigate, for instance, how motivated laboratory mice are to access more space (Sherwin 2004) and how much farmed mink like to swim (Mason et al. 2001).

2.3.2 Fearful behaviour

Background and why this tool can be useful

Fear is a normal adaptive emotional state that serves to keep animals out of danger, but prolonged and/or inescapable fear can cause poor welfare and suffering.

Fearful behaviour includes approach/avoidance (covered above), freezing, startle, shivering, attempts to escape and aggression.

Fearful behaviours can also be used to assess an animal's underlying state of anxiety. Anxious animals will typically show a heightened fear response when exposed to mildly aversive stimuli, such as when humans startle more easily when stressed.

Caveats and limitations

Behaviours indicative of fear will vary between species and the nature of the threat. Observers must therefore be trained to recognise fearful behaviours in the species in question.

Example of use

Fearful behaviours have often been used to assess how animals react to people, such as their keepers or visitors. For example, Carlstead et al. (1999) found that fearful behaviour

in male black rhinos increased with the proportion of the enclosure perimeter open to visitors, which also positively correlated with rhino mortality.

2.3.3 Incidence and intensity of stereotypies

Background and why this tool can be useful

Stereotypies have been redefined as 'repetitive behaviours induced by frustration, repeated attempts to cope and/or central nervous system (brain) dysfunction' (Mason 2006). This definition excludes repetitive behaviours that do not indicate a welfare problem, such as a dog circling before lying down to sleep. Typical examples of stereotypies including repeatedly following the same path (e.g. pacing) and head-swaying.

Stereotypies are considered to be indicators of poor welfare for three main reasons: (i) they are linked with environmental conditions generally considered aversive, for example restricted feeding (e.g. Bildsøe et al. 1991, Rushen et al, 1993) and social isolation; (ii) they often develop from attempts to perform specific behaviours, suggesting frustration (e.g. repeated escape attempts in caged laboratory mice); and (iii) they are often linked with other signs of stress, such as enhanced corticosteroid outputs (e.g. von Borell & Hurnick 1989; Wielebnowski et al. 2002; Mason & Latham, 2004). In addition to their role as indicators of poor welfare, stereotypic behaviours may lead to further harm for example through persistent skin abrasion caused by repetitive behaviour.

Caveats and limitations

Stereotypies do seem to be reliable signs that an environment is, or has been, inadequate. There are two caveats when using stereotypies in welfare assessment: (i) stereotypies may help the animal to cope, and (ii) occasionally, they represent 'scars' of past poor conditions. Thus non-stereotyping animals may sometimes be even worse off than stereotypers. Physically preventing a stereotypy may be counter-productive and so should be avoided. Instead steps should be taken to identify the cause of the stereotypy and a management strategy implemented to reduce any identifiable triggers if possible. Because of these limitations other welfare indicators should ideally also be used in welfare assessment (see Mason & Latham, 2004).

Example of use

Some stereotypic behaviours (e.g. pacing) will be clearly visible during hands-off visual inspections but more complex behaviours (e.g. route tracing in birds and fish) may only become apparent after careful observation. Careful scientific study is required to investigate causation, implications for the animal's current welfare status and to identify means of reducing the behaviour and improving welfare.

Careful observations should be made to determine if an animal is showing stereotypic behaviours and, if so, to determine when, under what circumstances, how often and for how long. If the stereotypy has developed recently then it is likely that this is a reflection of some recent or current environmental problem for the animal. If the animal has behaved this way for a long period, and particularly if it developed the behaviour whilst in another environment (e.g. another zoo) then it may be a behavioural 'scar' rather than an indication of current environmental deficits. However, great care should be taken in making this assumption and one should not assume improvements cannot be made - treatments may simply take longer to affect well-developed stereotypies (e.g. Meehan et al. 2004).

Most zoo studies evaluate simply the presence and frequency of stereotypes but use of other measures can help identify underlying mechanisms and thus how best to reduce the behaviour. For example, measuring how animals react when interrupted mid-bout could help identify if the stereotypy really is a 'scar' from the past (Mason et al. 2007).

2.3.4 Over-grooming and other self-harming behaviours

Background and why this tool can be useful

Self harming behaviours are known to occur in humans who are suffering from a range of psychological disturbances and have also been observed in animals. They can range from mild self-harms such as over-grooming to severe bite wounds.

Over-grooming can result in areas of bald skin or clipped fur or feathers. Before it is assumed that the cause is psychological, the many infectious and non-infectious causes of skin irritation have to be ruled out. This behaviour is not completely understood, but seems a likely welfare indicator for two main reasons. Firstly, it is typically more prevalent in conditions that seem sub-optimal; for example fur-biting is seen in farmed mink, but has never been seen in free-living wild mink (reviewed Mason, 1995), and isolation and/or barren housing conditions increase feather-plucking in parrots (Meehan et al, 2003). Secondly, these behaviours appear to resemble obsessive-compulsive-type behaviours in humans (e.g. Garner et al, 2003, 2004), an issue of welfare significance because obsessive-compulsive disorders are often associated with elevated anxiety. Excessive over-grooming type behaviour may lead to skin wounds.

Caveats and limitations

As mentioned above, there are many other possible causes of damage or loss to pelage and these need to be ruled out before it can be concluded that the over-grooming has a psychological cause related to poor welfare. Animals may over-groom themselves or conspecifics, and it should not be assumed that the animal with the affected pelage is the one with the problem: careful observations must be made to identify the over-groomer.

Example of use

Detection of over-grooming should raise the suspicion that some aspect or aspects of the environment are suboptimal. Determination of the cause of the problem is likely to require other observations and investigations about the animal and its environment.

Other potentially self-harming behaviours that may reflect poor welfare include abnormalities of eating and drinking.

The consumption of substances that are potentially harmful can be a result of an inadequate diet but is also associated with inadequate captive environments. For example, *coprophagia*, the eating of faeces occurs naturally in some species, particularly herbivores but where this is not a normal behaviour or is done excessively it can be an indicator of poor welfare. The eating of vomit is rare in wild animals and may be indicative of health or psychological problems (Hill, 2009). Some animals are known to eat substances that have little or no nutritive value (*geophagy*, for example parrots eating dirt). This practice can fulfil the purpose of detoxification, and is found in many taxonomic groups including primates, parrots, koalas and some reptiles (Gilardi, *et al.*, 1999). If this behaviour is observed in captivity, it may indicate high tannin or alkaloid components in the diet. This may be a particular issue for free-ranging enclosures that include native vegetation.

Polydipsia is the excessive consumption of water and can be spread over a period or may be concentrated over a relatively short period of two or three hours. Excessive drinking (apart from that related to renal and other diseases), with a two to four-fold increase above normal intake has been seen in some animals in close confinement (Fraser and Broom 1990).

2.3.5 Apathy and cognitive bias

Background and why this tool can be useful

In humans, behavioural apathy (low levels of activity, excessive sleeping/resting) can be caused by chronic stress, depression and anhedonia (impaired abilities to feel pleasure) (e.g. Leonard 2002; Feil et al. 2003; Pruessner et al. 2003), and in laboratory animals, similar depression-like states can be induced by isolating animals, exposing animals to repeated aggression and defeat, or repeatedly disrupting the cage environment (see e.g. Gambarana et al. 2001). Excessive inactivity could therefore indicate apathy. However, high levels of resting/sleeping may also be adaptive; animals have evolved to minimize unnecessary energy expenditure (see any optimal foraging text, for example), and activity levels can also be affected by e.g. reproductive state (e.g. Joergensen 1985), and ambient temperatures. To identify welfare-related apathy, one therefore needs additional data on libido, and interest in food 'treats' and/or environmental enrichments.

More recently, emotional state has been measured in animals by looking for 'cognitive bias'. Humans that are anxious or depressed have a more pessimistic outlook and similar bias has been found in animals. Animals in a negative emotional state tend to react pessimistically when faced with an ambiguous stimulus whereas those in a positive mood react optimistically (Mendl et al, 2009).

Caveats and limitations

Levels of activity vary greatly between species and within species. Determining abnormally high or low levels of specific behaviours or of state of arousal in general is therefore not easy and requires data on normal levels against which comparisons can be made. Within species, levels of activity in healthy individuals can vary with age, sex, breeding status, season, environmental temperature, social environment and other factors.

Cognitive bias as a measure has the advantage of being unaffected by many of the factors that influence other welfare measures, such as activity levels and arousal (see Mendl et al, 2009 for a full discussion of strengths and weaknesses of this technique).

Example of use

Where one of a group of animals persistently shows a much lower level of activity than the rest a welfare problem should be suspected. States characterised by low levels of activity are seen in a wide variety of systemic diseases (often associated with feelings of malaise) and, as suggested above, may be caused by some types of repeated stresses.

Carefully designed scientific studies have measured cognitive bias in a range of species, although none to date in zoo animals. For example, wild-caught starlings were trained to expect an instant or delayed food reward depending on whether a light was on for a short or long time. When exposed to a medium duration light, birds kept in large enriched cages (known to be associated with better welfare) expected instant food whereas those in

smaller, unenriched cages expected delayed food, i.e. they were more pessimistic (Matheson et al, 2008).

2.3.6 Poor maternal care/infanticide

Background and why this tool can be useful

Poor maternal care and infanticide are warning signs that there may be welfare problems for three reasons: (i) in humans, it is linked with stress and depression; (ii) in a range of other species, it is increased by manipulations that are probably sub-optimal/stressful, e.g. changes to the social or physical environment, low ambient temperatures, and food restriction (reviewed Clubb & Mason 2002); and (iii) in zoo gorillas, it is associated with elevated cortisol outputs (Bahr et al.1998).

Caveats and limitations

Many factors may affect infant mortality rates and determining the role of maternal competence in specific situations can be difficult. Experience is a major determinant of maternal behaviour, and this needs to be taken into consideration when making welfare inferences based on assessment of maternal competence. Whether or not normal maternal care was received in infancy affects maternal competence in adulthood, and having prior experience of infants can also be important for full maternal competence, especially in naturally social animals (see discussion for various primates in Kirkwood & Stathatos, 1992).

Example of use

Infanticide and poor maternal quality may indicate poor welfare. They may be secondary, for example to maternal disease or be caused by stress to the mother or a suboptimal physical or social environment. However, many other factors have to be carefully taken into account before concluding that infant mortality or failure to thrive can be ascribed to poor welfare of the dam as it may be due to other factors acting directly on the infant (e.g. climatic factors).

2.3.7 Hyper-aggression

Background and why this tool can be useful

Aggression is a normal part of the behavioural repertoire of social species. However aggressive interactions that result in injury pose a welfare problem. A high level of non-injurious aggression also has the potential of reducing welfare and the threat of aggression can have harmful psychological effects on potential recipients and reduce access to resources such as food or resting areas.

The welfare of individuals of group-housed animals unable, because of the restrictive nature or design of their captive environment, to avoid exposure to the aggression of a conspecific may be compromised. This may be exacerbated when group composition differs from that usually occurring in the wild. Frustration, associated with some suboptimal factor in the environment, may be causal factor in high levels of aggression (Carlstead 1986). Pain and frustration result in increased aggression in a number of species (Morton and Griffiths 1985).

Caveats and limitations

The diagnosis of hyper-aggression (excessive aggression) depends upon knowledge of normal levels of aggression in terms of frequency and intensity of aggressive behaviours. Frequency and intensity of aggressive behaviours are affected by many factors (e.g. age, sex, season) and so making a firm diagnosis that aggression is excessive and a firm inference that this is due to some suboptimal aspect of the environment is difficult. Other investigations are necessary (for example to rule out that the observed aggression is outside normal limits or that it is not due to some underlying painful condition) before such conclusions can be drawn.

Example of use

For the reasons outlined above, levels of aggression judged to be abnormal should be further investigated as they may be a reflection of underlying welfare problems. Many species (particularly, but not exclusively, primates) exhibit reconciliation behaviour after aggressive interactions that aids in the avoidance of further aggression in the future. Such behaviour is important in reducing welfare problems associated with hyperaggression. Evidence is now emerging that indicates that the abilities or willingness of individuals to engage in such behaviours may be affected by the quality of rearing conditions (Kempes, *et al.*, 2009). In particular, the importance of social contact with mother and other young individuals has been highlighted.

2.3.8 Play

Background and why this tool can be useful

Welfare studies often focus on negative welfare indicators but good welfare is not simply the absence of negative experiences. It is also, and perhaps more so, the presence of positive experiences such as pleasure. Play is considered one of the main positive welfare indicators.

Although mechanisms and functions are still under debate, play has been linked to good welfare for several reasons: (i) it tends to increase when conditions are good and decrease when they are poor, (ii) it is a rewarding behaviour in itself and (iii) the performance of play may lead to short- and long-term benefits to the individual concerned. As play is socially contagious, it could also spread good welfare to others in the population.

Caveats and limitations

Play varies greatly between individuals and species and so can be difficult to define. It can be difficult to disentangle factors that affect play that are relevant to welfare from those that are not, such as age, sex, species and personality (reviewed by Held and Spinka 2011).

Factors associated with poor welfare can sometimes lead to increased play, such as reduced parental care or socially stressful situations (reviewed by Held and Spinka 2011).

Play fighting can often lead to fighting for real, which would obviously not indicate good welfare, and the line between the two can be blurred.

Previous conditions can affect the behaviour. Animals housed in conditions that prevent or restrict the performance of play will often show a marked increase in the behaviour when moved to less restrictive conditions; a phenomenon known as 'rebound' (Boissy *et al* 2007).

Example of use

Play behaviour is common in mammals but particularly so in young animals. Broadly speaking it falls into one of three main categories: social play, locomotory play and object play.

As play is likely to be seen sporadically, recording protocols should be designed to capture bouts of the behaviour. A complete absence of play may indicate poor health or welfare of the individuals, instigating further investigations, but caveats of the measure outlined above should be borne in mind.

Play has been used, amongst other measures, to investigate the effect of changes to the captive environment on welfare, such as visitor numbers, space and environmental enrichment (e.g. Todd et al. 2007). Care must be taken when interpreting results as manipulations, such as adding toys for enrichment, may provide more opportunities for play.

In addition to play frequency, the quality of play may change in response to environmental conditions. As reviewed by Held and Spinka (2011), Barrett et al. (1992) recorded not only a reduction in play in wild gelada baboons but also a switch to less physical forms of play as rainfall reduced.

2.3.9 Allogrooming/allopreening

Background and why this tool can be useful

Allogrooming and allopreening involve one animal grooming or preening (in the case of birds) another. It is seen in a range of species, including primates, cats and parrots.

As well as helping maintain body condition such behaviour plays a very important role in maintaining social bonds and reducing tension in groups. Being groomed is thought to have a 'soothing' effect as it is associated with reduced heart rates and stress levels. It is generally regarded as having value as an indicator of positive emotional experiences.

Caveats and limitations

Allogrooming and allopreening is only seen in social species and some social species display very little.

The behaviour can be affected by several factors, such as season, social structure and reproductive state in horses (reviewed in Boissy et al. 2007).

An increase in allogrooming or allopreening can be seen following aggressive, and likely stressful, encounters. Some studies have found higher levels of allogrooming in barren environments, associated with poor welfare, compared to enriched conditions.

Example of use

Rates of allopreening and allogrooming have been used to investigate the impact of changes to an animal's husbandry and captive environment. For example, the effect of foraging enrichment on captive parrots (Coulton et al. 1997) and the impact of housing common marmosets in larger, more complex cages (Kitchen and Martin 1996).

When designing any such experiments, consideration should be given to the caveats listed above.

Research may be required to establish what level of allogrooming or allopreening is associated with good welfare in the species in question as abnormal behaviours, such as tail-biting or over-grooming (see above), can develop.

2.4 Physiological indicators of welfare

2.4.1 Physiological changes associated with stress in zoo animals

Stress affects all living creatures and is a normal and important aspect of life. Effective response to environmental challenges is paramount for biological fitness. Animals seem to switch between behaviours according to rules of thumb, and these have evolved within species under natural conditions in the wild. In captivity, some of these decision rules may be redundant or inappropriate (Barnard, 2004, p 81-82). Therefore, observation of stress responses should be interpreted in the context of the evolutionary background of the species. However chronic stress, characterised by the longer lasting, adverse effects of a stressor, or extreme but short term levels of stress such as that associated with a novel and/or an extremely aversive or frightening situation, are obviously of concern since they may lead to pathological changes such as immuno-suppression, weight reduction, depression, apathy and long term behavioural changes.

Physiological indicators of stress are frequently used in studies of the welfare of farm and laboratory animals but have only quite recently begun to be applied for welfare studies in zoos. The development of non-invasive techniques has raised the possibility of their more widespread use in future for welfare monitoring (Hawkins et al, 2003).

It is not in the scope of this chapter to describe the various physiological changes associated with exposure to a stressor and how responses are controlled via the central nervous system (CNS) and the endocrine system. A stress response can be measured as a change in the animal's behaviour and the associated changes in its autonomic and neuro-endocrine systems. Currently most scientists agree that the animals' perception of the nature of the stressful situation is a major determinant of the intensity of its response. For example, where an animal has some control of its environment, and/or can predict the occurrence of the stressor, there is a reduced stress response. One of the main stressors for many captive wild animals, particularly those kept in a zoo environment, is a lack of control or predictability within the environment. Potentially this may lead to a situation where the animal experiences chronic stress.

The function of the stress response is to maintain homeostasis, and so behavioural and physiological changes that enable the animal to cope with or adapt to a stressful situation should not be viewed as problems in themselves. Significant welfare challenges occur when the animal is unable to cope or adapt fully. However, establishing the values of the various physiological parameters that reflect this point is not easy. This is a relatively new area for research, and there is much more to be learned about the causes of stress in zoo animals and the way that animals differ at both species and individual level in their methods for coping. In addition, levels of stress are extremely difficult to assess, and the way that a stressor is perceived may differ between individuals, for example, depending on their previous experiences.

Although various techniques are available for the measurement of physiological responses to stress there are problems with using many of these for assessing zoo animal welfare. These problems include those related to obtaining the required samples and the effects on the animal of their collection.

The main methods for measuring physiological stress responses are based on investigations of the following endocrine systems and indices of fitness and reproduction.

- Sympathetic-Adrenal-Medulla axis (SA)
 - a. Adrenalin/Noradrenalin
 - b. Heart rate
 - c. Respiration rate
 - d. Body temperature

- Hypothalamic-Pituitary-Adrenal axis (HPA)
 - e. Adreno-corticotrophic hormone (ACTH)
 - f. Corticosteroids (e.g. Cortisol)
 - g. Vasopressin (AVP)
 - h. Follicle stimulating hormone (FSH)
 - i. Testosterone
 - j. Prolactin
 - k. Oxytocin
 - l. Body temperature
 - m. Immune function

- Neurotransmitters
 - n. Dopamine
 - o. Serotonin

- Fitness/Reproductive ability
 - p. Body weight changes
 - q. Feed and water intake
 - r. Number of offspring
 - s. Reproductive hormone levels
 - t. Immune responses

Only a few of the physiological measures used in studies of farm and laboratory animal welfare have the potential for practical use for welfare assessment within the zoo environment. In general the limitations include those associated with catching and restraining animals to fit the necessary monitoring devices or to collect samples as these procedures themselves may be associated with welfare costs. Many controlled studies of farm animal welfare require the animal to be constrained in some way (e.g. to be kept away from other members of the social group to prevent damage to equipment), or to be caught and sampled regularly. This is obviously problematic if the animal is unused to being handled, is dangerous, or becomes easily stressed.

A selection of the physiological measurements that have previously, or may in the future, have potential for assessing zoo animal stress are discussed below.

2.4.2 Heart rate

Background and why this tool can be useful

Heart rate measurement has been used effectively for tracking changes associated with particular stressors using radio telemetry. Typically the animal must be fitted with a transponder that transmits heart rate, ECG or other data for analysis. Where heart rate has been used to assess transport stress in wild ungulates (Roe deer, Montane et al., 2002), it has proven to be of limited value.

When viewed in conjunction with behavioural data, heart rate can provide additional information that may be helpful in drawing inferences about the animal's subjective feelings.

Caveats and limitations

Many factors affect heart rate, e.g., size, age, sex, environmental temperature, activity level, and emotional state. Heart rate can be raised under circumstances in which animals are probably feeling pleasure (e.g. in a predator that has just successfully chased and caught its prey) and in which they probably have unpleasant feelings (e.g. in the prey that has just been caught). So the relevance of elevated (or reduced) heart rate to welfare state cannot be interpreted without knowledge of the animal's circumstances and its behaviour.

There are drawbacks in using heart rate change as a measure of zoo animal welfare. Unless the transponder is implanted it is possible for other members of a group, or the animal itself, to damage the equipment. Implanting devices requires surgery, which causes discomfort or pain and requires licensing when conducted for scientific purposes and may not be possible in the zoo situation. The use of ECG equipment is costly and impractical, and the usefulness of simple telemetric devices (e.g. Polar Electro Heart rate meters) depends on the model used: some are not designed for animal use (and so there are problems with electrode placement); there are problems with 'noise' (due to movement of animals) and since the researcher cannot manually detect errors there is no certainty that the recording is accurate. An additional problem is that heart rate changes are often almost immediate and as such it is often difficult to determine what the cause of the change may have been.

Example of use

Because of the complications listed above, measurements of heart rate are unlikely to be helpful in routine assessment of the welfare status of animals. They may certainly have a role in research. Where monitoring devices can be attached to animals, observations of changes in heart rate can be helpful in signalling features of their environments or aspects of their management routine which elevate heart rate as part of a stress response.

Measurement of heart rate is frequently used in clinical investigations and can be helpful in indicating various disease states that may have welfare implications.

2.4.3 Cortisol

Background and why this tool can be useful

Cortisol has been successfully measured in blood plasma, saliva, faeces and urine. Cortisol responses were used in a study of the effects of transportation on captive vicunas (Bonacic et al., 2003) but this study was carried out under experimental conditions since it required taking blood samples from the animals. An alternative to this for zoo-kept species, is the use of new techniques for assessing levels of cortisol in saliva, urine and faeces (Lane, 2006). Faecal cortisol has been used successfully in a number of zoo housed species including chimpanzees (Galindo et al., 1999) and felids (Carlstead et al, 1993; Brown et al, 1994; Jurke et al, 1997) and birds (Wasser et al, 2000; Shepherdson et al, 2004). An alternative approach is to use salivary cortisol, such as has been used in a pilot study on elephants (Dathe et al., 1992) and in jaguars (Montanha et al 2009). This doesn't necessarily rely on keepers being able to handle their animals in order to collect the samples, as animals can be trained using positive reinforcement to come and present their mouths for swabbing. Experimentally, cortisol released through the gills of fish has been measured in aquarium water (Zuberi et al., 2011).

Measurements of cortisol have proved to be invaluable for researchers assessing stress responses in farm animals. Cortisol has proven to be particularly useful because it shows a graduated response. This means that the effect of a variety of stressors can be compared in terms of their aversiveness to an animal.

Caveats and limitations

As with changes in heart rate, changes in cortisol concentrations signal responses to events that the animal may perceive as pleasant or unpleasant. Without knowing the circumstances, it is not possible to draw inferences about welfare state (how an animal feels) just from data on cortisol concentrations.

Non-invasive techniques such as salivary and faecal cortisol offer huge potential for assessing the impact of the physical and social environment on an animal, but more work needs to be done to develop this as an effective and practical technique for all species. As with many hormones, cortisol secretion varies during the 24 hour day and overall levels also vary to some degree between individuals. Thus effective use of cortisol as a welfare indicator depends on acquiring samples frequently during both a baseline and treatment period, without stressing the animal during collection of the sample. Cortisol analysis techniques must also be validated for the species in question before using as a measure. In the zoo situation this is often difficult and the longer term studies that have been done, for example on polar bears in the US (see Shepherdson et al., 2004), have relied on samples taken once every two weeks. It may be that faecal sampling over an extended time period can offer a possibility for monitoring stress levels of individuals, but there are obvious limitations, such as the time involved, and ensuring that the cortisol profiles of all members of a group are identifiable. For example in a study of faecal cortisol levels in captive Hawaiian honeycreepers (see Shepherdson et al., 2004) samples could only be taken from pairs of birds (i.e. cage levels of cortisol) and not individuals. An additional problem involves the cost involved in analysing samples. Various independent and university laboratories have the facilities and expertise to carry out assays, but the costs involved may vary and may mount up if sampling is to be carried out regularly.

Some faecal cortisol studies on zoo macaws and rhinos have been undertaken recently at the Central Science Laboratory, York (see Owen et al, 2004; Talling et al, 2004).

2.4.4 Prolactin

Background and why this tool can be useful

The prolactin concentration in the blood has been found to be a useful index of stress in farm animal research. The concentration of this hormone rises in response to a variety of stressors.

In studies of farmed animals, measurements of blood prolactin concentrations have been used to help identify the least stressful methods for capture and restraint as it has been found that prolactin concentration tends to increase in response to a variety of stressors.

Caveats and limitations

As with HR and cortisol, prolactin levels do not give a direct indication of welfare state (how an animal feels). Inferences about the significance of raised or lowered concentrations can only be made in the light of other information about the animal and its circumstances.

Another problem with this measurement is that it requires blood samples to be taken, and so the limitations are the same as for sampling cortisol in blood. However if combined with other health checks before and after transportation or restraint this could be a useful indicator of the level of stress associated with the techniques used for moving zoo animals.

Without detailed knowledge of species-specific normal prolactin levels and the (many) factors affecting these, measurements of prolactin levels could not be interpreted. At the present time, these data are not available for zoo animals and so, whilst prolactin measurement could have a role in research, it cannot be used in routine welfare assessment in zoos.

2.4.5 Immune measures (e.g. Neutrophil/Lymphocyte ratio)

Background and why this tool can be useful

There is some evidence that the relative concentrations of neutrophils and lymphocytes in the blood may be affected by hormonal responses to stress. Measuring neutrophil/lymphocyte ratio may provide an index of adrenal cortex activity associated with the impact of potential stressors. In a recent study of the effects of captivity on vicunas, Bonacic et al (2003) used a range of haematological measurements to characterise the responses of the wild ungulates to various challenges.

The induced stress response is usually characterised by an increase in neutrophils and decrease in lymphocytes. Thus a change in the neutrophil/lymphocyte ratio is a useful indicator of a stress response, and has potential for use in zoo animals, where blood samples are routinely taken as part of a health screening programme.

Caveats and limitations

Interpretation of neutrophil/lymphocyte ratios depends upon having reliable data on normal values and information on the factors that may affect this. Neutrophil and lymphocyte concentrations are known to change in many disease conditions and interpretation of the significance of these changes to welfare is not straightforward.

2.4.6 Reproductive hormones

Background and why this tool can be useful

Measurement of testosterone, oestrogen, and progesterone can be used in investigations of reproductive abnormalities. Endocrine profiles for each individual can be useful for determining their reproductive state and for tracking changes over time. For example, ovarian activity was investigated in this way, in captive felids, by Brown and others (1994).

It has been reported that some stressors that may affect welfare can result in disturbances to reproductive hormone concentrations. Detection of such abnormalities could therefore be an indication of welfare challenges.

Caveats and limitations

Apart from assessing concentrations of hormones in urine or faeces, the assessment of hormonal profiles requires invasive and stressful procedures such as restraint and blood sampling. There is also the expense of laboratory assay procedures to consider. For most species, there is an inadequate knowledge base to support the use of this as a tool for welfare assessment.

2.4.7 Body temperature changes

Background and why this tool can be useful

Body temperature can be a useful indicator of a stress response since in some species of mammals it rises in response to an acute stressor due to activation of the Sympathetic-Adrenal-Medulla axis (SA). The adrenalin/noradrenalin response is accompanied by an increase in heart rate, respiration rate and body temperature, associated with the 'fight or flight' response. Measurement of body temperature may also help gauge the adequacy of the environment in ectothermic ('cold blooded') animals.

Data on normal body temperature are relatively easily obtained as body temperature is often assessed as part of a normal veterinary examination. In addition the use of infrared thermometers can be useful for easily, and non-invasively, assessing the skin temperature of animals, for example so that management procedures can be monitored and changed if necessary. Remote Infra-red heat sensing technologies are becoming increasingly available in veterinary medicine as a diagnostic technique to detect localised areas of increased heat that can indicate inflammation or other pathological processes.

Caveats and limitations

Measurement of body temperature without restraining animals (which may itself result in temperature change) is rarely possible. Telemetric methods are available but fitting sensors may also present challenges which may have welfare consequences themselves (Hawkins et al, 2003).

Changes in body temperature often occur during normal physiological processes (e.g. exercise, basking in reptiles, pregnancy etc.). Body temperature may be found to be either elevated or depressed in disease and these factors can be confounding variables. Drawing inferences about welfare status from body temperature measurements can only be done with regard to other information about the animal and its circumstances. These potential confounds should therefore be taken into account and other measures used alongside body temperature for welfare assessment in zoos.

2.4.8 Weight and body condition

Background and why this tool can be useful

Welfare may be adversely affected when body weight is either too high or too low in relation to body size – i.e. when an animal is either too thin or too fat. Animals in poor condition may be predisposed to some parasitic or infectious diseases and those that are excessively fat may be predisposed to some metabolic and locomotory problems.

Changes in weight and body condition are regularly used for monitoring the health status of farm and other animals. If animals are weighed or their body condition scored regularly then any changes (especially sudden changes) will be readily accessible to the animal carers.

Many zoo animals can be trained to use weighing scales for a food reward, thus making this a stress free method for gaining objective data regularly. Body condition scoring has advantages of being non-invasive and not requiring specialist equipment. These are certainly useful aids in assessing health and welfare in zoo animals and in assessing the effects of diet changes, movement between enclosures and zoos and during breeding.

Caveats and limitations

Weight changes can occur as a result of a wide variety of normal or pathological factors. There may be normal diurnal or seasonal weight changes, or changes due to age or reproductive status. Interpreting weight changes therefore depends upon knowledge of normal patterns of variation. Weight changes, up or down, can occur in many diseases. If animals cannot be trained to enter, stand on or hang from suitable weighing devices, and have to be captured and restrained for weighing, this has the potential to cause stress.

Body condition scoring systems must be formulated and validated for the species concerned since species vary with respect to where they deposit fat reserves. It is important that scoring is done consistently and so assessors need to be trained and their ability to score accurately validated. As with body weight, condition can be affected by a variety of factors and may not indicate the exact nature of the problem and so further investigation (e.g. physical examination) may be required.

2.4.9 Concluding comment

There have been relatively few studies in zoos in which physiological measurements have been used for assessing welfare. There are obvious limitations to using physiological parameters, including the collection of samples for measuring the various indicators currently used for assessing farm and laboratory animal welfare, and the lack of information on normal values and the factors affecting them. New techniques and improved health screening via regular blood sampling may offer the zoo community measures that can be used alongside behavioural techniques to give a fuller and more accurate picture of the welfare status of individuals for each zoo kept species.

2.5 Clinical and pathological indicators of welfare

2.5.1 Background and why this tool can be useful

Physical health is a key aspect of animal welfare.

Once signs of poor health have been identified the observer then needs to come to a decision as to whether this is a likely indicator of poor welfare – and to what extent

welfare is likely to be compromised. (See limitations section). Knowledge of the species, its behaviour, basic physiology and understanding of how injury and disease affect the individual is important in making this judgement. Table 2.5.1 classifies some physical and behavioural changes according to whether they are likely to be indicative of severe disease, moderate disease or merely a suspicion of disease that might require confirming by other means (physical examination, blood sampling, radiography etc). The more severe the disease, the greater the degree to which the animals welfare is likely to be adversely effected.

The action required is dependent on the extent of the problem. Clearly animals showing signs of severe disease need urgent treatment or euthanasia on humane grounds. For animals showing moderate disease or signs suspicious of disease the welfare cost/benefit of treatment/further investigation must be considered. (See limitations).

It is important that the pattern as well as the severity of disease be determined (i.e. how many individuals are affected, to what degree and how frequently). Disease and ultimately death is inevitable during an animal's lifetime even under optimal husbandry conditions. Disease in a single animal, whilst regrettable, does not necessarily require a review of how this species is kept. Disease in a multiple animals in the group however, especially over a prolonged period, is likely to be a reliable indicator a chronic welfare problem and that the husbandry standards are insufficient for the animals' needs. (See also Inspection of health and husbandry records as a tool for assessing welfare).

The basis for this tool for assessing animal welfare is to use those observational techniques developed for assessing health and to equate signs of poor health with poor welfare.

As discussed in the introduction to this chapter, key components of an animal's welfare are how it feels and functions. Disease and injury are often associated with pain or discomfort, and can lead to temporary or permanent loss of function (e.g. inability to feed or move freely) with associated additional impacts on welfare.

Thus techniques developed for identifying disease states, such as visual inspection, are also useful for identifying cases of poor welfare. Furthermore the severity and chronicity of the disease process and the number of animals and frequency that they are affected is likely to relate directly to the extent of the welfare problem.

Animals can be predisposed to some diseases as a result of exposure to some psychological stressors. Hence this tool can also play a subsidiary role in identifying cases of poor welfare other than those pertaining directly to an animal's physical health (see also section 2.3).

Caveats and limitations

This tool is very useful for identifying signs of ill health. Information gained from its use can provide clues as to the extent of the animal's problem and, with appropriate training, inferences can be made as to the cause of the problem and what might be the best course of action.

The tool is a crude instrument and visual manifestations of disease are not always consistent even within individuals, let alone between them, different species or taxa. The tool is most effective when used on demonstrative species where their behaviour,

General condition	Poor sloughing reptiles Areas of hair or feather loss (NB may be associated with normal moult) Change of colour (fish)/dystrophic/malformed fins	Dystrophic/malformed feathers. Lack of normal hair/feather regrowth. Failure to slough – retained spectacles, areas underlying necrosis. Poor growth/deformities	
Wounds	Multiple excoriations – may be due to cage mate aggression or inappropriate substrate Malformed fins	Penetrating wounds. Slow rate of healing Pressure sores Self mutilation (including skin irritation – itching due to parasitism)	Wounds penetrating a body cavity. Skin loss covering large areas. Obviously infected wounds.
Hoof/nail growth	Excessive wear or mild overgrowth– is the substrate and diet appropriate?	Overgrown or deformed hooves/nails leading to abnormal gait/prehension.	Obvious infection or pain – unwilling to use limb. Inability to walk. Sloughing of one or more hooves.
Horn growth	Excessive wear or mild overgrowth– appropriate cage furniture?		Penetrating injury due to abnormal growth. Obvious infection/discomfort.
Skeletal system/neurological			
	Abnormal gait but not affecting speed or willingness to move. (e.g. reduced range of movement due to healed fracture / congenital deformity) Increased slowness, stiffness or resting behaviour, reduced behavioural repertoire (reduced climbing, or play behaviour)	Able but unwilling to use limb (acute phase) Abnormalities leading to difficulty in acquiring / apprehending food, keeping up with conspecifics, mating etc.	In ability to maintain itself in an upright position (e.g. fish swimming upside down, snake stuck on its back, extreme vertigo in mammals). Limb fractures. Limb loss (may not be applicable in invertebrates or cause major welfare problems in some smaller vertebrates). Inability to use limb – either physical or due to pain. Chronic unwillingness to use limb.
Eyes	Mild ocular discharge, clouding/opacities or hyperaemia	Persistent discharge, Obvious discomfort Visual impairment	Gross swelling and behavioural evidence of pain.

		leading to inability to negotiate obstacles, find food or interact with cage mates.	Eye protruding from socket. Inability of eyelids to close over eyes (in species with eye lids)
Respiratory			
Nasal discharges/ breathing	Mild clear or blood tinged discharge, animal bright. Normal breathing pattern for activity level.	Pus or prolonged, repeated bloody discharge from nose or mouth. Increase breathing rate and effort.	Marked increase in respiratory effort. Open mouth breathing (where not part of normal behaviour), Cyanosis (blue tinge) of mucous membranes or skin in animals that don't have pigmented skin.
Digestive			
	Abnormal texture and colour of faeces	Diarrhoea – without depression Constipation, frequent unproductive straining Mild to moderate colic of short duration	Severe diarrhoea – associated with depression Profuse and or bloody diarrhoea Severe colic

2.5.2 Inspection of Health and Husbandry Records

Background and why this tool can be useful

The following table shows some of the types of data that can be derived from health and husbandry records.

Table 2.5.2: Examples of data that can be derived from health and husbandry records.

<p>Demographic data: These give a numerical description of the population. There are many different parameters that can be used to help identify potential welfare problems. Explanation of their use and derivation is beyond the scope of this document, however some examples are given below.</p> <p>Note: There are many different definitions of the various parameters. It is unimportant which is chosen as long as consistency is maintained. The definitions below are consistent with those used by the SPARKS and DEMOG computer programs (Wilken & Lees, 1998; www.isis.org)</p>	
Birth rate	Annual number of births/100 animals in the population
Inter-birth interval	Length of time between birth/hatching of successive offspring (individuals, litters, groups or clutches depending on species).

Mortality rates	Annual Death rate = % population dying per year. Annual Neonatal death rate = % Animals born per year dying as neonates.
Survivorship	Probability of surviving from birth to age x. This is done for each age class and a graph plotted for the population. This graph highlights ages when animals are most likely to die. It also shows maximum and average lifespan for the group being analysed.
Longevity	Average age at death

Health data: These describe the types of health problems seen and their frequency. Parameters of particular use for assessing animal welfare are:	
Categories of diseases seen	E.g. nutritional, environmental, infectious, degenerative, trauma.
Incidence	Number of new cases of each class of disease/yr

Ideally these data should be collected every year for each species held (see limitations section re practicality of doing this). Any difference from normal should be investigated further as it might be indicative of an underlying welfare problem.

The most difficult part of using this tool is knowing what is 'normal'. There are two approaches to this:

- The first is to collate data from as many institutions as possible that hold the species (and get information on the species in the wild). These sorts of data may well already have been collated for species that are part of managed programmes (e.g. EEPs). In these cases the information is often to be found in the species studbook or it can be obtained directly from the studbook/programme manager. The latter is the preferred route as the studbook keeper/manager will have detailed knowledge of the study population and of mitigating circumstances that might have impact on the data (e.g. whether certain institutions have been advised to stop breeding because they had been too successful in the past etc.). Average values for the population might be taken as 'Normal' (but see below for caveats). Target values would be those from the institutions that have the lowest (non-cull) mortality rates, least disease and good breeding rates. These values are likely to change as husbandry practices improve hence regular review is required.
- Target values indicative of current best practice are not always available (e.g. when the species concerned is rarely held in captivity or data are not available from other collections). Institutions can still evaluate their own data however by plotting values over time and looking for any trends or abnormalities.

a. Demographic data can be used to highlight possible cases of poor welfare.

- Many causes of poor welfare will lead to increased mortality and decreased life expectancy. Similarly, measures of reproductive success (e.g. birth rate, inter-birth interval) can also be negatively affected by causes of poor welfare. Although demographic parameters can often indicate welfare problems, they are not always directly linked to animal welfare. Numerous other factors can affect demographic parameters whilst having little or no effect on welfare. For example a colony of harvest mice will have a higher reproductive rate than a single sex display group and yet their welfare status might be the same. Despite this lack of obvious cause and effect, deviations from 'normal' values should still be seen as indicators of potential welfare issues that might need further investigation using some of the other tools discussed in this chapter.
- Demographic data are particularly useful for assessing large groups of animals where individual identification is difficult and use of visual inspection, behavioural observations and physiological parameters is limited. Fish, amphibia and colonies of small birds and mammals might all fall into this category.

b. Health data can indicate welfare problems and their potential causes.

- As discussed previously in section 2.5, poor health typically has a direct impact on welfare because diseases and injuries often cause pain, discomfort or malaise. A high incidence of disease is likely to be indicative of some aspect of sub-optimal husbandry. Further analysis of the types of disease seen can suggest the causes of these welfare problems and hence allow rectification. For example a high incidence of bone fractures might indicate suboptimal nutrition (e.g. regarding calcium or vitamin D levels). Arthritis might indicate chronic pain which requires managing and, if the incidence is unusually high, that the substrate might be inappropriate.
- Examination of health records complements visual inspection as a tool for assessing welfare. Visual inspection provides a snapshot of current problems in living animals. Health records show how disease patterns change over time and they also include data from laboratory investigations and from animals that die. Laboratory and post mortem records might be the only way to determine the types of diseases affecting undemonstrative species thus allowing inferences to be made as to their welfare status and that of the remaining animals kept in the same conditions.

c. Analysis of records allows monitoring of potential welfare problems over time.

- A major strength of this tool is that it allows monitoring of the population over time and comparison across different institutions with similar recording systems. Zoo managers can evaluate the impact of husbandry changes on animal welfare and use this information to produce species recommendations. Zoo inspectors can use the data to audit welfare and see the effect of previous recommendations they have made.

Caveats and limitations

a. Practical limitations of its use

- The value of this tool depends on the quality of the records kept. If the data are inaccurate, inconsistent (e.g. different assessors with different interpretations) or

missing the inferences made they will be at best of limited value and at worst wrong.

- When comparing data it is vital that the parameters of interest have been calculated in the same way. (e.g. is birth rate defined as births/100 animals or births/female of reproductive age? What definition is being used for 'birth' in marsupials?).
- Small population sizes will also limit the power of this tool. As a rule of thumb when populations are less than 20 individuals demographic data become difficult to analyse.
- Time consuming – for zoos holding large number of species it is likely to be impractical to plot and do a full analysis of data for each. Judgement will be needed as to which species to prioritise. Targeting species where problems are suspected or where other methods of assessment are difficult might be one way of overcoming this problem.
- Insufficient base line data – from the wild/other collections to be able to determine 'normal' values.

b. Limitations of the tool itself (i.e. limitations even if data quality is optimal)

- Historical: Visual inspection/ (+ other tools) may give you an idea of the welfare of an animal today. Inspection of records is an audit of welfare over varying periods of history (may be lifetime or just previous week). If analysis of records is the only tool used, timely intervention to correct severe welfare problems might not occur.
- Difficulty of interpretation. As stated previously, factors that affect welfare are likely often to have an impact on demographic data also. However demographics are influenced by many other factors also which are of no relevance to welfare (have no direct bearing on an animal's feelings or function). Detailed knowledge of the collection, species management and the other welfare assessment tools is needed if demographic data are to be used in drawing inferences about welfare.
- Difficulty in comparing data if the study population is different in age or sex composition from the managed population. For example, if the zoo studied holds a bachelor group of macaques, birth rate is obviously going to be lower than for a breeding group. Data analysis and interpretation should only be done by personnel who have a good understanding of the collection.
- Similarly this tool is difficult to use when there is regular immigration and emigration to and from the study population. For example, if the zoo doing the analysis is a holding institution for young adult stock prior to export for release. Deaths due to degenerative disease might be expected to be lower than average for the population as a whole.
- This tool is not useful for assessing welfare of an individual. (c.f. other tools for this) It is more useful for indicating potential problems in groups of animals.

Areas for future development

The advent and development of computerised record keeping and data analysis programmes has vastly increased the scope and accuracy of information that can be

obtained from animal records. ZIMS (Zoo Information Management System), the international record keeping and data analysis system, is expected to be deployed in 2012. This will replace the ARKS (Animal Record Keeping System) system completely.

Institutions are not limited to collecting demographic and health records. Data more specific to animal welfare might also be collected (for example, those data generated through the use of other tools suggested in this chapter). (See also appendices with examples of animal welfare audit forms.)

3. The roles of zoo staff in the management of animal welfare

Animal welfare assessment in the zoo environment is a process working on more than one timescale and involves:

- ongoing daily assessment as part of keeper duties
- regular welfare audit and review of the housing and husbandry of the collection (See Appendix 1 which includes an outline of the Chester audit system)
- species specific appraisal in relation to social/housing changes
- zoo inspections made in accordance with the Act (See Section 4)

These different levels of welfare appraisal are complementary to each other. Each participant, from junior keeper to senior manager, is part of this process and over the course of a year each has individual obligations to the animals in the collection. Individual zoos will differ in their organisational structure and the roles of keeper, senior keeper and curator are defined as follows;

Keeper – member of staff responsible directly for care of animals through the provision of diet and maintenance of exhibit. This person may be very junior and relatively inexperienced or may have considerable knowledge of the particular species.

Senior keeper – member of staff who still carries out practical husbandry but in addition has responsibility for staff and their conduct.

Curator – member of staff responsible for planning of the collection, who has an overview of the staff and who has responsibility for the systems (husbandry, reporting etc) that are in place.

These roles may be more fluid at smaller zoos with a less rigid structure. For example, keeper staff may report directly to curators or senior keepers to directors. What is important is that set procedures are in place, regardless of the size of institution, that allow for effective communication to resolve welfare issues

3.1 The Keeper's role

The keeper is the front-line in ensuring the highest standards of welfare for zoo animals and therefore must have a good understanding of the normal behaviour and physical 'norms' for each species they care for. In particular the following apply to all keeper staff:

- all animals must be clearly seen and inspected daily. An initial inspection should be carried out first thing in the morning. Additional observations of animals must be carried out whenever possible throughout the day;
- keepers must look for abnormalities such as signs of injury (see section 2);
- keepers must look for signs of disease (in both animals and their enclosures) (see section 2);
- keepers must look for signs of behavioural abnormality in relation to the individual animal and its relation to the group (if applicable) (see section 2);
- keepers must look for signs of an overall *change* in welfare status;
- keepers must also respond to reports of abnormal welfare, or situations, which may affect welfare, from visiting public;
- keepers must maintain enclosures that meet high standards of appropriate hygiene and repair (e.g. holes or loose wires that could cause injury);
- keepers must provide the appropriate diet both in presentation, appropriateness and condition;
- keepers must monitor use of specific enrichment devices, materials or systems.

Experienced keepers should continually refer to previous experience with the species or individual(s). Trainee keepers and junior staff must be trained to identify abnormalities and possible welfare problems as part of their initial training – this is an obligation of senior staff. In particular, consistent, longitudinal care is important in the detection of changes in individuals and/or groups.

If any deviations from normal physical appearance or behaviour are observed a keeper has an obligation to report this to their line manager. This may be through, or directly to, a senior keeper, curator or vet. In practice in many zoos junior keepers would verbally report welfare concerns to a more senior keeper and this may then be additionally recorded in both section and zoo records. Written and verbal reporting and recording procedures should therefore be in place. The system in place should be inclusive so that all keepers have an ability to report concerns regardless of rank.

3.2 The senior keeper / curator's role

Senior keepers/curators must pay due attention to any animal welfare matter reported to them. They have an obligation of care to all species within their remit and are obliged:

- to respond by either inspecting the individual(s) themselves or by reporting the matter to more senior staff (if appropriate);
- in the event of a welfare problem being identified, find solutions, in conjunction with other staff including the vet, to alleviate the problem;
- in the event of injury and/or disease report this to the vet and, in conjunction with the vet, provide the most appropriate treatment/solutions;

- to put systems in place that allow the efficient reporting of welfare matters and systems for welfare audit in their collections;
- be responsible for the organisation of keeper training to identify welfare problems;
- in the longer term, plan appropriate enclosures that provide for good welfare and/or select species that can be housed in existing enclosures whilst maintaining good welfare standards. All other staff may be involved in the planning of enclosures.
- keep up to date with advances in knowledge

3.3 The vet's role

The vet plays a key role in monitoring and assessing animal health and welfare and should be involved at a very early stage if there are any welfare concerns. The vet may also be the initiator of a concern over the welfare of an individual or group of animals. A vet may have a welfare matter reported to them directly by a keeper, senior keeper or curator and is obliged to provide appropriate, professional care in such circumstances.

In addition vets have an obligation to keep up to date with advances in knowledge of the methods of prevention and treatment of diseases relevant to the health and welfare of the animals in the collection.

3.4 Welfare audits and management review process

In addition, all individuals responsible for animal care, either directly or indirectly, may be involved in the development of appropriate welfare audit methods (Appendix 1). Zoos will find it helpful, for maintaining high standards of welfare, to carry out such an audit. Best practice would make this a biannual or annual event. Different zoos may choose to carry out this process at different levels, however, for all, the maintenance of good records of both veterinary and husbandry matters will be essential. During this audit process the records should be reviewed by senior management to highlight priority actions to address more urgent welfare concerns. Larger scale historical reviews of records may also provide interesting research projects, which may pay dividends in pinpointing 'hidden' welfare problems.

In addition to this, the yearly zoo inspection, carried out in accordance with the Act allows for an independent evaluation of the standards (SSSMZP) of the zoo. This will be discussed in Section 4.

3.5 Staff roles in zoo animal welfare illustrated by an example problem scenario

- A junior keeper notes during their morning inspection that there is blood present in the ring-tailed lemur enclosure. Further close inspection of all individuals in the group leads to a wound being identified on an adult male.
- The keeper alerts a more senior keeper to come and inspect the individual. This senior/head keeper makes the decision to isolate the male and inform the Curator that veterinary assistance is required.

- The keepers also note the injury in their daily report sheet, which goes to the Curators office and will be entered in animal records (ARKS). In addition this event is also noted in the section diary.
- The animal is examined by the vet and appropriate treatment administered. Keepers are given instructions for appropriate follow-up care. The vets keep medical records (results of examination, diagnostic tests, drugs administered etc.) preferably on a dedicated zoo animal medical record system.
- The keepers inspect the enclosure/cage mates to attempt to identify the cause of the injury. Females are observed being aggressive to other males. The females are coming out of oestrus and are responding aggressively to any approaches by males.
- Appropriate action is taken to attempt to lessen the likelihood of further attacks on males by females e.g. provide extra visual barriers to lessen tension in exhibit; prepare a contingency to separate males entirely for a short period of time if required; provide more scatter-feeds or puzzles to increase other behaviours. Also:
 - the injured animal is monitored closely throughout the period of treatment and the vet makes follow-up assessments.
 - after assessment of the situation in which the welfare problem was identified long-term changes may be made to husbandry regime.
 - planned future housing (keepers, curators, vets, site development staff) to alleviate such situations

This example demonstrates that welfare problems may in many circumstances be a combination of physical, behavioural and psychological difficulties and appropriate solutions might require a holistic approach. **Fig. 3.1** summarises the different timescales and processes that overlap to effectively monitor the welfare of individuals in zoos.

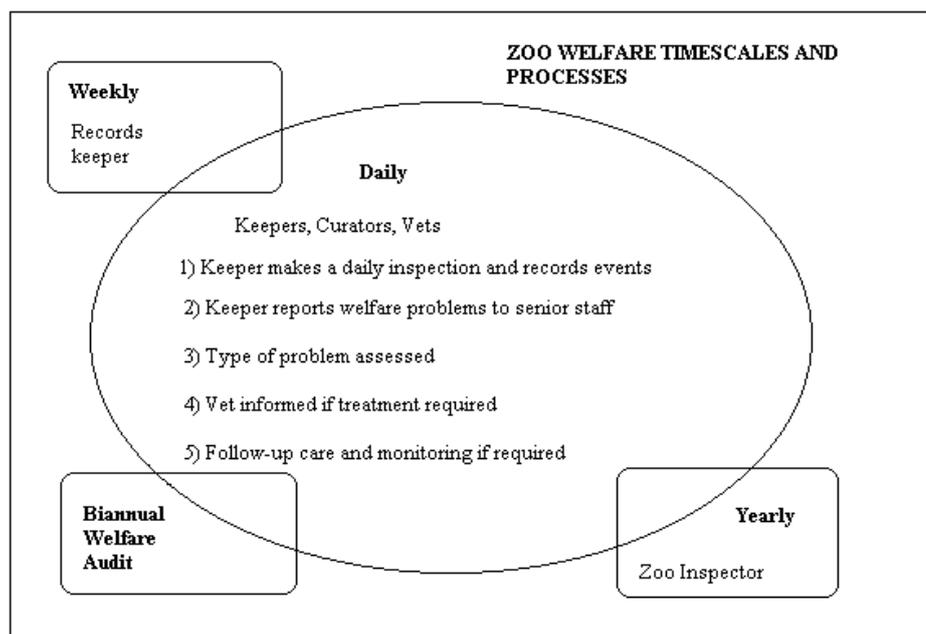


Fig. 3.1 Diagram to illustrate the differing timescales in the assessment of welfare by staff in zoos

4. The role of the zoo inspectorate in animal welfare

The Act provides a requirement for licensing by local authorities, following a process of formal inspections of zoos, which includes the health, welfare and safety of the animals present. Standards for animal welfare are furthered in the SSSMZP. Both are fundamental in ensuring that satisfactory conditions and standards are achieved in zoos, and should be referred to by any person from the inspectorate. Inspectors are obliged to keep up-to-date with advances in knowledge in animal welfare assessment.

The Act requires that a local authority arranges for an inspection to be carried out at differing times: prior to issuing, refusing, renewing or significantly altering a zoo licence, and during the period of a licence. There are also provisions for special and informal inspections, as defined.

For an inspection other than a special or informal, or where a dispensation is in force, a team of inspectors comprising not more than three appointed by the local authority, and two nominated by the Secretary of State, will assess the standards of animal welfare. One nominated inspector from the Secretary of State's lists will be a competent veterinary surgeon, and it is usual for the local authority to appoint similarly.

The toolkits within this chapter may serve to assist directly in the assessment of animal welfare during the inspection process but most are more relevant for use by zoo staff in the management of their animals. Whilst some may be of value for direct use by inspectors, we suggest that the role of the inspector will more usually be one of auditing operating procedures to check that zoos have appropriate systems for the routine assessment and regular review of their animals' welfare. Any actions considered necessary by the inspectors as a result of their own assessments of animal welfare or of

their findings concerning the zoo's systems for routine assessments and regular reviews, may be reported to the local authority for tackling either by setting conditions or making recommendations on a licence or amended licence. A local authority officer with concerns for animal welfare at any other time, having failed to receive adequate reassurance from the operator, is advised to discuss them with the local authority's veterinarian or Secretary of State's inspector, and under certain circumstances a special inspection may be deemed appropriate.

A special inspection will usually include a veterinarian in the inspection team and, in the case of an inspection where a dispensation exists, a veterinarian may again be nominated or appointed (as appropriate to the dispensation) to demonstrate that animal welfare issues are addressed.

Informal inspections are to be carried out by a local authority in any calendar year when no other inspection has been undertaken, and will usually take place towards the end of the year so as to avoid the possibility of more than one inspection in that year. The inspection will be carried out by a person appointed and deemed competent from within the local authority, or may be carried out by a suitable person on its behalf.

Further guidance on inspections may be found in the Defra guidance document: Zoo Licensing Act 1981 Guide to the Act's provisions which can be seen on the Defra website at the following address: www.defra.gov.uk/wildlife-pets/zoos/

5. Education and Staff training

The efficacy of detection, recognition and reliability of welfare assessments and the effectiveness of measures taken to address problems that exist will greatly depend on the standards of knowledge, education and training of the relevant staff. The interpretation and significance of behavioural characteristics in relation to the welfare state of an animal is often far from straightforward. In recent years much progress has been made in understanding the causal factors and signs of poor welfare particularly in relation to behaviour. It is important that staff responsible for the care of zoo animals should be knowledgeable of these areas and as far as possible keep up to date with recent developments.

Assessment of welfare should be an integral part of any course relating to the education and training of zoo keeping. Animal behaviour and welfare is already included in a number of courses that cover zoo management, both vocational and academic in nature. (Information on animal welfare education and training can be found in Appendix 2). 'On the job' training also forms an important part of education on recognising and dealing with welfare problems.

6. Recommendations for research

We have become knowledgeable about the basic principles of nutrition, disease control and other aspects of biology relevant to the welfare of animals through work principally based on humans and domesticated species. These principles are crucial, but there is a great deal of work still to be done to elucidate in detail the many variations in specific requirements among species kept in zoos. Likewise, at present, in many cases, when antibiotics, analgesics and other drugs are given to zoo animals, dose rates are based on those that have been determined to be safe and effective for the common domesticated

animals and for humans – there is a need for much more work on species-specific regimes for zoo animals.

In prioritising research for welfare improvements, it is necessary to have a clear view of what the major problems are. These are likely to vary from species to species and to be dependent also on housing and husbandry regimes. The welfare assessment methods outlined above will help in identification of where the major problems lie.

Small, single-zoo studies will not yield the information required to identify, prioritise and tackle major health and welfare problems. Large, cross-institutional studies should therefore be prioritised (e.g. Carlstead et al. 1999; Wielebnowski et al. 2002) and databases that span zoo populations utilised to their fullest.

As a result of economic factors, the main focus of efforts to explore animal welfare has been on farm and laboratory animals. Many of the methods for welfare assessment mentioned above were first developed for use in these contexts or as spin-offs from developments in human medicine. Zoo-based research does not always utilise the full gamut of techniques available or the increasingly sophisticated techniques under development. Greater collaboration with animal welfare groups based in universities would therefore be beneficial.

There is also a need for the development and evaluation of physiological welfare indices (e.g. cortisol assays, especially those based on faecal or urine samples that are collected without causing stress) for use in further species.

Research in some of the areas outlined above is challenging, time consuming, technically demanding and expensive. Obtaining funds for studies in these areas is not easy. However, there are increasing opportunities because of the growth in interest in animal welfare research. Quite a number of universities in the UK have animal welfare research groups so there are new opportunities for collaboration between zoos and universities in this field, and various organisations accept applications for funding for animal welfare research.

7. Recommendations for the development of specific welfare codes

Codes of recommendations for welfare are valuable tools for helping to set standards and encourage good practice in farm animal husbandry. In many cases, it is possible to give much greater individual attention to zoo animals than is typical for farm stock so approaches found helpful in promoting welfare in production animals will not necessarily be relevant in the zoo context. However, it seems likely that the development of further codes of recommendations for the welfare of zoo animals would be helpful. Ideally, since species are finely adapted to their natural environments and have specific requirements related to this, such codes should be at the species level. However, the development of such species-specific codes by the zoo and other wild animal keeping communities for the very wide range of species kept would be a major undertaking and it is appropriate that, where resources are available for this, efforts should be carefully prioritised. Whilst species-specific codes may be the ultimate aim, codes dealing with taxa at higher levels (e.g. at the level of genera or families) may be a more realistic goal for some groups, at least in the shorter term.

There are a variety of sources of information and guidance on husbandry of zoo animals including The International Zoos Yearbook, and publications produced by the Association of British and Irish Wild Animal Keepers (ABWAK), the British and Irish Association of Zoos and Aquariums (BIAZA), The European Association of Zoos and Aquaria (EAZA) and the American Zoo Association (AZA).

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10. Useful Websites

- Defra website www.defra.gov.uk/wildlife-pets/zoos/
RSPCA website (www.rspca.org.uk – see especially the ‘All About Animals’ section)
The Shape of Enrichment (www.enrichment.org)

Appendix 1 Example of animal welfare audit – Chester Zoo

(This document has kindly been provided by Chester Zoo as an example and outline of the procedures used in an animal welfare audit. Its inclusion does not imply endorsement by the Zoos Expert Committee.)

Mechanisms for identifying and acting on potential welfare issues:

Frequency	Audit activity	People involved	Action (as appropriate)
Daily	Observation of each individual Written daily reports	Keepers	Rectify problem themselves. Alert animal health team/curators/maintenance
Weekly	Mortality/morbidity review	AH team / curators	Identify patterns of mortality, morbidity, Formulate/review treatment plans / husbandry changes.
Monthly	Team leader meetings: Audit of previous months births, deaths, movements, husbandry changes /ongoing issues etc. Maintenance tracking meetings Welfare and enrichment forum	Team leaders / curators / AHT Keepers/curators Keepers/research dept/AHT	All: Highlights issues that might be solved by cross department cooperation. Curatorial and other team leaders alerted to potential or on going problems. Issues prioritised. Solutions suggested. Deadline for implementation set.
Quarterly	Outside audit of mortality. Reporting of main clinical issues. Reporting and discussion of research pertaining to health, husbandry and conservation	Scientific committee members, Director, Curators, Vets, nutritionist Other animal division managers	Identifies patterns of morbidity / mortality (+ comparison to previous years).
Biannual	Aquarium/Herp Dept Walk round, review collection, areas for improvement, progress since last meeting, new issues/concerns,	Curator lower vertebrates Team leader aquarium/Herp dept AHT	Identify on going issues/ areas for improvement. Prioritise issues, decide on actions and deadlines for implementation
Annual	Bird and Mammal Dept Walk round, review collection,	Chief Curator, Curator Higher Vertebrates	Identify on going issues/ areas for improvement. – Complete welfare audit for each

	<p>areas for improvement, progress since last meeting, new issues/concerns,</p>	<p>Team Leader Veterinary Manager</p>	<p>enclosure. Prioritise issues; decide on actions and deadlines for implementation – commission full species review (see attached) for key species.</p>
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Appendix 2 Information on training available

There are several levels of animal welfare education and training available. The three main levels are outlined in the following paragraphs along with web links to sources of further information.

There are a growing number of Level 3 Diploma courses for zookeepers, some of which are validated by City & Guilds. Such courses often include units on, for instance, training and enrichment which have elements of behavioural content. The relevant website for information on vocational and further education courses in animal care is www.lantra.co.uk.

At degree (BSc) and Foundation degree (FdSc) levels, many colleges and universities offer degrees in animal behaviour, animal welfare, and animal science. Some degrees in conservation biology may also include modules in animal behaviour. Many of these colleges and universities have strong links with zoos, where classes may be delivered or projects carried out. Up to date information on related courses can be found on the Universities and Colleges Admissions Service website, www.ucas.com.

At postgraduate level, a few universities provide the opportunity to study various aspects of zoo animal welfare at MSc level. Some programmes are wholly zoo focused, whilst some have a broad animal behaviour and welfare perspective. However, all of these programmes include modules on animal health and welfare; animal behaviour; and provide opportunities for zoo-based research, with very strong links with zoos in the UK and abroad. The official website for postgraduate courses is www.prospects.ac.uk

Staff from zoos involved in research regularly participate in these courses.

Chapter 5 Veterinary services

1. Introduction

The requirements for veterinary care for the animals in zoological collections are laid out in Section 3 of the Secretary of State's Standards of Modern Zoo Practice (SSSMZP), see www.defra.gov.uk/wildlife-pets/zoos/ Provision of animal health care, which interprets the requirements of the EU Zoos Directive. Paragraphs 3.7 – 3.18 deal specifically with veterinary care, but without going into detail as to how this is to be achieved.

It is not the intention of this chapter to provide a guide to zoo animal medicine, which is the prerogative of veterinary training and the relevant literature, but rather to indicate to zoo managers, local authorities and zoo inspectors where the minimum standards of veterinary service may lie, and the various options for achieving a far better than minimum level of veterinary care in a licensed zoo. Neither this chapter, nor the SSSMZP are directed at the veterinarian per se, although he or she may benefit from knowing what the zoo is expected to provide. The onus is firmly on zoo operators to ensure that the standard of veterinary service that they employ is sufficient and appropriate for the animals that they keep.

2. Options for veterinary service in zoos

The Standards indicate (3.7-3.9) the need for a comprehensive programme of veterinary care, from a veterinarian(s) familiar with current practice in zoo medicine, particularly in the species kept in the collection. The areas for which the veterinarian should have responsibility and active involvement are suggested in 3.9, and these cover many areas of the zoo's operation and spread wider than just the care and treatment of the animals. Paragraph 3.8 covers one scenario for provision of the service, but there are others which can be considered.

The vast majority of UK veterinarians are in domestic animal practice, in one form or another. Compared with 30 years ago, a large proportion are in clinic-based small animal practice, and may find it difficult to offer a service which involves travel and outside visits. Those in farm or equine practice may not be familiar with or equipped for the care of birds and reptiles, but have much to offer a safari park with large numbers of herbivores. Some zoos have dealt with this problem by using different vets for different groups of animals, but the possibilities for communication breakdown would seem to be considerable.

2.1 Full time employed vet

Major zoos can justify the employment of a full time vet(s) because their collections are large and diverse enough to need a considerable volume of preventive and curative care. Some smaller zoos have adopted the more economic arrangement of employing a vet in an additional capacity (e.g. curator) to help justify the cost and in this case care must be taken to avoid any potential conflicts of interest between the veterinary and curatorial/managerial role. In either case there are costs and benefits to be considered. Particularly important is the need to provide comprehensive facilities and equipment (see below), as well as adequate and knowledgeable cover for time off, conferences and holidays. The full-time vet may need to use the services of other specialists when their experience of some species is limited, or of university veterinary schools or local practices when equipment or skills are not available in the zoo. In all cases, the resident vet should

be in control of the situation and all communication, and zoo managers should be careful not to usurp the position of their vet by consulting elsewhere directly. The zoo must make sure that the vet is given sufficient time and resources to maintain continuing professional development (CPD), both in the zoo field and in general veterinary skills.

2.2 Specialist consultants

Zoos and aquariums of all sizes employ vets who have specialist knowledge and broad experience of their species. Apart from those collections near enough to the specialist's home base for all their needs to be covered, most will need to establish some support from a local practice for emergencies and possibly the occasional use of facilities such as radiography. Such systems can work perfectly well, as long as there is a clearly established decision-making chain and lines of communication. The careful maintenance of records is particularly important. For the specialist, CPD should be an essential part of their practice, and they can be in a position to provide a degree of development for co-operating practices. The zoo only needs to reassure itself that this is ongoing.

2.3 Local practice

Many local veterinary practices provide excellent service to zoos, as they nowadays have excellent facilities and may cover a wide range of disciplines within their membership. They are also equipped to provide 24-hour cover, although the zoo should make sure that out-of-hours service is not delegated to a different "emergency" practice, with no knowledge of their operation. Except in the case of the larger zoos, however, it will be hard for the practice to justify the maintenance of CPD in the zoo field for all veterinary staff, and this can be a reason for the zoo work of the practice to be primarily the responsibility of one member, who can direct his colleagues if necessary. From time to time, with the level of knowledge in zoo medicine increasing rapidly, the practice may need to consult specialists in the field or in certain disciplines. In such cases, it is essential that everyone involved know who is leading the case or investigation, and that zoo management and staff respect that.

2.4 Frequency of service

Whatever the source of veterinary services selected, other than the resident vet option, it is important that they include regular advisory visits, over and above those needed for emergencies, to assess general health, maintain surveillance and the preventive veterinary programme, and to review records and reports. A recommended minimum has been suggested in Appendix 5.5 of the SSSMZP, and is repeated here with modification:

Large to medium sized mixed collections - weekly

Large bird collections and smaller mixed collections – monthly

Large aquariums, small bird parks – two-monthly

Medium –sized aquariums (especially with other taxa besides fish and invertebrates), large specialist reptile collections, tropical houses – three-monthly

Small aquariums, butterfly houses, small park aviaries, museum collections, small raptor centres – six-monthly

2.5 Evidence of service

Inspectors will require to see evidence that the agreed level of veterinary service is being undertaken. It is recommended that a signed record or diary of veterinary visits is maintained for inspection, and that a contract or service agreement is undertaken between the collection and the lead veterinary consultant or practice, which clearly lays down the responsibilities of both parties. This is in addition to the normal animal veterinary and pathology records which will be maintained.

3. Areas of involvement

SSSMZP paragraph 3.9 delineates areas of a zoo's operations for which the veterinarian should be responsible (in the case of an employed resident vet) or actively involved in. It can be seen that these duties are extensive and include aspects of training of personnel, preparation of protocols, supervision of the application of animal health legislation, control of nutrition and even involvement in exhibit planning and design. These requirements make it clear that a substantial involvement in and understanding of the zoo industry and its needs are important for the vet. Zoos should not use veterinary services which are not willing or able to meet this level of involvement.

3.1 Routine inspection of the collections

Knowledge of the collection and methods of housing and caring for the animals is essential for the correct application of any veterinary programme, and the zoo should allow time for this regular familiarisation process. Regular "walk-rounds" of the collection can highlight problems which may not have been recognised, and also monitor the progress of ongoing intervention.

3.2 Directing or carrying out treatment of sick animals

On many occasions it will be neither possible nor justified for the visiting vet to carry out every application of a treatment, and there is a great value in designating a member of staff to be trained as a veterinary assistant. Some zoos are assisting this process by employing trained and qualified veterinary nurses to fulfil this role, and this is to be recommended. Zoos should ensure that staff do not attempt to undertake veterinary treatment of their animals without the full involvement of the veterinary service.

3.3 Administration of vaccines, worming and other aspects of preventive medicine

Preventive medicine is the key to zoo animal health, and this standard serves as a reminder that a comprehensive programme is required, which is entirely under veterinary control. Sufficient resources should be made available to ensure that such a programme is established and maintained, and clear evidence should be available to inspectors.

3.4 Health monitoring of animals and safe and proper collection and submission of samples

Routine monitoring and surveillance is an integral part of modern zoo medicine. The amount of interference with animals for this purpose needs to be offset against any level of individual stress or group disruption, and should not develop to a level where it may be

considered as experimentation (unless appropriately licensed). It is recommended that an ongoing programme be set up and that any sample submission involved in this process, which may be done by keepers, is supervised by the veterinarian so that material is not wasted or shipped unsafely. Successful and meaningful diagnosis is highly dependent on the timely submission of good quality samples, and badly packed material can be a serious health hazard and may well be destroyed by the shipper or the recipient.

3.5 Training of zoo personnel in health and hygiene

Major zoos and those owned by major companies are likely to have advanced health and safety protocols, and it is important that the veterinarian has input to the animal related aspects. In smaller establishments the necessary skills may not be present and the vet can advise by using examples and information from general veterinary practice. However, knowledge of the specific hygiene hazards from exotic species will be necessary, and may be sourced elsewhere. Zoo personnel should also be trained in techniques of cleaning and disinfection, and other techniques used to prevent transmission of disease between animals or its introduction from outside the zoo (biosecurity).

3.6 Ensuring that post mortem examinations are carried out

(See Section 5 - Post mortem arrangements)

3.7 Supervision of quarantine premises and other such tasks required by law or as part of good veterinary practice

(See Appendix 1 - Legal aspects)

3.8 Nutrition and the design of diets

This is specifically mentioned in the Directive, and is one of the most important aspects of health care in the zoo. Most domestic animals are fed on prepared diets, and the need for the general veterinary practitioner to become involved in their nutrition at any level is limited. By contrast, although prepared diets are also available for some zoo animals, this is far from the case for the majority of species, many of which may have very unfamiliar natural diets. Diets from different geographical regions may be composed of components not available in different countries, or components with different nutritional contents depending on the geographical location, and may require supplementation or other adaptation. A great deal of research is needed in this area. Palatability and quantity may be as important as nutrient content in maintaining animal health, and there should be access to practical literature as well as a facility for analysing diets.

Much zoo nutrition is still driven by tradition, and diets suffer from the phenomenon of “dietary drift”, whereby prescribed diets gradually get changed by keeping staff over time, for various reasons. Diets should therefore be reviewed regularly, and the services of a nutritionist should be considered to back up the veterinary service.

3.9 Planning and exhibit design

Obviously the veterinary service should have the major input into the design of any veterinary, quarantine or isolation facilities in the zoo, but also there should be input into the general design of exhibits. This will help to avoid potentially harmful structures or materials, as well as ensuring that any veterinary intervention is easy to accomplish

(access for trapping or darting animals etc.). Vets receive training in the environmental control of animal housing, such as humidity, ventilation and temperature, and this knowledge should be utilised.

3.10 The establishment of written procedures to be followed in the event of accidental use of dangerous drugs

Dangerous drugs are regularly used in zoos to immobilise and control animals, and they can have fatal effects if accidentally administered to people. The development of contingency plans for such a hazard should be the joint responsibility of the vet, the H&E officer, the medical adviser and the drug manufacturers. Often COSHH safety sheets are available from manufacturers and will already be present in veterinary practices.

4. Veterinary facilities in the zoo

For zoo veterinary work to be done properly, facilities and equipment will be required. These should be appropriate for the size and variety of the collection, and the types of animals kept. These include a place to examine animals, capture equipment, holding and isolation quarters, secure storage for medicines, and clinical waste disposal.

For some collections the facilities of a local veterinary practice can be used for most purposes, and it may be more practical to transport most animals needing investigation or treatment to the practice (e.g. falconry centre, reptile collection). It may even be appropriate to hospitalise such specimens at the practice, so long as they do not create undue risk to staff or the public. Some animals may be best examined and treated in their own enclosures and may have to be chemically immobilised before any intervention can take place.

A large zoo with a full-time vet will have to provide most of the equipment and space which would be found in a general practice, as there may be no other convenient source of assistance.

The following points should be considered when judging a particular zoo's requirements, and apply equally to all species, from elephants to fish:

- it should usually be possible to capture or otherwise restrain every animal in the zoo for veterinary examination. This may require physical equipment such as nets, catching boxes or crush cages, or remote capture equipment such as blowpipes and dart rifles;
- in order to avoid the need for capture, consideration should be given to training animals to co-operate with veterinary procedures;
- having captured an animal, there should be means of transporting it safely either to another part of the zoo for holding and examination, or off site for the same purpose, if appropriate;
- if the animal is not adequately anaesthetised at this point, there must be equipment or drugs to induce and maintain anaesthesia safely if appropriate, for the humane treatment of the animal and the safety of personnel;

- there should be a room for examination with, as a minimum, a table, hot and cold running water and washing facilities, good lighting, ventilation and temperature control, and power outlets. The room should be able to be cleaned and disinfected, have good drainage, be of sufficient size with adequate doorways, and be dedicated to the purpose. When complete clinical facilities are not provided, the animal should be able to be moved elsewhere for further care, or the necessary equipment brought in. Under the latter circumstances, care should be taken that any legal and safety guidelines can be met (e.g. radiation protection);
- there should be secure holding facilities for animals requiring hospitalisation or isolation, with biosecurity barriers for infectious cases;
- when the zoo has a full in-house veterinary service, the facilities provided should be capable of meeting the reasonable and likely needs of the animals in the collection;
- there should be a lockable cupboard or room for medicines, taking into account temperature and light exposure and a safe means of disposing of out-of-date medicines. A record should be kept of drugs in stock and their administration, in addition to the details recorded in clinical records, so that drug use may be audited. Controlled drugs should be kept in a zoo for emergency purposes only, unless a resident vet is on site, and the required records must be kept. Antidotes to toxic drugs should be available;
- suitable containers for sharp and contaminated clinical waste should be provided, and a disposal service arranged.

5. Post mortem arrangements

The post mortem examination (PME) of animals which die in a zoo is a vital part of health and disease surveillance, and of a comprehensive veterinary programme. As well as providing a potential diagnosis of the cause of death of the individual, the examination provides an insight into the general health of the group, acting as a form of population biopsy. This is particularly the case when an animal may have died of an apparently obvious cause, such as accident, trauma or predation. The temptation for managers to discard such carcasses as not requiring or meriting PME for financial reasons should be resisted, as they can provide very valuable information on nutritional status, parasite loads, developmental anomalies in small populations, and unrecognised chronic disease.

The general presumption under zoo licensing is that the majority of deaths will be investigated, and any decision not to investigate will be made by the collection's veterinarian, not by managers. In the case of a Balai approved collection, examination of all animals covered by the approval will be required.

In order to get the best value out of the PME, certain prerequisites must be in place:

- a rapid method of retrieval of the carcass (especially in the case of fish and reptiles, where there is often no opportunity in the exhibit for post mortem cooling to occur);
- a safe handling protocol to protect handlers and other animals from infection;

- storage facilities for carcasses which cannot be despatched or examined immediately, including cold storage and freezer space (neither of which should be in use for other purposes), with secure bags or containers;
- safe disposal of the remains of examined carcasses;
- access to a veterinary pathologist, preferably with specialist knowledge of zoo animals and wildlife, and the appropriate facilities;
- a record keeping system which allows ready data retrieval and clearly relates the PME findings to the animal's clinical and curatorial records.

There are various options available to a zoo for carrying out PMEs. If they are to be done in-house, there must be appropriate facilities available. This means a minimum of a dedicated PM room, with good lighting, washable impervious surfaces, drainage capable of trapping solid waste, hand-washing facilities, a PM table and instruments. If carcasses suspected of harbouring hazardous pathogens (e.g. *Chlamydothrix*, *Mycobacterium*), or primates, are to be examined, then a safety cabinet or operator safety hood is required. Such facilities are generally beyond the resources or needs of all but the largest zoos, and are not available in most veterinary practices. Aquarium specimens are generally examined under simple laboratory facilities, as the risk of inhaled pathogens is low, and most specimens are small and can be accommodated in a washable tray.

The gross PME needs to be carried out by a competent person, which essentially means a veterinarian, veterinary pathologist or, under some circumstances, a trained technician or aquarist under veterinary supervision. The need to train aquarists in post mortem technique and proper sample-taking from fish and invertebrates is recognised because dead aquarium specimens deteriorate too rapidly for shipment elsewhere, unless fixed whole. Following the PME, samples may need to be taken for further examination (microbiology, toxicology, histopathology) and these will almost always have to be shipped to a specialist laboratory. Training needs to include safe handling techniques for fresh and fixed material and associated chemicals.

In many, if not most, collections, the costs and Health and Safety requirements of post mortem facilities will mean that carcasses are generally despatched to a veterinary laboratory, where the whole examination, further tests, and carcass disposal can be carried out competently and in safety, and this should be the generally recommended option (except for aquaria). Some veterinary laboratories will not handle primates or unfixed primate material, particularly the Veterinary Laboratory Agency's Investigation Centres (Defra). Others may not consider themselves competent in the examination of non-domestic animal material. The zoo's veterinarian or a List 1 (veterinary) Zoo Inspector should be able to recommend a suitable laboratory.

6. Record keeping

The keeping of comprehensive veterinary records is both a Directive requirement and part of normal good veterinary practice. The zoo needs to ensure that full and up-to-date records are kept on all aspects of animal health and that these are available on site, as they will be required to be seen by inspectors. They should also be available for access by any other vet who may be required from time to time to deal with an animal, and for despatch to another zoo, should an animal be moved. These records should be provided

to any other vet who takes over a case, or indeed the care of the whole zoo, and so should be clearly regarded as the property of the zoo. If there is any doubt about this, it should probably be made part of the contractual arrangement that any copyright is assigned to the zoo, without which the transfer of records becomes impractical.

With regard to veterinary accounts, the zoo should regard these as potentially commercially sensitive, and there is no requirement for inspectors to see these, unless there is a serious dispute over the level of attendance.

Records can be kept in any durable form, but computerised entry is ideal, provided it is fully and securely backed up.

Appendix 1 Legal aspects

This list gives the main areas of legislation or other guidelines that cover veterinary involvement with zoos (other than the Zoo Licensing Act 1981). It is not comprehensive and readers should be aware that legislation may be frequently amended or updated. It should be noted that there may be significant differences in legislation between Scotland, Wales and England. Veterinary surgeons working in or providing services to zoos need to be particularly aware of, and advise their clients about, relevant aspects of these instruments and guidelines, and zoo owners need at least to be aware of them.

The Veterinary Surgeons Act 1966 and associated orders and statutory instruments.

This is the law that governs the veterinary profession. Only qualified Veterinary Surgeons registered with the Royal College of Veterinary Surgeons are able to practise veterinary surgery, i.e. diagnose and treat disease in animals, except for administration of first aid by an owner. There are certain exceptions, for example for veterinary students, veterinary nurses and farriers. This legislation strictly limits the procedures owners or their agents may carry out on their own animals.

Protection of Animals (Anaesthetics) Acts 1954 and 1964. These Acts have been repealed in England and Wales by the Animal Welfare Act 2006. In Scotland the 1954 Act has been amended by the Animal Health and Welfare (Scotland) Act 2006. The 1954 Act requires that an appropriate anaesthetic is administered for painful operations, except for certain routine agricultural procedures. In Scotland this means that where an operation is performed without the use of an anaesthetic then it is to be regarded as being performed “without due care and humanity”.

Veterinary Medicines Regulations 2006, the Supply of Relevant Veterinary Medicinal Products Order 2005, and associated legislation – applies to the use, prescription, sale and supply of veterinary medicinal products. In particular it specifies requirements for the labelling and storage of prescribed medicines, and the recording of their use.

The Royal College of Veterinary Surgeons Guide to Professional Conduct lays out the principles of veterinary professional conduct that every veterinary surgeon is obliged to observe, and in doing so make animal welfare their overriding consideration at all times. Includes the provision of 24-hour emergency cover, requirement for third party insurance, requirements for CPD, professional etiquette and the 12 principles of certification. Annex h provides guidance on the use of medicines for dart guns (www.rcvs.org.uk)

Animals (Scientific Procedures) Act 1986³. Covers the use of animals for scientific or experimental purpose. Guidance on the interface of this Act with the Veterinary Surgeon's Act is given in annex b of the RCVS Guide to Professional Conduct.

Animal Welfare Act 2006/ Animal Health and Welfare (Scotland) Act 2006. This legislation replaces the Protection of Animals Act 1911 in England and Wales, the Protection of Animals (Scotland) Act 1912 and amends the Animal Health Act 1981 in Scotland. No specific guidelines for the care of zoo animals will be produced under this

³The Animals (Scientific Procedures) Act 1986 transposed EU Directive 86/609 into UK law. The Directive was replaced by Directive 2010/63/EU in September 2010; the aim of which was to strengthen the protection of animals used in scientific procedures. As well as vertebrate animals the new Directive extends protection to all live cephalopods. The 1986 Act will be amended on 1 January 2013 to bring the new Directive into UK law.

Act, but the general imposition of a duty of care on the owner applies to all vertebrate animals.

The Balai Directive 92/65/EC. Controls movement of animals within the EU and from third countries. Full approval for a zoo under Balai offers certain advantages for EU internal movement of species, particularly primates. This requires the appointment of an Approved Veterinarian by a zoo (Approval of Bodies, Institutes and Centres under Article 13 and Annex C of the Balai Directive 92/65/EC (as amended by regulation EC No. 1282/2002)) who is in charge of disease surveillance and control measures such as quarantine/ isolation facilities, day to day compliance with the animal health requirements of the Directive, and on EU rules on animal welfare during transport and on the disposal of animal waste. A lesser level of Registration is also available.

The Rabies (Importation of Dogs, Cats and other Mammals) Order 1974 (as amended). A Veterinary Supervisor is required for premises authorised under this Order in which zoo animals are kept in rabies quarantine. This legislation is not replaced by Balai and still applies in the UK for rabies-susceptible species.

Animal By-Products (Enforcement)(England) Regulations 2011 / The Animal By-Products (Enforcement)(No.2)(Wales) Regulations 2011/The Animal By-Products (Scotland) Regulations 2003 and EC Regulation no. 1069/2009. Includes guidance on the feeding of animal by-products to zoo animals. In particular, it forbids the feeding of zoo animals to other animals, specifies labelling, storage and recording of other animal by-products used as food for zoo animals, and controls the disposal of any related waste.

The Animal Health Act (2002) and Orders made under it provides for measures for the prevention and eradication of **animal** diseases, including the control and monitoring of imports. It also includes various Regulations made under the European Communities **Act** 1972. This Act amends the Animal Health Act 1981 to provide additional powers to tackle foot and mouth disease, other diseases and scrapie in sheep. The Act covers England and Wales. The Animal Health & Welfare (Scotland) Act 2006 makes similar provisions in Scotland. Control Orders are generally made under this Act to implement EU Directives or when important diseases appear in the UK, such as Avian Influenza, and these give substantial powers of entry, closure and destruction of animals to Defra or its agents. It includes a list of notifiable diseases that must be reported to Defra.

The **EU FMD Directive.** New legislation in the UK to comply with this Directive to deal with future outbreaks of FMD is:

[The Animal Gatherings \(England\) Order 2006](#)

[The Animal Gatherings \(Wales\) Order 2007](#)

[The Animal Health Act 1981 \(Amendment\) Regulations 2005](#)

[The Foot-and-Mouth Disease \(England\) Order 2006](#)

[The Foot-And-Mouth Disease \(Wales\) Order 2006](#)

[The Foot-And-Mouth Disease \(Scotland\) Order 2006](#)

[The Foot-and-Mouth Disease \(Control of Vaccination\) \(England\) Regulations 2006](#)

[The Foot-and-Mouth Disease \(Control of Vaccination\) \(Wales\) Regulations 2006](#)

[The Foot-and-Mouth Disease \(Slaughter and Vaccination\) \(Scotland\) Regulations 2006](#)

[Regulatory Impact Assessment](#)

[Explanatory Memorandum to AHA 1981\(Amendment\) Regulations](#)

[Explanatory Memorandum to FMD Order and Vaccination Regulations](#)

The [Avian Influenza and Influenza of Avian Origin in Mammals \(England\) Order 2006](#) / Avian Influenza and Influenza of Avian Origin in Mammals (Wales) Order 2006 came into force in England on 27 April 2006 and in Wales on 6 July 2006 respectively. They implement the majority of the requirements of Council Directive 2005/94/EC on the control of avian influenza. In Scotland the main pieces of legislation are the Avian Influenza and Influenza of Avian Origin in Mammals (Scotland) Order 2006, the Avian Influenza (Slaughter and Vaccination) (Scotland) Regulations 2006 and the Avian Influenza (Preventative Measures in Zoos) (Scotland) Regulations 2005.

The Welfare of Animals (Transport) (England) Order 2006/The Welfare of Animals (Transport) (Wales) Order 2007/The Welfare of Animals (Transport) (Scotland) Regulations 2006 implement EC Regulation 1/2005 (on the protection of animals during transport) which applies to transport of zoo animals, stipulating transport conditions.

Veterinary Instructions, Procedures and Emergency Response (VIPER). These are Operational Instructions that would be used by Veterinary, Technical and Administrative staff of the State Veterinary Service (SVS) during the suspicion, confirmation and management of an outbreak of disease (such as FMD or Avian Influenza) in Great Britain. Instructions form part of the Contingency Plans of Defra, Scottish Government and WAGEPC. In addition, there are local procedures within each Animal Health Divisional Office.

The Firearms Acts 1968 to 1997. Veterinary surgeons and others using darting equipment and other firearms will require a licence under this legislation. The Act puts strict controls on the storage and use of firearms, and any weapon capable of remote delivery of drugs is included, as are the darts used as ammunition. The transport or shipment of such weapons within the UK is also strictly controlled. Local Police Authorities administer the Act.

The Health and Safety at Work Act 1974 covers many aspects of veterinary practice, including The Ionising Radiations Regulations 1999, which covers Health and Safety requirements for work with x-rays etc, and COSHH (Control of Substances Hazardous to Health) rules apply to many substances used in zoos (medicines, disinfectants etc.).

The Data Protection Act 1998 relate to client and professional veterinary records.

The Hazardous Waste (England and Wales) Regulations 2005 designate waste handling and treatment, and require registration of premises producing over 200kg of hazardous waste per year. This is relevant to the disposal of clinical, post mortem and carcass waste, as well as out of date or unused medicines.

Appendix 2 Sources of continuing professional development

Continuing Professional Development (CPD) for veterinarians is a mandatory requirement and records must be kept. From the point of view of the zoo operator it is important that a sufficient proportion of the CPD undertaken by the veterinary service provider is relevant to the zoo's needs. To this end, the operator may usefully be aware of the range of opportunities available. Sources of CPD in zoological medicine include professional associations through meetings, newsletters and journals, designated courses from universities or commercial providers, textbooks and internet/listserve resources. Zoological organisations also provide and publish information covering the wider field of zoo management and research. Zoo operators are required to produce evidence of their veterinarian's current CPD, and it is useful to have copies of his RCVS CPD Record Cards available at inspections.

Postgraduate qualifications in zoological medicine are available in the form of the Royal College of Veterinary Surgeons (RCVS) Certificate (CertZooMed) and Diploma (DZooMed) in Zoological Medicine, the MSc in Wild Animal Health (University of London/Institute of Zoology) and the Diploma from the European College of Avian Medicine and Surgery (DipECAMS). In addition, veterinary surgeons may be an RCVS Recognised Specialist in Zoo and Wildlife Medicine, or be FRCVS in a zoo-related topic. However, it should be appreciated that these qualifications may not be appropriate for some areas of zoological medicine, and many veterinarians with expert and specialist knowledge in this field will not hold these qualifications.

Specialist veterinary associations

British Veterinary Zoological Society (www.bvzs.org/)
European Association of Zoo and Wildlife Veterinarians (www.eazwv.org/)
European Association of Avian Veterinarians (www.eaav.org/)
American Association of Zoo Veterinarians (www.aazv.org/)
Association of Avian Veterinarians (www.aav.org/)
Association of Reptile and Amphibian Veterinarians (www.arav.org/)
Fish Veterinary Society (www.fishvetsociety.org.uk/)
International Association for Aquatic Animal Medicine (www.iaaam.org/)
British Veterinary Camelid Society (www.camelidvets.org)
Veterinary Deer Society (www.vetweb.co.uk/sites/deer.htm)

Zoological associations

British and Irish Association of Zoos and Aquariums (www.biaza.org.uk/)
European Association of Zoos and Aquaria (www.eaza.net/)
National Aquarium Workshop (details available through UK aquaria)
European Union of Aquarium Curators (www.euac.org/index2.html)
International Aquarium Congress (details available at the EUAC website).

Chapter 6 Diving in zoos and aquariums

1. Introduction

Diving is a very specific activity carried out by a number of licensed zoos and aquariums. Advances in aquarium technology are increasingly being used for both fish exhibits and for other species to provide large windows with underwater viewing (penguins, seals etc). Diving activity is consequently increasing and will become a more regular component of zoo inspections. While diving in aquariums comes under the legislation of the Health and Safety Executive (HSE), there is often a lack of familiarity of diving practice among zoo inspectors and local authorities, particularly in relation to animal management and welfare. In addition, there have been several proposals in recent years for 'swim-through' experiences where the public experience close animal contact by swimming in the exhibit with the animals, similar to those in the USA.

The aim of this chapter is to provide zoo inspectors and local authorities with the necessary guidance for good practice relating to diving in aquariums to help both the zoo licensing and inspection process. It also outlines the procedures involved with diving in aquariums that are covered by the HSE.

The HSE Diving Inspectorate is responsible for inspecting all commercial diving operations regardless of the business or location, be it the oil industry or aquariums. Diving regulations arose to control risks arising from specific hazards over and above those covered in the Health and Safety at Work Act 1974. The main sets of regulations that apply to diving are as follows:

The Diving at Work Regulations 1997 (DWR)

DWR cover all dives when one or more divers are at work, whether employed or self-employed. The Regulations apply to everyone: from the client, for whom the work is being done, to the diver undertaking the work. Everyone involved has a responsibility to take measures to ensure the health and safety of those taking part in the diving project. DWR seek to control the hazards and risks associated with diving. They are 'goal setting' regulations, i.e. they do not specify in detail how diving at work should be carried out. The employer has to plan and manage the work to protect the health and safety of everyone taking part as far as is 'reasonably practicable' www.hse.gov.uk/diving/index.htm.

Approved Codes of Practice (ACOPs)

HSE has produced a set of five ACOPs, one for each of the different sectors of the commercial diving industry. To comply with the relevant advice in an ACOP generally means you are complying with the law, although there are alternative approaches that need individual evaluation. Diving in aquariums comes under the 'The Scientific and Archaeological Diving Projects ACOP' www.hse.gov.uk/diving/acop.htm.

2. Reasons for aquarium diving

Diving is carried out in aquariums for a number of reasons which are outlined below.

2.1 Maintenance

- Improve efficiency of filters – removal of load
- Removal of algae and detritus for aesthetics and to maintain good water quality
- Removal of particulates, *Cyanobacteria*, hydrogen sulphide accumulation in sand to maintain good water quality
- Visual monitoring of fish health
- Removal of animals for routine health checks
- Removal of animals in cases of disease or injury
- Construction of display components
- Installation and replacement of substrate and theming

2.2 Feeding

- Maintain healthy livestock by providing balanced and controlled diets to different species
- Target specific species for feeding to reduce predation, to control aggression and enable drug administration

2.3 Educational

- Enhance visitor experience through diver interaction and a closer experience with the animals (particularly in swim-through exhibits)
- Educational messages through diver presentations for visitors which cover conservation issues, animal biology and behaviour
- Opportunities for question and answer sessions with visitors
- Training for public e.g. dive courses, shark awareness courses
- Training for staff e.g. emergency drills, livestock transfers, new staff acclimation to feeds and maintenance

2.4 Research

- Using diving as a method to enable closer observations for research on topics such as animal husbandry, hydrodynamics, water chemistry, corrosion, animal behaviour, nutrition, breeding and disease

2.5 Special events

- Function events/corporate hospitality e.g. evening feeds, diver presentations
- Media diving e.g. celebrities diving in tank, public awareness events (note this is covered by a specific ACOP for media diving www.hse.gov.uk/diving/acop.htm)

All zoos and aquariums that undertake diving activity should have a Dive Manual that outlines their standard operating policies and procedures for diving, risk assessments and working practices. The Dive Manual should refer to the specific issues relating to the animals, exhibits and practices carried out in that organisation.

3. Dive teams

The structure of the dive team is specified by HSE legislation.

3.1 Team structure

Diving in aquariums is always carried out in teams that consist of a dive contractor, dive officer, dive supervisor, divers and one or more tenders. The number of divers and size of the team will be dictated by the size of the aquarium and type of dive. The responsibilities of each member of the team are as follows:

The Diving at Work Regulations (DOWR) 1997 imposes duties on all those involved in a diving operation to protect the safety of the divers. The dive contractor responsibilities are as follows:

- employ the divers taking part in each diving project;
- appoint the diving officer, in writing, along with an accurate description of their responsibilities;
- appoint the diving supervisors in writing. Copies of the written appointment must be held on file and the names of each supervisor must be recorded on the daily dive logs; and
- ensure safe diving under DWR is planned, conducted in a safe way.

Dive Officer/Supervisor

The diving officer/supervisor has overall responsibility for the safety of the diving project, and must be appointed in writing by the diving contractor. This includes insuring that:

- dive regulations relevant to the diving operations are issued;
- suitable risk assessments and diving project plans are provided;
- the dive location is safe and suitable for the diving operation;
- records of all qualifications, training and experience of all team members and the renewal dates for medicals, first aid and oxygen administration is kept up to date;
- the team is medically fit to dive ;
- suitable plant and equipment are provided and properly maintained;
- records of service for all relevant diving equipment are kept;
- suitable and sufficient people are able to provide first aid and oxygen administration;
- adequate first aid and emergency equipment is available; and
- an up-to-date record is kept for each diving operation and/or project and is kept on site for two years after the date of the last dive. This applies to all dives conducted by staff, volunteers and paying or non-paying members of the public.

The criteria for a dive officer/supervisor are as follows:

- must be adequately trained and experienced in the procedures and safety requirements used in the diving operation;
- does not have to be medically fit to dive but must be physically capable of rescue duties;
- does not to be a qualified diver, but whenever possible they should be qualified; and
- must be a minimum of 18 years of age.

Dive Tender

The criteria for a dive tender are as follows:

- must be adequately trained in the communication signals, surface rescue procedures and safety requirements used in the diving operation;
- does not need to be a qualified diver;
- does not need to be medically fit to dive;
- must be a minimum of 18 years of age; and
- must be physically capable of rescue duties

Divers

Divers have a number of responsibilities under DWR. These include:

- holding an approved qualification for diving;
- being competent to work safely;
- holding a valid certificate of medical fitness to dive;
- complying with the directions of the supervisor and the dive plan; and
- maintaining a daily record of their dives which they should keep for at least two years

General

- there must be a minimum of two people qualified to the HSE First Aid at Work level on the dive team, it is preferable if one of these is the Dive Supervisor;
- there must be a minimum of two people qualified in oxygen administration on the dive team, it is preferable if one of these is the Dive Supervisor; and
- any person who uses or operates specialist equipment must be competent and/or suitably qualified to do so.

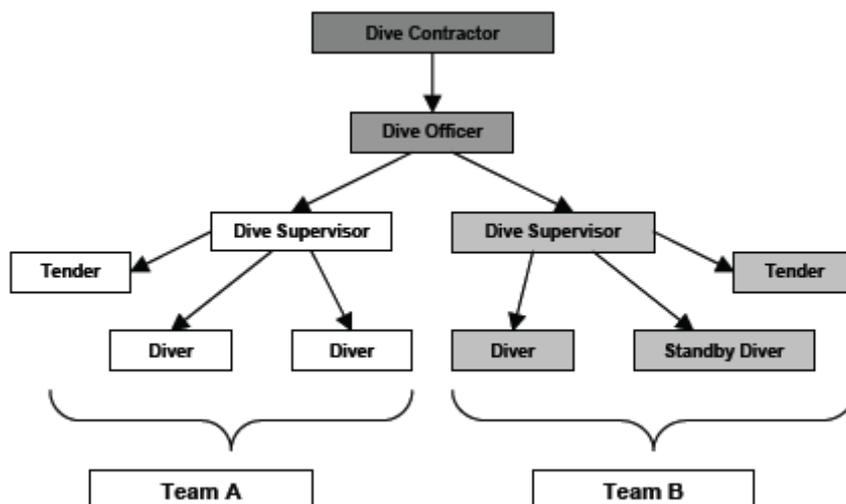


Figure 1: Example of breakdown of diving hierarchy and responsibilities.

3.2 Dive team qualifications

As a minimum requirement, all aquarium divers in the UK must have either commercial HSE Part IV, CMAS 3* or equivalent (PADI Divemaster and BSAC Advanced are two common UK equivalents). A Rescue Diver may be permissible providing the tank or

display has been designated as benign (see Section 4.1). Divers must be medically fit, with an annual HSE approved dive medical

The following are desirable qualifications of which a percentage of the divers must have:

- HSE First Aid at Work training qualification
- Oxygen administration certification

3.3 Volunteers

Volunteers can be integrated into a UK aquarium diving team if they have the relevant qualifications, training and experience as described above. The entire dive team cannot consist of volunteers irrespective of the classification of conditions. The general guidance from the HSE is that up to half of the dive team can consist of volunteers.

3.4 Members of the public

Members of the public must be fully supervised by a fully qualified dive team of an appropriate size and qualifications and all relevant documentation (dive plan, risk assessment etc) must be completed.

The few aquariums in the UK that routinely conduct dive experiences for the public (two at present) do so by operating as dive centres. Policies and procedures for public liability and health and safety come under the standard operating procedures of a dive centre. There are additional considerations for the potential interaction of members of the public with animals in a confined environment (see Section 5.).

For those zoos and aquariums allowing irregular dives these usually relate to special events, particularly media diving. Media diving (any diving activity for the purposes of broadcasting or recording for broadcast) is highly variable with regard to team size and purpose of dive and should only take place after full consultation with the Diving Contractor or his appointed representative. There is a specific ACOP for Media diving that must be followed (Media diving projects, Diving at Work Regulations 1997). Diving for the purposes of filming for scientific purposes still qualifies as Scientific & Archaeological and therefore does not come under the Media diving ACOP.

4. Health and safety

4.1 Benign and non-benign conditions

The aquarium exhibits will be categorised as either benign or non-benign environments by the HSE.

Benign conditions are identified as a tank or pool with no strong currents, clear water, no trapping, entanglement or overhead hazards, easy entry and exit to and from the water, where tasks are not long and arduous and with no special risk category animals are present. If a diving exhibit cannot adhere to the described conditions, then it is classified as a *non-benign* environment.

The categorisation of aquarium tanks in a particular aquarium can be made using a risk assessment and the guidance of the local HSE Inspector.

4.2 Risk assessments

A standardised template for both risk assessments and project plans to be compiled for exhibits that require diving activities. The risk assessments can then be broken down into two categories:

- a) specific risk assessment: risks that apply to a particular task or area e.g. target feeding a special risk category animal or diving in overhead environments. These type of examples will contribute to forming the *generic* risk assessment;
- b) generic risk assessment: a uniform risk assessment for common tasks and common use areas that form the routine diving practices.

All dive staff members should be trained and aware of the potential hazards in and around the dive site. This can include overhead obstructions, slippery walkways, unattended dive kit, proper use of ladders etc. These should be included in the generic dive risk assessment. All staff are required to reduce other hazards by keeping the dive site clear, washing down walkways etc.

A section should be included on the dive operation record for the dive supervisor to note that all divers have read and are aware of the generic risk assessment criteria.

Project plans summarise the dive plan. The target objectives should be fully explained with clear instructions of what is permitted and not permitted throughout the designated activity, e.g. “while performing maintenance in the open ocean tank, both divers are expected to keep in eye contact with each other and in reasonable distance to perform a rescue procedure”. Whether they are involved in feeding or maintenance schedules, all participating divers should be fully briefed on each of the project plans and acknowledges them in the form of a signature. This ‘indemnity’ paperwork can then be filed and reviewed by the Dive Officer. This will be most important when feeding strategies are implemented for shark feeding, etc. If a diver ignores the feeding protocol and endangers themselves, other divers or livestock, then the Dive Officer/Dive Contractor can then apply the appropriate disciplinary action.

4.3 Emergency procedures

A suitable emergency procedure must be in place and clearly understood by all members of the dive team and support staff.

As specified by the HSE, as an absolute minimum the following must be available at the dive site:

- method of contacting emergency services, with contact details of the nearest hyperbaric facility;
- oxygen administration equipment;
- fully equipped first aid kit stored in a waterproof container; and
- a rigid stretcher with integral securing straps

First Aid and medical materials must be replenished as soon as possible after use to ensure an adequate supply of materials at all times. No dive operations are to be conducted without the necessary first aid and oxygen supplies. First Aid kit and oxygen should be checked and recorded by a qualified person before diving operations begin.

Emergency drills should be conducted to train staff and to prepare for possible emergency situations. The frequency of the drills will be determined by the risk assessment, the nature of the dive site, the type of divers involved and the dive conditions. The frequency of emergency drills may differ from one institution to another, but it is standard practice to perform scenarios on a regular basis. Under the risk assessment criteria for each dive exhibit, there should be a list of scenarios that could occur during diving operations. Each scenario should be fully understood by all participating staff on the dive site.

The emergency drills should be fully documented and a de-briefing session carried out to identify possible areas for improvement. Improvements could lead to a change in diving practices. The logs of these emergency drills should be made available at the dive site.

Emergency scenarios that may occur during aquarium diving operations:

- Out of air
- High pressure leak
- Contaminated air supply
- AGA mask (full face mask) positive pressure leak
- Communication failure
- Panicked diver
- Vomiting diver
- Unconscious diver
- Bite or sting
- Crush injury
- Abrasion
- Collision

Note that out of air and high pressure leaks can be considered RIDDOR incidents which are to be reported to the HSE.

4.4 Zoonoses

Zoos and aquariums are required to undertake health surveillance for staff under the Management of Health & Safety at Work Regulations 1999. This requires organisations to systematically watching out for early signs of work-related ill health in employees exposed to certain health risks. The annual dive medical is one mechanism to monitor health problems associated with diving. However, should zoonotic diseases be identified in animals housed in the aquarium, dive practices will need to be reviewed.

Practices should also be in place to minimise the transfer of disease to animals in different tanks by divers e.g. freshwater showers between diving in different marine tanks.

5. Diving with animals

5.1 Animal welfare considerations

Diving in zoos and aquariums mean diving in close proximity to animals in a confined environment. The welfare of the animals must be considered as an integral part of the diving operating procedures. HSE legislation for diving focuses on safety issues for the divers and does not consider animal welfare. It is therefore important and relevant for this to be considered as part of the zoo inspection procedure.

Diving practices encompass a wide variety of activities and species which may range from professional aquarium staff diving in a coral tank or penguin pool to conduct essential maintenance, to members of the public having a dive experience in a large mixed species tank that includes predators. Some of these diving practices are essential for the maintenance of exhibits and welfare of the animals. Other diving practices may relate more to public education and awareness or income generation.

All diving should aim to minimise any negative welfare impacts on the animals by considering the following:

- design of the exhibit that enables easy entry and exit of the diver with minimal disturbance to the animals;
- suitable space and refuges in exhibit to allow diving practices without animals feeling cornered, chased, threatened or stressed;
- appropriate briefing and training for all divers on species in the exhibit, including special considerations and acceptable/unacceptable interactions with animals.

The institutional Dive Manual should give more details of the specifics of diver conduct in the water. The diving project plan should consider risks to both the animals and the divers. The following guidance will not all apply to every institution, but provides some examples of what is considered best practice. Divers should:

- always shower before diving and not wear any toiletry products that may pollute the exhibit
- assess the dive entry into the display in clear view of any animals that may be spooked and/or any bottom dwelling animals
- enter the water gently, either by ladder, ramp or rail
- enter water to minimise disturbance to animals
- be aware of proximity and location of animals
- avoid large animals overhead (particularly sharks) when exhaling air bubbles
- manage equipment, buoyancy and movements to minimise interactions or stress on animals
- minimise interactions and contact with animals to those that are absolutely necessary (e.g. target feeding, capture, medical administration etc)
- avoid sudden or aggressive moves near animals
- avoid any motions that will mimic an injured fish at the surface
- carefully inspect areas where there is theming or obstructions that may hinder an intended path for the diver(s).

The impact of diving on species in zoos and aquariums has not been well studied and in many cases negative effects may be hard to distinguish from other factors, such as water quality, diet and/or disease. It is therefore recommended that method statements should be prepared in advance of diving in an exhibit that covers the following issues:

- purpose of diving activity (including definition of essential vs. non-essential)
- size of exhibit
- frequency of diving
- number of divers on each dive (considering potential impact of larger dive teams conducting fewer dives vs. smaller dive teams conducting more dives)
- species in exhibit and natural behaviour

- temperament of individual animals in exhibit and how this might change daily or seasonally
- evidence of unnatural behaviour, particularly conditioned behaviour that can be related to diving
- light period

5.2 Special risk category animals i.e. dangerous animals

Special considerations need to be made when diving with dangerous animals, particularly elasmobranchs (sharks and rays). It is recommended that the organisations' Dive Manual includes a section that highlights potentially dangerous animals in each exhibit and what precautions should be taken.

Table 1 gives an example of how this has been approached by The Deep (Hull). The table outlines what species are potentially dangerous, a description of that species, what damage they can inflict and what dive training/awareness has to be enforced. Operators should develop protocols regarding precautions for particular dangers, as illustrated by the approach used in Table 1. These precautionary measures should ensure that both the diver(s) and the animal's welfare are addressed.

Table 1: Example of section in Dive Manual detailing considerations for dangerous animals in one exhibit. (taken from the Diving Operations Manual – The Deep, Hull)

Species		Precautions
Sand Tiger (<i>Carcharias taurus</i>)		Full training, awareness and buddy diving. No chain mail gloves must be worn due to the risk of entrapment in the teeth. Never touch near head or make quick movements in front of eyes.
Southern Stingray (<i>Dasyatis americana</i>)	Pelagic ray (1.5m). Not normally dangerous but can cause crushing injuries to hand when feeding.	Full training, awareness, buddy diving and chain mail gloves whilst handling or feeding.

The most up-to-date information on best practice for the management of elasmobranchs (sharks and rays) can be found in the Elasmobranch Husbandry Manual (Smith *et al.*, 2004), which includes a chapter on safe diving with elasmobranchs (Hodges and Sabalones, 2004).

Considerations also need to be made when considering whether to feed sharks while diving and the following guidance is based on information in Janse *et al.* (2004). Decisions should be based on:

- Species behaviour
- Number of specimens
- Size of specimens
- Exhibit layout

A feeding strategy has to be formulated taking into consideration the behavioural changes when feeding, nutritional demand, and frequency of feeds. Monitoring and recording behaviour is important along with what food was consumed. Divers should be aware of a change in conditions and trained to adapt to the situation and if necessary, terminate the dive operation.

It is recommended that only one diver feeds at a time, the other acts as the safety diver. A minimum of two divers are advised, especially if the diving operation has a high risk. Feeding sharks at the bottom of an exhibit is safer than feeding mid-water. A wall or vertical feature may be used to aid divers in increasing safety.

Various types of feeding receptacles are used throughout the aquarium diving industry, ranging from zip-lock bags, buckets to acrylic cylinders. It is preferable that the diver can see what is inside the container and also prevent the contents from drifting out.

5.3 Animal management

Exhibits should be designed to consider the catching and isolation of animals, particularly the use of swim-out tanks for larger tanks. Practices will vary in complexity depending on the species, numbers and sizes involved. Protocols should be established for the following:

- introduction of new animals to exhibit
- removal of existing animals from exhibit
- removal of injured or sick animals from exhibit
- monitoring health of animals using diving (including taking measurements)

Staff training levels, risk assessments and emergency procedures will need to be considered in each circumstance.

6. Communication

There is a legal requirement by HSE for two way communication between the divers and the dive supervisor. This has additional advantages in terms of animals' management, e.g. being able to talk to each other whilst doing a feed to report observations and increase safety.

There are many different kinds of communication systems that are available and institutions will need to develop the most appropriate method, depending on their circumstances.

Options include:

- two-way voice communication e.g. AGA (full face mask) between divers with a live link to the supervisor;

- two-way voice communication between divers and presentation/interpretation staff, this may be hard-wired or wireless;
- audio signals using bolts (with commands/signals defined by the number and speed of strikes of the bolts) between divers and the supervisor;
- visual communication using diving slates or hand signals between divers and the supervisor;
- manual signals using a lifeline (rope) between the diver and supervisor, which has the advantage of the supervisor being in direct contact with the diver.

The supervisor must have a means of communication with the Duty Manager and the allocated first aid staff on site. Whatever the communication methods, protocols should be detailed in the Dive Manual and staff should be fully trained with the system. This is particularly important with hand signals that people learn during dive training, but do vary among training institutions. Additional signals specific to the institution may also be developed to detail specific activities. The method of communication will also be defined in the Diving Project Plan.

7. Record keeping

7.1 Dive medicals

All divers participating in aquarium diving operations require an HSE diving medical assessed by a qualified dive doctor. It is the responsibility of both the divers and the dive officer/supervisor to ensure that divers are medically fit and hold the relevant certificates. Medicals are to be conducted annually and copies of all certifications are to be kept on site. Divers who fail a medical, or whose medical has expired, cannot dive in the aquarium. If a medical examiner does not award a certificate of medical fitness, a diver has the right to appeal against the decision within 28 days to HSE's Employment Medical Advisory Service (EMAS) using the appeals procedure (copies of this are available from the medical examiner).

7.2 Dive logs

The Dive Supervisor must forward the completed company dive logs and risk assessments to the diving contractor. These records must be kept for a minimum of two years after the last entry. Under no circumstance can any of the paperwork related to the diving operations be taken off-site. If there is a diving incident and legal implications arise then the appropriate paperwork must be available on demand.

Divers must keep a personal log book of all participated dives. This log book must be kept for a minimum of two years.

7.3 Indemnity forms

Indemnity forms may be required for the following practices:

- members of the public diving in aquariums;
- staff conducting specific activities e.g. hand-feeding sharks.

Indemnity forms will be required for insurance purposes so will require consultation between the Dive Contractor or Dive Officer and with the company insurers.

7.4 Animal records

As part of the zoo licence, records are required relating to mortalities. As with touch pool exhibits, specific attention should be given to unnaturally high mortality rates in exhibits that are routinely dived. It is also recommended that the zoo/aquarium should closely monitor, through its records, any problems that may relate to diving practices and, if identified, take measures to change practices as soon as possible.

8. Equipment

8.1 General

- first aid and oxygen equipment must be present at each dive site and it is the responsibility of the Dive Supervisor to determine whether all appropriate equipment is available for the dive to go ahead;
- there must be suitable means of entering and exiting the exhibit;
- dive tender and supervisor must wear suitable clothing and footwear (e.g. steel toe-capped boots, hard hat for low overhead obstructions, lifejacket);
- additional safety equipment may be required on the task conducted at the discretion of the dive contractor and supervisor;
- the Dive Supervisor must ensure that there is adequate illumination for the duration of the dive

8.2 Maintenance of plant and equipment

- air is generally used as breathing gas during aquarium diving operations. Compressed air must conform to BS4001 regulations. Air analysis must be done at a maximum of six month interval or if there is any doubt as to the purity of the air. Appropriate records of air analysis must be kept on site. Appropriate systems also need to be in place if other breathing gas is used e.g. Nitrox;
- any high pressure compressors and fill panels used to fill SCUBA cylinders must be regularly serviced by a qualified service technician. Any person who uses such equipment must be fully trained in the operating procedures and potential hazards of the equipment;
- it is recommended that a maintenance and usage log for equipment be kept;
- all SCUBA diving equipment must be regularly inspected and serviced by qualified staff in accordance with the manufacturer's recommendations;
- frequency of servicing should reflect the usage level of the equipment. If daily visual inspection or testing of SCUBA equipment indicates that it is not functioning properly then it must be removed from service, labelled and serviced as soon as practical. All servicing must be done by a qualified service technician. An inventory of all SCUBA equipment must be kept including serial numbers, dates and details of service and the service technician's identity. Copies of these records must be kept on site;

- it is advisable that appropriate hygiene procedures be implemented.

8.3 Personal diving equipment

There are several options that may be used in terms of breathing apparatus, including:

- SCUBA with half face mask
- SCUBA with full face mask (AGA mask)
- re-breathers
- surface supply (hookah)

Additional personal equipment may include suits (wetsuit, semi-dry suit, dry suit), weight belts, gloves, fins.

The institution will select the most appropriate equipment according to circumstance (type of exhibit, water temperature etc.). All dive staff must be appropriately trained in the use of dive equipment.

9. References

Hodges, V. and Sabalones, J. (2004) Diving with elasmobranchs: Safety protocols. In *Elasmobranch Husbandry Manual. Captive Care of Sharks, Rays and their relatives*. By Mark Smith, Doug Warmolts,

Dennis Thoney and Robert Hueter (Eds). Ohio Biological Survey Inc., Columbus, Ohio, USA. pp. 163-169.

Janse, M., Firchau, B, Mohan, P.J. (2004) Elasmobranch nutrition, food handling and feeding techniques. In *Elasmobranch Husbandry Manual. Captive Care of Sharks, Rays and their relatives*. By Mark Smith, Doug Warmolts, Dennis Thoney and Robert Hueter (Eds). Ohio Biological Survey Inc., Columbus, Ohio, USA. pp. 183-201.

Smith, M., Warmolts, D. Smith, Thoney, D. and Hueter, R. (Eds). *Elasmobranch Husbandry Manual. Captive Care of Sharks, Rays and their relatives*. Ohio Biological Survey Inc., Columbus, Ohio, USA.

Chapter 7 Managing zoonotic risk in zoos in the UK

1. Introduction

This guidance is intended to provide a practical approach to the control of zoonotic disease in zoos in the UK. It covers both risks to human health and risks to other zoo animals.

The guidance provides advice on meeting legal requirements for those managing zoos, as regards controlling the risk of infection to humans and animals. The guidance supplements and complements the guidance produced by the Health and Safety Executive (HSE) Managing Health and Safety in Zoos and the Department of Environment, Food and Rural Affairs (Defra) Standards of Modern Zoo Practice and general biosecurity guidance. Other HSE guidance, such as that on open farms may also be relevant where zoos have

What is a zoonosis?

A zoonosis is an infectious disease that can be transmitted between humans and animals. For example:

- by direct contact with an animal such e.g. rabies resulting from a bite
- by contact with an animal's faeces e.g. *E.coli* O157
- by contact with a contaminated environment e.g. anthrax
- by inhalation of contaminated dust or droplets e.g. psittacosis (chlamydiosis) and Q fever
- indirectly via ingestion of contaminated food e.g. campylobacteriosis
- via vectors such as biting insects e.g. West Nile fever and Lyme disease

The infectious micro-organisms that cause zoonoses include viruses, bacteria, fungi, protozoa and other parasites, with both domestic and wild animals acting as reservoirs for these pathogens.

The diseases they cause in humans range from mild and self-limiting (e.g. most cases of toxoplasmosis) to fatal (e.g. Ebola haemorrhagic fever). The potential for a particular disease agent to cause harm in humans will vary with the individual's immunological status.

In many countries, food is the most common source of zoonotic diseases. It is perhaps worth noting that many of the zoonotic agents causing disease in humans cause little or no obvious clinical disease in their animal hosts. e.g. *E.coli* O157 in cattle & Q fever in sheep.

similar exhibits.

An approach to risk assessment is described, together with a suggested template, along with practical measures to control these risks. In addition, guidance is given on

appropriate screening and monitoring for disease in animal populations and how this can contribute to the control of zoonotic disease.

2. Scope

This guidance is aimed primarily at zoo operators but it should also be useful to those who are involved in the management and care of the animals such as zoo vets and those responsible for human public health such as the Health Protection Agency. External inspectorates (HSE, local authorities and Defra) can use the guidance as a means of ensuring that operators are following best practice for the sector in meeting their legal obligations.

The main aim of the guidance is to provide advice for zoo operators/managers on controlling the risk of infection to visitors.

What is a zoo?

A zoo is defined as a permanent establishment where living, wild animals are kept for exhibition to the public for seven or more days a year, with or without charge for admission. This includes:

- aquaria
- sanctuaries
- bird gardens (including birds of prey)
- safari/wildlife parks

The zoo itself may be part of a larger concern e.g. display of exotic birds on a farm.

3. Legal framework

3.1 Health and safety law

The main legislation of relevance to the control of zoonotic infection at work, and to those who may be affected by the work, is the Control of Substances Hazardous to Health (COSHH) Regulations. Under COSHH, the definition of hazardous substances includes micro-organisms that can cause harm to human health and, although this guidance uses various terms such as “infectious micro-organism”, “zoonosis/zoonoses” or “zoonotic infection”, the term used in COSHH is “biological agent”. This means the bacteria, viruses, fungi and internal parasites (such as tapeworms) that create a hazard to human health. Most agents cause harm by infection but they can also cause allergies, be toxic or otherwise harmful to health, for example the agents that cause spongiform encephalopathies.

COSHH applies in workplace situations where there is intentional work with biological agents eg growing them in a laboratory. But it also covers situations where there may be incidental exposure to the agents because they are present in either a human or animal, in their body fluids, waste products (urine and faeces) or material that could be contaminated by these waste products, for example animal bedding.

COSHH requires employers to protect their employees by assessing the risks of exposure to zoonotic agents and either preventing exposure or, where this is not reasonably practicable, putting in place measures to control exposure. COSHH also requires that the risk of exposure to those who may be affected by the work activity in this case, visitors to the zoo, be assessed and controlled so far as is reasonably practicable. This means taking reasonable steps to ensure the health and safety of visitors.

3.2 Animal health/biosecurity legislation

The Zoo Licensing Act 1981 (the Act) requires the inspection and licensing of all zoos in Great Britain. The Secretary of State's Standards of Modern Zoo Practice (SSSMZP), which include provisions for a high standard of animal healthcare and for animal contact areas, are used by inspectors when making their recommendations to local authorities as to whether to grant a licence under the Act.

The Animal Health Act 2002 includes a requirement to control the risks to human health from zoonoses as well as controlling the spread of disease among "animals and poultry" themselves. 'Animals' are defined under the Act as cattle, sheep and goats, and all other ruminating animals and swine. 'Poultry' are defined as domestic fowls, turkeys, geese, ducks, guinea-fowls and pigeon pheasants and partridges. All of these species of mammal and bird can be encountered in a zoo environment. The Act can also be extended to cover any four footed animal or bird as well as fish, reptiles, crustaceans, or other cold-blooded creatures of any species if required.

Certain animal diseases (see Appendix 3 – Notifiable animal diseases), some of which are zoonotic, are notifiable i.e. if an animal is affected or suspected of having one of these diseases it must be reported to the local Animal Health office.

3.3 Public Health legislation

Health protection legislation in England was updated in 2010 to give public authorities modernised powers and duties to prevent and control risks to human health from infection or contamination, including by chemicals and radiation (similar legislation is in place in Scotland and Wales). The amended Act and accompanying regulations⁴ extend the previous list of notifiable diseases of humans (for new list, see Appendix 4 – Notifiable disease in humans) and gives local authorities wider and more flexible powers to deal with incidents or emergencies where infection or contamination presents, or could present, a significant risk to human health. Some of these powers can be exercised directly by the local authority, for example requiring disinfection/decontamination of premises on request; others require an Order from a Justice of the Peace. It is worth noting that there are many important zoonotic diseases of humans that are currently not notifiable in either humans or other animals, e.g. Q fever.

⁴ Public Health (Control of Disease) Act 1984 (as amended) together with the Health Protection (Notification) Regulations 2010, the Health Protection (Local Authority Powers) Regulations 2010 and the Health Protection (Part 2A Orders) Regulations 2010 The Health Protection (Notification) Regulations 2010

What is the risk of acquiring a zoonotic infection from visiting zoos?

In 2009 Defra estimated there were around 500 zoos in the UK. Of these, 267 were licensed zoos subject to periodic inspection by Defra and local authorities. (NB: very small zoos are eligible to apply to their local authority for exemption from a full zoo licence).

Zoo visitation in the UK is steadily increasing with 24.8 million visitors to BIAZA collections alone in 2007 (The British and Irish Association of Zoos and Aquariums is the professional organisation representing the zoo and aquarium community). At the time of writing we can find no published zoonotic disease outbreaks associated with visitor contact with zoo animals in the UK.⁵ There have however been a number of reviews published looking at zoonotic infection associated with a wide range of different types of animal exhibits including several high profile outbreaks affecting large numbers of members of the public. These outbreaks have largely been associated with contact with farm animals rather than zoo animals, e.g. on open farms in the UK and Europe or at US State/County fairs.

Zoos do not generally pose the same level of risk as open farms because of the nature of the exhibits and the much reduced (or zero) degree of contact allowed between visitors and the animals. However there is still a potential for zoonotic infection to take place. Two case studies of zoonoses in zoo visitors are presented below:

An outbreak of psittacosis in a bird park in Japan⁶ – 12 confirmed cases of psittacosis were reported in visitors to a bird park associated with visiting an exhibit in a series of three hothouses. All birds in this exhibit were allowed to free fly, and public feeding was allowed. Of those infected, all had had direct contact with birds. Investigations revealed that sick birds were not quarantined and that the hothouses operated using a predominately closed air circulation system. This might have raised the concentration of the pathogen, increasing the possibility of transmission. In addition the routine use of dehumidifiers and high pressure water sprays (jet washers) in these closed hot houses might have led to increased dispersal of the pathogen and hence heightened risk of infection.

An outbreak of salmonellosis associated with a reptile exhibit in a zoo⁷ – 39 confirmed cases of salmonellosis were reported in visitors to a temporary Komodo dragon exhibit in a US zoo. The young dragons were kept in an enclosure on a substrate of wood mulch and surrounded by a 2ft high wooden barrier. During the 9

⁵ There was a recorded outbreak of VTEC O157 amongst visitors to a zoo but the source of infection was wild rabbits frequenting a picnic area and not the zoo animals themselves. (G. Pritchard pers. com.)

⁶ **An outbreak of psittacosis in a bird park in Japan** T. MATSUI, K. NAKASHIMA, T. OHYAMA, J. KOBAYASHI, Y. ARIMA, T. KISHIMOTO, M. OGAWA, Y. CAI, S. SHIGA, S. ANDO, I. KURANE, K. TABARA, A. ITAGAKI, N. NITTA, H. FUKUSHI, A. MATSUMOTO, and N. OKABE **Epidemiol Infect.** 2008 April; 136(4): 492–495.

⁷ **An outbreak of salmonellosis among children attending a reptile exhibit at a zoo.** Friedman CR, Torigian C, Shillam PJ, Hoffman RE, Heltzel D, Beebe JL, Malcolm G, DeWitt WE, Hutwagner L, Griffin PM. **J Pediatr.** 1998 May;132(5):802-7

days that the dragons were on display the wood mulch was not changed and the animals were frequently seen to place their front feet on the tops of the barrier. One of these dragons was subsequently found to be shedding *S. enteritidis* in its faeces. None of the infected people reported touching the dragon but over 80% of those infected touched the barriers surrounding the exhibit. Washing hands at the zoo after visiting the dragons was highly protective. On the basis of an attack rate of 4.3% among exhibit attendees under 13 years old on whom data were collected, we estimate that 315 additional cases of salmonellosis occurred among visitors in this age group. This large outbreak demonstrates the importance of environmental contamination in the transmission of Salmonella from reptiles, and the protective value of hand washing. Recommendations regarding reptile exhibits should emphasize this indirect route.

4. Risk assessment

The process of risk assessment is a specific requirement of COSHH and is carried out to identify substances hazardous to health (in this case, the risk of zoonotic infection) in the workplace, and to identify the measures necessary to prevent or control exposure to that hazard. Other health and safety legislation may require more general assessment of workplace hazards or else specifically address certain hazards e.g. manual handling. Although assessment is usually carried out to identify hazards to employees, the same process can be used for others who may be affected by the work such as visitors to the zoo. General guidance on controlling the risk of infection in the work place can be found at: www.hse.gov.uk/pubns/infection.pdf

The health and safety policy for the zoo must set out in general terms how the risk of zoonotic infection to visitors will be managed, and specific assessments should be carried out for any activities that bring visitors into contact with animals or their excreta/body fluids.

These risk assessments can take many different forms: they could be specific to zoonotic hazards or could address all hazards associated with the activity e.g. the risk of biting, scratching, escape etc during contact sessions; or be specific to the animal concerned and address all activities involving that animal e.g. feeding, cleaning as well as visitor contact activities. They are best carried out with the input of those in charge of a particular activity/area as they will be most familiar with the animals concerned. Risk assessments should also include input from a technical specialist such as the zoo's vet who is familiar with the occurrence of potentially harmful micro-organisms in the zoo's animal collection.

There are four components to risk management:

- describing the activity to be assessed and who is involved
- identifying the hazards
- assessing the risk
- controlling the risk

A suggested template for assessment is shown in Appendix 5 – Risk assessment template.

4.1 Describing the activity to be assessed and who is involved

You need to consider the nature of the activity that will, or could bring visitors into contact with animals, either directly or indirectly, and also whether there are any groups at increased risk of infection.

Consider:

- numbers of visitors passing through the area being assessed, the activities which they may be undertaking and how these may vary between different visitors groups (ages/ special needs etc);
- whether there is any staff presence/supervision
- the range of species with which the visitors may come in contact (either directly or indirectly);
- whether free ranging wildlife and pest species are present (as well as animals within the zoo's collection that are under consideration), and whether these might act as a source of infection either to the zoo animal or the zoo visitors who may come in contact with them or their excreta.

4.2 Identifying the hazards

Micro-organisms are found virtually everywhere in the natural environment. Most of these are harmless to humans and serve many important functions. Some however, under certain circumstances can gain entry to the body and cause serious disease. When identifying potential hazards that might lead to zoonotic infection it is easier to consider potential **sources of infection** i.e. the material that could contain infectious micro-organisms rather than trying to produce an exhaustive list of potentially harmful micro-organisms. You then need to consider how the infectious material might gain entry to the body – **the routes of transmission**.

A competent health and safety professional or zoo manager should be able to list the relevant sources of infection and transmission routes for the activities to be assessed.

There are four main sources of infection to consider:

- blood and other body fluids such as saliva
- waste products such as faeces or urine
- respiratory discharges such as those produced when coughing or sneezing
- skin – direct contact

Routes of transmission that should be considered include:

- putting contaminated hands or fingers in the mouth, nose or eyes - either directly or via eating or drinking with contaminated hands (i.e. faeco-oral route)
- breathing in infectious droplets from the air e.g. respiratory discharges such as those produced when coughing or sneezing
- splashes of blood and body fluids such as saliva from spitting into the eye or other mucous membranes such as the nose and mouth
- broken skin if it comes into direct contact with a source of infection (eg faecal matter or saliva when being licked, sucked or spat at) or else something contaminated by a source of infection

- a skin penetrating injury e.g. a bite or a scratch or through the bite of insect that is able to transmit the disease from animals to humans.

In addition to considering sources of infection and transmission routes, it may be worth considering the hazard posed by some specific infections or diseases. Technical assistance from the zoo's vet would be required to identify any particular diseases of concern for the activities being assessed. For instance, the risk of exposure to animals infected with cryptosporidiosis or *E. coli* O157 might be considered high if visitors were bottle feeding young ruminants but not if they were simply driving through an enclosure housing animals and their young.

When considering which specific diseases to include in the assessment, the vet should consider (see also 4.3 Assessing the risks)

- the micro-organisms the animals in question are most likely to carry. This can be derived from knowledge of the literature⁸ on diseases of the species being assessed and information on the types of micro-organisms found in the zoo's own animal collection.
- the potential for these microorganisms to cause harm in humans – some people may be more susceptible to infection than others; special consideration should be given to high risk groups (e.g. the very young, elderly or pregnant). Consultation with relevant health professionals e.g. local Health Protection Team (www.hpa.org.uk) may be useful.

4.3 Assessing the risks

The next stage of the assessment should identify the **likelihood** that visitors could come into contact with animals and other sources of infection. Three key situations to cover include:

A: Planned animal contact opportunities

Consider:

- level of supervision – how is contact supervised? Ratio of supervisors to visitors, training given to supervisors etc.
- behaviour of animals e.g. how likely are they to approach, how likely are they to lick, urinate/defaecate/bite or scratch whilst being handled
- different types of visitor should be considered - some groups will be more susceptible to acquiring infection either due to their behaviour (e.g. young children putting things in their mouths) or due to differences in their immune status
- type of contact and degree of contamination – are the visitors' clothes/footwear/hair likely to be contaminated or is contact limited to touching only
- established or short term – how habituated are the animals to being handled. Stressed and young animals are more likely to shed potentially harmful micro-organisms
- location of contact session – indoors/outdoors, on zoo premises or elsewhere, degree of environmental contamination in area during and after session

⁸ For example the European Association of Zoo and Wildlife Veterinarians' Transmissible Diseases Handbook www.eaza.net/activities/Pages/Transmissible%20Diseases%20Handbook.aspx

- availability of hand washing facilities, their location, type and how obvious they are to the visitor (level of signage, supervision, visitor instruction etc)

B: Walk through/drive through exhibits where animal contact is not encouraged

Consider:

- degree and means of separation of humans and animals
- type of substrate/materials visitors may come into contact with and such materials potential to harbour micro-organisms
- cleaning schedule of the enclosure and areas that visitors may access
- how much time visitors spend in the exhibit (dwell time) and activities undertaken. For example, the likelihood of visitors sitting, eating, drinking in the enclosure as opposed to just traveling through
- behaviour of the visitor e.g. whether they are likely to obey instructions not to feed the animals or stray from the path
- behaviour of animals e.g. are they likely to approach or stray into visitor areas

C: Other activities where visitors may come in contact with sources of infection

Although assessments should focus on the most likely sources of animal contact, this process should be extended to cover areas where animals (including wildlife and pest species) may have contaminated the general environment, especially where hand-to-mouth contact is likely, for example outdoor picnic areas and children's play areas/equipment. Contamination may be as a result of material bought in on shoes or push-chairs or else because wild animal species congregate in the area.

So far as reasonably practicable, the likelihood of any specific zoonotic diseases identified (see also 4.2 Identifying the hazards) infecting and causing harm to the visitors also needs to be considered. The primary duty in COSHH is to prevent exposure, but if this cannot be achieved, then exposure must be adequately controlled – adequate means to a level that won't harm people's health.

This stage of the assessment should be carried out in conjunction with someone with specialist knowledge of zoonoses and their animal hosts e.g. the zoo's veterinary surgeon. They can provide advice, based on previous experience, local knowledge, and other sources of information (e.g. reports of disease in the literature).

Consider:

- the likelihood of potential zoonoses occurring within the zoo being assessed – have these diseases been reported in the UK, have they been reported in the zoo being assessed and if so at what frequency?
- the likelihood of these diseases being spread (i.e. communicability) both among the animal population and to the visitors, either from the animals directly or from contamination of the environment
- the likelihood of these diseases going undetected and becoming established in the animal population or the environment – consider variation in clinical signs; whether the animals might become asymptomatic carriers; whether they are immune to infection e.g. as a result of vaccination; whether animals suspected of shedding potentially harmful micro-organisms are removed from the exhibit or not; and how

long the micro-organisms can persist in the environment given the current enclosure design and cleaning regime

- the likelihood of new diseases being introduced to the population; knowledge of biosecurity measures such as quarantine and disease screening in newly acquired animals; separation from free ranging wildlife; pest control and health status of employees in contact with animals during routine husbandry including preparation of food.

5. Controlling the risks

Control measures fall broadly into two categories:

Measures controlling the load of potentially harmful micro-organisms in the animals & environment and the risk of the visitor becoming contaminated.	Measures controlling the risk of infection becoming established in a visitor following contamination / exposure to potential harmful micro-organisms.
A: Good biosecurity and high standards of veterinary care - measures that reduce or eliminate the occurrence of diseases of concern in the animals.	C: Good personal hygiene measures – measures taken by individuals to control their risk of infection using the facilities provided e.g. hand washing, not eating in animal areas etc.
B: Good environmental hygiene and design - measures to reduce contamination of the environment or the visitors themselves	

Controlling the load of potentially harmful micro-organisms

A: Good biosecurity and high standards of veterinary care

High standards of preventative health care and biosecurity should be maintained. Some useful guidelines on designing and implementing such a programme can be found at www.defra.gov.uk/animalhealth/inspecting-and-licensing/balai/index.htm .

Consider:

- quarantine and appropriate health screening of all new animals before being introduced. Consider also health screening of animal-keeping staff for key diseases that may be transmitted to the animals (e.g. screening primate-keeping staff for tuberculosis) and exclusion of staff suffering from gastrointestinal infections from animal food preparation areas as would be the case in human food preparation
- vaccination of staff and animals in order to reduce the potential of disease transfer into and within the animal group if this is deemed appropriate
- measures to decrease the chance of disease transfer to the animals by free ranging wildlife or pest species

- prompt identification of disease in animals; systems in place for recognizing and reporting suspicion of disease - including staff awareness of signs of disease in the animals (and themselves)
- isolation of known or suspected case(s) of disease. This may require temporary closure of the exhibit if it is more practical or appropriate to isolate the whole enclosure rather than individual animals
- prompt veterinary investigation of any suspicion of disease and treatment as required
- preemptive screening for certain zoonotic agents may be useful – particularly those that occur infrequently but have serious consequences to human health should a visitor become infected (e.g. TB). However screening may also lead to a false sense of security as many of the more common zoonotic organisms (e.g. *E. coli* O157) are only shed intermittently and hence a negative test result only indicates that the animal tested was not shedding that day, and not indicative of its infection status or capacity to shed in the future. Further information on screening and monitoring for disease in the animal population in Appendix 1 – Monitoring and screening for disease
- the use of neonatal animals, animals in late pregnancy and animals that are not well habituated to humans for handling sessions should be avoided as these categories of animal are more likely to shed potentially harmful micro-organisms or bite or scratch the visitors.

B: Good environmental hygiene and design

Enclosures should be designed to reduce the chance of visitors coming into contact with sources of infection (i.e. animals or their excreta/body fluids). This can be done by use of barriers e.g. use of standoff barriers (double fencing) or solid barriers or by making the areas occupied by visitors less attractive to the animals than other parts of their enclosure - for instance judicious placement of feeding areas, perches and preferred rest areas so that these are still visible to the public but not within easy reach.

Special consideration should be paid to preferred areas for defecation and urination and measures taken to discourage contamination of signage explaining about the animals, public pathways, handrails and barriers, doors and any other items that you would expect the visitor to touch.

All diseased or dead animals should be removed from the enclosure as soon as they are discovered (remember to include free ranging wildlife and pest species). Care should be taken to control risk of spillages of infected material (body fluids or faeces) when moving the animal.

Food dishes and feeding areas should be out of reach of the visitors. Any uneaten food that could have become contaminated by animal body fluids should be removed from the enclosure at least daily.

Where animal contact is specifically encouraged, this should be done in an area that is easy to clean and disinfect to control the build up faecal material and be close to hand washing facilities. If there are to be exceptions to this rule, clear justification must be given and additional hygienic measures must be taken to reduce any risk of contamination to the visitors own clothing and footwear. (e.g. by preventing entry to the animals' environment

and allowing touching by hand only or by requiring visitors to wear protective clothing and footwear in the enclosure that is removed/decontaminated on exit).

Kissing or any other type of facial contact with the animals must be actively discouraged.

If animal feeding is allowed this must be carefully supervised. Visitors should be discouraged from picking up dropped food from the floor and re-feeding (more likely to be contaminated with saliva and faeces than fresh food). After the feeding session, any feeding equipment used should be decontaminated and any uneaten food disposed of immediately.

A regular cleaning regime must also be put in place for all enclosures/animal areas to which visitors are given access. The frequency and type of cleaning carried out will depend on the animals and their specific management needs. For example, a cleaning regime may be needed that balances the need for cleanliness with the need to allow animals to mark territory. Where cleaning may disrupt the scent marking behaviour of a particular species, areas of the enclosure should be cleaned in rotation and/or known scent marking areas cordoned off.

The substrate of indoor enclosures should be cleaned and replaced on an appropriate cycle. Natural substrates can be used in enclosures to which visitors are given access. In these circumstances there should be designated visitor pathways that can be kept clear of faecal contamination.

Particular attention should be paid to cleaning and, where practicable disinfection of signage, artifacts, barriers, handrails, seating and other items a visitor is likely to come in contact with.

In designated animal contact areas e.g. children's farm areas, class rooms etc, removal of any obvious excreta/secretions areas should take place as soon as possible and definitely after each contact session. The area should also be thoroughly cleaned when the animals are returned to their quarters at the end of the working day.

Systems should be in place to allow cleaning/decontamination of enclosures following the diagnosis of a potentially zoonotic disease. If this is not possible, the enclosure will have to remain closed to visitors until such time as the micro-organisms in question will no longer be surviving in the animals or the environment.

Cleaning agents that are safe for use in animal enclosures/contact areas should be used and cleaning should be carried out in such a way so as to limit spread/exposure of any zoonotic agent that might be present e.g. wet mopping rather than dry brushing, damping-down of bedding and other material before removal, low pressure rather than high pressure hoses.

Controlling the risk of visitor infection

C: Good personal hygiene measures:

Despite all the measures outlined above it is inevitable that visitors will at some point come in contact with potentially harmful micro-organisms. Good personal hygiene is the key to controlling the risks from contamination by infectious micro-organisms.

Ingestion is a key route by which many organisms can enter the body. Measures taken to reduce the chance of ingestion include:

- excluding zoo animals from designated eating and drinking areas
- not allowing eating and drinking in enclosures - this should be indicated by signage at the entrance to exhibits
- providing adequate/appropriate hand-washing facilities in areas where contact may, or will take place e.g. where feeding is allowed and in contact sessions

For more guidance see also Appendix 2 – Hand-washing – when, where, and how.

It is also important to provide information to visitors about the risks of acquiring zoonotic infection and the hygienic measures they can take to reduce these risks. This should include information about hand hygiene, what to do if bitten or scratched so that injury is reported and is treated properly and the need to provide adequate supervision to children or other groups who may be more likely to put contaminated materials in their mouths. Information should also be available on any additional measures to be considered by high risk groups.

Information can be conveyed in many ways including:

- written information in the form of signage, leaflets or electronic format (such as websites). Zoos that have a significant proportion of visitors for whom English is not their first language should consider multilingual or pictorial material
- oral instruction by a member of staff or a recorded briefing e.g. an attendant at an animal feeding session
- direct supervision by a member of staff e.g. hand washing following a class room session.

The form in which information is supplied will depend on the activity and type of contact the visitor may have, e.g. signage should be posted at the entrance to all designated contact areas; school and organized groups should be provided with written material prior to their visit.

Supplementary measures for specific enclosure types

Indoor bird enclosures

Consider:

- ventilation arrangements – ventilation will be needed to provide fresh air; remove stale air; help control temperature and humidity; and remove dust
- whether ventilation system is closed or open. Open systems must ensure a good flow of fresh air so that stale/contaminated air cannot build up. If closed or re-circulating systems are used, they will need some means of filtration to remove any airborne micro-organisms. These can be protected with rough filters to remove any large airborne particulates. Consideration should be given to filtration of incoming air, depending on the immediate external environment e.g. presence of other captive birds or wild relatives.
- positioning of fans, inlets and outlets so as to avoid dead space which may lead to pockets of stagnation

- presence of other environmental controls e.g. for humidity and temperature. Tropical environments where temperature and humidity are high may increase likelihood of growth of certain disease causing environmental micro-organisms such as fungi (e.g. *Aspergillus* species). Regular removal of rotting plant material and other organic debris e.g. uneaten bird food may help control levels
- where sprays and misters are used to control humidity, measures should be in place to control the growth of *Legionella* bacteria.

Touch pools

Consider:

- whether pool is stand-alone or linked to other systems/exhibits. Linked systems could potentially increase the risk of disease entering the water especially if linked systems contain mammals (including divers)
- water treatment used – water is likely to be treated so as to maintain animal health. Additional measures may be need to provide assurance i.e. to control any external contamination e.g. UV treatment of water especially if re-circulated back into other systems or exhibits
- as with other formal contact areas, that visitors should wash hands after touching fish. Visitors with obvious cuts/grazes on hands should be advised not to put hands in water/touch the animals.

Domestic animal petting areas

The risk assessment approach outlined in this document is equally applicable to domestic animal contact areas. However zoo managers should also be familiar with specific guidance produced by Farming and Countryside Education: Preventing or controlling ill health from animal contact at visitor attractions – Industry Code of Practice. See www.face-online.org.uk/resources/preventing-or-controlling-ill-health-from-animal-contact-at-visitor-attractions-industry-code-of-practice

What next?

You need to put the results of your risk assessment into practice i.e. implement the controls – this is a specific requirement of COSHH.

There is a template for risk assessment in Appendix 5. Most zoos will have more than five employees so therefore have a legal requirement to write down the results of the risk assessment. But this also allows you to share the results with other, including external enforcement agencies and it provides you with a record so that you can review it at a later date if, for example, something changes.

It should be remembered that risk assessment is not just a paper exercise and that any changes to the activity, e.g. introduction of a new animal species or information about a new zoonosis need to be reflected in the assessment. It is also good practice to set a review schedule for assessments to ensure they are formally reviewed periodically e.g. on an annual basis to make sure they are still fit for purpose. You should take into account, for example, any accidents or incidents that have occurred or feedback from visitors about the controls you have put in place.

Appendix 1 Monitoring and screening for disease

Any screening or monitoring programme needs to take into account the costs associated with such a test programme as compared to any likely benefits (to human visitors and the animals being tested).

Consideration should also be given to the validity of the test regime in the species in question and what action would be taken in the event of a positive test result.

Routine screening of animals that may be infected with endemic infections such as *E. coli* O157, *Campylobacter* or *Salmonella* is unlikely to be of any benefit. In addition, for some infections it may not always be possible to prove with any certainty that a particular animal is “negative” so all should be treated as potential carriers since excretion can be intermittent, the organism may survive in the environment. Therefore, the focus should be on controlling the risk of infection through good personal hygiene measures and good environmental hygiene and design.

Screening for endemic infections may be of value in the event of a local outbreak of disease as part of the epidemiological investigations carried out by public and animal health officials. Defra may require zoos to monitor for certain diseases in the event of an outbreak of animal disease in the general environment e.g. highly pathogenic avian influenza.

Screening would be better focused on the higher hazard, but rarer, infectious diseases that may be associated with certain animals. Screening is likely to be opportunistic, for example when an animal is undergoing veterinary treatment or checks or else by means of pooled samples from the environment. Such screening gives an indication of the likelihood of public exposure to certain infections which will help inform the risk assessment. For example, testing for European Bat Lyssavirus in a walk-through bat exhibit containing fruit bats is likely to provide the reassurance that even if there is contact between bats and visitors, the risk of infection is negligible.

Screening animals prior to import and during quarantine is highly recommended as it will reduce the chance of bringing in new potentially zoonotic micro-organisms which would be difficult and costly to eradicate once introduced to your collection. Guidelines for minimizing the risk of disease transfer between UK zoos can be found in appendix 5 of BIAZA’s animal transaction policy. See www.biaza.org.uk/animal-management/animal-management-resources/

Screening regimes for animals from other sources should be devised by the zoo’s veterinary surgeon on a case by case basis following a risk assessment.

Appendix 2 Hand-washing – when, where, and how?

Hand-washing is one of the most important means of controlling the spread of infection. However, concerns have been raised recently about the reliance on this as a control method because of the failure of individuals, especially children, to comply.

The use of soap and warm, running water to wash hands has been reinforced following recent outbreaks of O157 on open farms; the use of hand hygiene gels alone is not seen as sufficient to remove infectious agents such as cryptosporidial oocysts that may be present on soiled hands.

Although some animal contact in zoos could be viewed as similar to that on open farms, for example in petting areas that have farm animal species present, there are some significant differences in that the zoo is not a working farm so the density of animals present and the extent of contamination is likely to be far less than in a farm environment. Some types of animal contact may take place in clean, classroom environments and will be minimal, and therefore the use of hand-hygiene gels may be appropriate subject to assessment.

When?

- Hands must be washed after any known animal contact.
- Hands should also be washed before eating and drinking even if formal animal contact has not taken place.

Where?

- Hand-washing facilities should be located immediately adjacent to the exit of an area where there is known/supervised animal contact if there is a one-way flow of visitors through the area. If there is a two-way flow of visitors they should be provided immediately adjacent to entrances and exits. A one-way system may help to ensure that washing facilities are properly used.
- Appropriate signage should direct visitors to use the hand-washing facilities as they leave animal contact areas.
- It is recommended that hand-washing facilities are also located adjacent to, or at the entrance of permanent catering facilities (i.e. not just in toilets that might be located in such establishments) and, where possible near picnic areas to prompt the washing of hands before eating and drinking. If it is not possible to site near picnic areas, signage should indicate where the nearest facilities are located.
- Visitors should be informed about the need to wash hands and the locations of all hand-washing facilities e.g. on zoo maps. Adults should be reminded of the need to supervise children when washing hands.

How?

- Hands should be washed with warm, running water and soap and dried using paper towels or hand driers. Warm water is preferable, but if facilities are supplied with cold water only, a soap that emulsifies easily in cold water should be provided.

- Bins supplied for the disposal of paper towels should either have no lid or else a lid opened by means of a foot pedal.
- Sufficient facilities should be available, especially at formal animal contact areas; numbers will depend on local knowledge of visitor throughput during a typical day.
- Hand-washing facilities could comprise a number of individual basins or else multi-station wash troughs (similar to surgeon's scrub sinks); communal sinks where the water is used by more than one person are not suitable – multi-station troughs have a number of taps that can be used on an individual basis.
- Facilities should be designed so as to be accessible by all i.e. some need to be positioned at heights suitable for use by children and wheelchair users.
- Running water should be of sufficient volume and pressure to remove any contamination from hands. Volume and pressure might be reduced if the water supply is supplied from a holding tank; therefore, a permanent pressurised water supply is preferable. However, where it is not possible to install permanently plumbed-in facilities especially at more remote locations on site, the use of portable/mobile washing facilities should be considered (a power supply will be need to heat water, but cold only devices are available).
- It is recommended that liquid soap dispensed by a hand pump is used.
- Facilities should be cleaned on a regular basis and checked to ensure that there an adequate supply of paper towels and soap at all times.

What else?

- Signage and other information – it is recommended that the signage used to indicate the need to wash hands is based on the mandatory sign in the Health and Safety (Safety Signs and Signals) Regulations 1996. This should be supplemented by signs prohibiting eating in animal contact areas (see below), and posters showing how to wash hands properly. Examples can be found on the Health Protection Agency Website on many hospital websites. See www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1194947399200



- Use of hand hygiene gels – Although washing with soap and water should be the primary method of cleaning hands, in certain circumstances gels could be used, on the basis of a risk assessment, taking into account the following factors:
 - alcohol-based hand-hygiene gels (concentration of 60-80%) are effective against multiple common disease agents (e.g., Shiga toxin-producing *Escherichia coli*, *Salmonella* species, and *Campylobacter* species). However,

they are ineffective against some organisms (e.g. bacterial spores, *Cryptosporidium* species, and certain viruses). In addition these gels are less effective on visibly soiled hands. Therefore, as much visible contamination and dirt as possible should be removed before using hand gels.

- there are gels available containing active ingredients other than alcohols which are effective against other disease causing agents but it should be noted that none are effective against spore forming bacteria at the concentrations used in such preparations. You need to check whether a particular formulation is effective against the micro-organism(s) of concern. Some information will be available from the manufacturer but you should also check the peer reviewed literature if possible. There is a useful summary of antimicrobial activity and summary of properties of antiseptics used in hand hygiene in the WHO Guidelines on Hand Hygiene in Health Care (see http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf).

Example assessment: (see also [Appendix 5](#) for an expanded version)

A zoo provides a class-room based educational session with reptiles where there is an opportunity to handle animals. Each session lasts 30 minutes but there are only 10 minutes between each session. There is currently only one hand wash basin available. The main infectious agents of concern are Salmonella species and it is known that an alcohol based products are effective against this agent. It is decided to only allow individuals with visually clean hands to handle animals and since this takes place in a clean environment, the use of a gel allows appropriate cleaning of hands in a timely manner.

Appendix 3 Notifiable animal diseases⁹

Disease	Species affected
African Horse Sickness	Horses
African Swine Fever	Pigs
Anthrax*	Cattle and other mammals
Aujeszky's Disease	Pigs and other mammals
Avian Influenza (Bird flu)*	Poultry
Bovine Spongiform Encephalopathy*	Cattle
Bluetongue	All ruminants and camelids
Brucellosis (<i>Brucella abortus</i>)*	Cattle
Brucellosis (<i>Brucella melitensis</i>)*	Sheep and Goats
Classical Swine Fever	Pigs
Contagious agalactia	Sheep and Goats
Contagious Bovine Pleuro-pneumonia	Cattle
Contagious Epididymitis (<i>Brucella ovis</i>)	Sheep and Goats
Contagious Equine Metritis	Horses
Dourine	Horses
Enzootic Bovine Leucosis	Cattle

⁹ See www.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/notifiable.htm

Disease	Species affected
Epizootic Haemorrhagic Virus Disease	Deer
Epizootic Lymphangitis	Horses
Equine Infectious Anaemia	Horses
Equine Viral Encephalomyelitis*	Horses
European Bat Lyssavirus (EBLV)*	Bats
Foot and Mouth Disease•	Cattle, sheep, pigs and other cloven hoofed animals
Glanders and Farcy*	Horses
Goat Pox	Goats
Lumpy Skin Disease	Cattle
Newcastle Disease•	Poultry
Paramyxovirus of pigeons	Pigeons
Pest des Petits Ruminants	Sheep and Goats
Rabies (Classical)	Dogs and other mammals
Rift Valley Fever*	Cattle, Sheep and Goats
Rinderpest (Cattle plague)	Cattle
Scrapie	Sheep and goats
Sheep pox	Sheep
Swine Vesicular Disease	Pigs

Disease	Species affected
Teshen Disease (Porcine enterovirus encephalomyelitis)	Pigs
Tuberculosis (Bovine TB)*	Cattle and deer
Vesicular Stomatitis	Cattle, pigs and horses
Warble fly	Cattle, (also deer and horses)
West Nile Virus*	Horses
<i>*zoonotic disease; can under exceptional circumstances cause infection in humans</i>	

Appendix 4 Notifiable disease in humans¹⁰

Acute encephalitis
Acute meningitis
Acute poliomyelitis
Acute infectious hepatitis
Anthrax
Botulism
Brucellosis
Cholera
Diphtheria
Enteric fever (typhoid or paratyphoid fever)
Food poisoning
Haemolytic uraemic syndrome (HUS)
Infectious bloody diarrhoea
Invasive group A streptococcal disease and scarlet fever
Legionnaires' Disease

¹⁰ See www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/NotificationsOfInfectiousDiseases/ListOfNotifiableDiseases/

Leprosy
Malaria
Measles
Meningococcal septicaemia
Mumps
Plague
Rabies
Rubella
SARS
Smallpox
Tetanus
Tuberculosis
Typhus
Viral haemorrhagic fever (VHF)
Whooping cough
Yellow fever

Appendix 5 Risk assessment template

Draft risk assessment for visitors entering animal enclosures – *guidance notes on filling in the form are in italics*. Note areas in blue can be filled in by zoo manager/health and safety officer. Areas in yellow are likely to require input from the zoo’s veterinary surgeon.

Name of Organisation	
Activity to be assessed	<i>Type of enclosure (including type of access)</i>
Location	<i>enclosure name</i>
People at risk	<i>include whether free or restricted access, supervised or unsupervised and likely numbers per day</i>
Zoo animals involved (taxonomic groups)	<i>species or taxonomic groupings (may be multiple)</i>
Other animal risks	<i>e.g. rodent / invertebrate pests / free ranging wildlife</i>

Sources of infection	Transmission route	Likelihood
<i>EG:</i> <i>Body fluids (Blood, placenta, body parts)</i> <i>Waste (faeces, urine, vomit)</i> <i>Direct skin contact</i> <i>Aerosol</i>	<i>route e.g. inhalation, ingestion etc</i>	<i>Would need to give guidance on terminology (i.e. what does low or moderate or high mean). This section should also give a brief justification for the score given</i>

Control	<i>Safe working practices that zoo managers should be able to come up with as a</i>
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Measures to minimise transmission risk	<i>result of knowing the animals, their enclosure and assessing potential sources of infection and transmission routes alone</i>
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Biological agents of primary concern	Source of infection	Harm to humans	Likelihood of occurrence at zoo
<i>Check relevant literature/handbooks for each animal species being considered</i>	<i>should tally with the ones in the blue section</i>	<i>Consider severity of disease caused in humans, whether it can be easily treated and whether it can spread easily from person to person</i>	<i>Vet should base this decision on factors such as the previous history of disease in zoo population, whether disease could be introduced into zoo animals</i>

Control measures to minimize contamination risk	<i>Measures directed at reducing the likelihood of the animals contracting the organisms listed and to controlling spread / contamination of the enclosure if these agents are suspected/ confirmed. This should be within the capability of the collection's vet who could fill this in without knowing the details of how the enclosure is managed (most zoo vets are not on staff and hence would not be capable of filling in the blue part). The zoo manager would not be able to fill in the yellow section as it requires specialist knowledge both microbiological and the disease history of the collection/animals concerned.</i>
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Further information/ notes	<i>Any further notes (e.g. justification why things added or not included)</i>		
Assessor (facility manager)	<i>Two assessors required as in most zoos, no one person will have sufficient knowledge to complete both parts.</i>	Assessor (microbiological)	<i>Two assessors required as in most zoos, no one person will have sufficient knowledge to complete both parts.</i>
Date		Date	