

OFFICIAL ZOO HEALTH CHECK 2000

**A study of
UK Zoological Collections**

UK ZOOS: FIT FOR LIFE?

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INTRODUCTION

Wild animals have throughout history intrigued the human race. Traditionally their diversity of form and their actions has led to wonderment and amazement and people have wanted to see wild animals for themselves. The first wild animal menageries are recorded as far back as the Ancient Egyptians and Henry III introduced the first elephant to his menagerie at the Tower of London in the 13th century. However, it was not until the early part of the 19th Century when animal collections became open to the public primarily in Paris, Vienna, Dublin and later London, that the 'zoo' concept established.

At this time, the collections were nothing more than living museums exhibiting creatures as objects from around the world, captured by the great Victoria explorers or presented as gifts from parts of Africa and Asia for diplomatic favours. The Zoological Society of London, founded in 1826, justified London's zoological collection as "the advancement of zoology and animal physiology and the introduction of new and curious subjects of the Animal Kingdom".

Throughout the 19th and early part of the 20th Century, animal collections remained in a few prestigious locations and although there were some private collections around the world, zoological collections were few. The 'zoo boom' did not begin until the 1950s when entrepreneurs recognised that zoological collections could potentially yield huge profits by entertaining the public and satisfying their curiosity in the animal kingdom. Zoos became established world-wide as recreational centres and the advancement in science was largely forgotten.

The 1970s and 1980s were the beginning of change for the now multi-billion pound zoo industry. Three factors arose which challenged such an introspective attitude: the development of sophisticated natural history television documentaries, the expanded opportunities for global travel, and an increased recognition of the welfare implications of captivity. People started to question the role of the zoo and their commitment to conservation, education and animal welfare. Zoos had no option but to change.

In September 1994 the Born Free Foundation together with the World Society for the Protection of Animals published 'The Zoo Inquiry', a document that "examined the reasons advanced for keeping wild animals in captivity". Prompted by the change in public opinion in the 1980s and 1990s, 'The Zoo Inquiry' produced a comprehensive report providing facts that contradicted many of the world's zoo claims as well as introducing some new grounds for concern. The conclusions were as follows:

"We conclude that captive breeding of wild animals for true conservation objectives, while a worthy aim, can only, at best, play a marginal role in species conservation". And "that most zoos do little to educate people about how the public can help to conserve wild species and that many zoos cause considerable physical and psychological animal suffering".

Media attention and public outcry over the report's findings put pressure on many zoos which had no option but to re-think their role and to improve their conditions. The zoo world even admits that these changes were a result of "outside forces" and, the Director of Paignton Zoo in Devon recently said, "they forced us to really think about what zoos are for" (Hicks, 2001).

Enforcement of the change came in an improvement in legalisation. Pressure groups campaigned for better zoo legalisation in Europe to improve animal welfare and ensure a greater commitment by zoos to other factors like conservation and education. In 1999, the European Commission approved their requests and the European Union Zoo Directive is due to be enforced in all EU Member States by April 2002. Britain (excluding Northern Ireland), in line with the EU Zoo Directive has already written and enforced their new zoo legislation, which was implemented in March 2000. The Secretary of State's Standards of Modern Zoo Practice, applicable to all zoological collections in the UK, ensures an improvement in animal welfare and a greater commitment to conservation and education.

Much improvement has apparently been made since the Victoria menageries of the 19th Century. But has the new legalisation and reports from "outside forces" really made a difference and made the 'zoo debate' redundant?

It is not enough to 'set the ball rolling', if change is to be significant then continual effort is needed 'to keep the ball rolling'. Similar investigations to the 'Zoo Inquiry' are needed to challenge the zoo industry, to investigate to what

degree improvements have been made and to continue to put pressure on the zoological collections to think about their role in society. UK zoological collections are world renowned as 'example' collections and the leaders in setting the standards. It is for this reason that such an assessment as this report is needed of these collections which are supposedly represents the highest standard of modern zoo. In April 2001, John Prescott, then Deputy Prime Minister and Secretary of State of the Department of the Environment, Transport and Regions (Government body responsible of zoos) stated, "British zoos are among the best in the world and make a vital contribution to the conservation of biodiversity" (Tim Ross, Political Staff, PA News).

This report on UK zoos, entitled 'Official Zoo Health Check UK 2000' has set out to assess the current situation of zoological collection within England, Scotland, Wales and Northern Ireland. The study was carried out during the years 2000 and 2001, following a scientific format and aims to assess standards representative of the whole UK zoo community.

This report explains how this assessment was carried out, which specific topics were investigated and what conclusions were made. It describes the typology of the UK zoological collection population, the methodology used to study the different aspects and, the conclusions drawn from the assessment.

In order to assess the current state of the UK zoo community, visits were made to randomly selected zoological collections. This method allowed the study to quantify the occurrence of aspects related to animal welfare (abnormal behaviour or the risk of disease transmission), conservation (presence of endangered species in zoological collections or species reintroduced back to the wild), research (scientific publications), as well as the legal status (presence or absence of zoo licence). It is important to bear in mind throughout this report that a considerable proportion of the zoological collections named in it include animals which may have been rescued from circumstances in which they were subjected to maltreatment. Some collections have a high proportion of rescued animals some of which may be included in this report (for example, in Table 6).

As well as investigating the zoological collections directly, the study also included bibliographic and Internet research and surveys carried out on Local Authorities (licensing authorities) and the general public. All the information accumulated was processed and presented in a way that allows replication and scientific scrutiny.

It is important to point out that this report constitutes a general overview of the UK zoo community, and further research is needed to explore hypothesis suggested by the results of this study. Due to this overview approach the data collected was mainly processed to produce descriptive statistics, although future processing would be require for a more in depth study. It was considered of a greater value for such a review to give a wider view of the UK zoos covering a variety of issues rather than concentrate too much on particular aspects of the zoological collections' work.

This report constitutes the first study of a series of investigations intended to produce a report about UK zoological collections 'health state' on a annual bases.

Great care was taken to ensure that the results of this study were not influenced by the opinions of the investigators. Zoo Check has lead campaigns over the last 16 years challenging the zoo community, and it could be said that this would constitute a biased approach. For this reason special attention was given to ensure that the collections visited were selected randomly, and the method to investigate was highly replicable.

In order to facilitate the potentially diverse interests of people reading this report, each specific topic is introduced and explained in individual chapters. However, to completely understand the concepts discussed and the terminology used it is important that the reader first reads the initial chapter of the UK Zoo Review.

It is not a function of this report to attribute to any zoological collection responsibility for any behavioural traits ascribed to any animal in its collection.

METHODS AND RESULTS

SAMPLING AND RANDOMNESS

The number of zoological collections in Great Britain and Northern Ireland far exceeds the number possible to qualify and quantify during the time allocation of this study. It was therefore necessary to reduce the sample size to a manageable level but in doing so, not lose the generalisation and representation of the results and conclusions to cover the total UK zoological collection population. In order to achieve this, random selection was used, further details of which are described below.

An information gathering system achieved through visiting the selected collections was designed. Called “**Zoo Scanning**”, it was based in the following principles:

- Only UK zoological collections were visited
- All zoological collections randomly selected for the survey were visited within a period of 5 months, from June to October 2000 (with the exception of one collection that was visited in May and used as a pilot study).
- Two experienced investigators (called Zoo Checkers) carried out the visits and data collection.
- Data collection followed a specific procedure to allow for efficient information processing (including quantification) once the Zoo Scanning period had finished.
- If problems occurred due to logistical reasons, procedures were in place to maintain the highest degree of representativeness of the sample.

Three different levels of randomness were applied: the selection of the zoological collections investigated (as described above), the date to visit the collection, and finally the events and places recorded during the visit. The three levels were integrated in the design of the Zoo Scanning.

Sampling of the zoological collections

Compiling of zoo list and securing of sample group.

- 1) Records from official sources (DETR, Scottish Executive, Welsh Assembly, and the Department of Agriculture of Northern Ireland) were compiled into a list of all the establishments currently (year 2000) known to have a zoo license. For the benefit of this report, this list will be called **list A**.
- 2) In order to take a generalist approach to investigating and analysing the broad range of zoological collections that exist, the zoo population (list A) needed to be categorised into eight different **types**. Using specific criteria (explained below) and using information available to Zoo Check, the zoological collections were divided into the ‘zoo types’.
- 3) The large quantity of zoological collections (list A) made it necessary to condense the sample size for investigation. Using computer generated **Random selection**, 25% of zoological collections from each zoo ‘type’ was selected. For the benefit of this report, this list will be called **list S**. The randomness was carried out as follows:
 - (a) The zoological collections were listed alphabetically in their zoo ‘type’.
 - (b) Each collection in each ‘type’ list was assigned a consecutive natural number starting with ‘1’
 - (c) Using Excel software, a computer-generated list of random real numbers between 0 and 1 was created. (NB. there should be an equal number of collections per ‘type’ list as computer generated random real numbers.)
 - (d) For each zoo ‘type’ list, each randomly generated number was multiplied by the total number of collections of that ‘type’. The integers of the numbers resulting from such multiplication were then recorded .
 - (e) The integers recorded indicated which collection in each ‘type’ list had been selected by matching each integer with the assigned natural number, as explained in (b).
 - (f) From this integer-selected list, only the first collections that together equalled the number sufficient to cover the 25% of each type were selected for investigation. The resulting list is list S.
- 4) Using the selected list (list S) as described above a **visiting schedule** was planned within the specified researching period using the geographical criteria, as described in the next chapter.
- 5) **All** the zoological collections in list S were visited and ‘scanned’ by a Zoo Checker between the specified period. If time allowed, extra collections (from List A) in proximity to selected S list zoos were visited and scanned. These

visits however did not compromise the selected zoological collections visiting schedule. For the benefit of this report, visited zoological collections, selected or not, will be called a '**scanned collection**'.

- 6) If a selected zoological collection was found to be closed or did not exhibit 'exotic' animals, a substitute collection was selected from List A, selecting the collection of the same 'type' that was the closest, geographically. If the substitute collection also had to be removed from the list, then this procedure was repeated until a collection of the same 'type' was found. New zoological collections found during the scans that were not in list A were included in the search for substitutes.
- 7) After each month, List A was **reviewed** and any new zoological collections found during the Scans was added as well as any collections found to be closed or not exhibiting exotics were removed from List A. If the visited collection was found to be of a different 'type' than previously designated, the category was changed. Each month the reviewed list was given a specific name B1 (end June), B2 (end July), B3 (end August), B4 (end September).
- 8) The altering of the original list A and the subsequent List Bs may have altered the number of selected collections for each specific zoo 'type'. Therefore, to uphold the 25% selected zoos for investigation of each 'type', further collections needed to be selected. This was carried out using the method of random selection as described in no. 2-4. Each month this procedure was carried out and revised lists of collections for investigation were created. A different name for the selection list was given (S1, S2, S3 and S4). In the case that after the list alteration too many zoological collections had been selected of a specific type, no substitute collection (in the event of a closed zoo) was selected, until the selected number of zoological collections of the specific type equalled to 25%.
- 9) Nearing the end of the zoo investigation period, list B4, the best estimation of zoological collection population and List S4, the collections selected for investigation (25% of the total collections of each specific zoo 'type') were used.
In the month of October, the alteration of list B and the selection of substitute collections was carried out slightly differently. October marks the end of the inspection period, and therefore alteration of List B4, would not allow further visits (too many zoos closed or not enough visitor after October). Since the 25% cover for each zoo 'type' was vital to the investigation, list **S5** was created by adding zoological collections that had already been scanned during the inspection period but not previously selected (see point 5). So not to weaken the random selection however, only the recently discovered and scanned zoological collections, which had been added to lists B, were used. These newly added collections were arranged alphabetically and then, those of the specific zoo 'type' needed until the correct total (covering 25% of each 'type') was achieved were selected. This created List **S5**.
- 10) Dividing the majority of the zoological collections in List A (& List B) into the separate zoo 'types' was carried out using specific criteria, described in a later section. **Farms** however, were difficult to distinguish. Many farms are now exhibiting 'exotic' animals ("animals not normally domesticated in Great Britain") and therefore would be classed as a zoological collection requiring a zoo license. In order to distinguish farms from farm parks with 'exotics', it was necessary to telephone the establishments and directly ask the centre's operators which animals they exhibit. The procedure, described below was designed to give a closer estimation of the number of Farms, which should be classed as zoological collection using the criteria of this study.
 - (a) Using the list of possible farms from list B4, the farms that were not present in list B1 were selected. These would be the new farms discovered during the zoo scans.
 - (b) The selected farms (present in B4 and absent in B1) were then contacted by telephone and asked which animals they display to the public.
 - (c) Using the data from the farm survey, the percentage of farms with at least one 'exotic' from the total of surveyed farms was calculated (providing that at least 50% of the surveyed farms answer to the inquiries).
 - (d) The resulting percentage to the total number of farms in B4 was then used to estimate the number of farms in zoological collections list B5.
- 11) Following the complex sampling procedure resulted in **list B5** (the best estimation of the zoological collection population), and **S5** (the randomly selected sample from list B5 that represent 25% of each type of zoological collection).

Sampling of visit date

All the visits to the selected zoological collections were made in the same year, during the high tourist season, and during normal visiting hours, which in itself uniforms the sample. However, to increase the level of randomness of the date of the visit, further sampling methods were designed.

The sampling method used to select the date of the visit to the zoological collections is as follows:

1. The map of the UK was split into two sections: East and West, roughly following the longitude 1.5°W. The West side was composed of Northern Ireland, the whole of Wales and Scotland, and the counties of England, west of the line bordered by the Isle of Wight, Oxfordshire, Leeds and Northumberland.
2. Zoo Checker A visited and scanned the zoological collections found on W side, and Zoo Checker B visited and scanned the zoos in all other regions.
3. Each Zoo Checker divided the period of visiting (18 weeks from June to October) into two halves of available visit time (excluding days off, which could be different for each Zoo Checker). These were distinguished as 'early' season and 'late' season.
4. The W side and E sides were again divided into two half sections 'north' and 'south', following the latitude 53° N (halving Wales and south of the English counties below Cheshire for the 'west' section, and below Lincolnshire for the 'east' section).
5. The 'South' section was assigned to the 'Early' season of visiting and the 'North' section for the 'Late' season.
6. Within each section (SW, SE, NW, NE), a visiting schedule was organised allowing approximately nine weeks to cover the collections taking into account opening times and transport. Trying to sustain a controlled sampling method, visits were carried out in a controlled manner (i.e. starting in one corner of the section and moving towards the opposite corner).

Sampling of recorded information

In May 2000 a pilot study was undertaken by both Zoo Checkers A and B, whereby a zoological collection was visited and scanned in order to determine the best recording method and standardise procedures between the two zoo checkers.

The agreed standardised procedures adopted by both the Zoo Checkers during the visits of the zoological collections are as follows:

Printed information

During the visit to the zoological collection the Zoo Checker collected all the printed material (leaflets, maps, guide books, etc.) available to the public on the particular visiting day. Each material was marked with the date of the visit.

Other information including all the information displayed on the WebPages of the specific collection on the Internet was saved to disk no later than three months after the visit of the collection.

Videotaped information

All information other than printed or Internet material was recorded on video with a camcorder.

During the recording, both the time and date menu option was in operation. Each tape was labelled with the code name designated to the specific collection, the date of the visit, the name of the Zoo Checker and the number of the tape (i.e. tape 1 of 4).

At the beginning of the visit and the first tape, the Zoo Checker verbally recorded the name of the collection, the date of the visit and information about the weather conditions. Other comments were made where necessary during the scanning.

The information recorded by the tapes was logged onto a spreadsheet (called a 'time sheet') noting specific events, species, enclosures and all other relevant information.

*'Population' information

Most information recorded did not require sampling since the totality of the 'population' to investigate was recorded. In these issues, Zoo checkers had to continue recording until all the 'population' was covered.

- During the visit ALL the animal enclosures displayed to the public were filmed, being sure to record clearly the enclosure's size, furniture, signs, animals and the enclosure's location for sufficient time.
- During the visit ALL the visible animals, their appearance and their behaviour was clearly recorded for a sufficient time. If an animal was not visible in the enclosure during the enclosure's filming, the Zoo Checker revisited the same enclosure later during the day. If the animal was once again absent from public view, the particular animal was recorded as being "not visible".
- During the visit ALL signs displayed to the public were filmed, making sure that all the text was legible.
- During the visit ALL shows, talks, 'public feeds' and displays to the public during the day of the visit were filmed from the beginning to the end in such a way that everybody watching the tapes would understand them completely. If shows or similar displays were repeated during the day using the same talkers and animals, only one of the shows was filmed.
- The 'scan' was not complete until ALL enclosures, signs, animals and shows/talks available to the public were filmed during the same day. It was necessary for the Zoo Checker to plan the visit so that all the above could be filmed.

*'Sampled' information

The fact that the Zoo Checker was unaware of the particular events in the zoological collection, the recording method was random in the sense that the Zoo Checker had no prior knowledge. However, the Zoo Checker's intuition, attention and perception does have an effect on which events were witnessed, which justifies the use of only two zoo checkers for the study.

The kind of events that were filmed included:

- During the visit any animal seen performing any sort of repetitive behaviour was filmed for the sufficient time to witness at least five 'repetitions' (of pacing, circling etc.).
- During the visit any visitor seen performing any prohibited activity (or not advised to do by notices and signs referring to visitors behaviour) was filmed for a sufficient time period.
- During the visit any visitor seen directly interacting with any displayed animal (physically or otherwise) was filmed for a sufficient time period so that the interaction and animal's reaction can clearly be identified.
- During the visit any keeper seen working in enclosures displayed to the public was filmed for a sufficient time period so that his/her work and equipment could clearly be identified.
- During the visit any witnessed incident occurring in a public area, out of the ordinary of a normal visit to a zoological collection, was filmed for a sufficient time period so that the incident could be understood by anyone watching the tapes at a later date.

TYPES OF ZOOLOGICAL COLLECTIONS

As discussed in the previous section, eight different zoo ‘types’ were identified to cover all possible forms of zoological collections. All zoological collections (collections of animals requiring a zoo license) exhibit ‘exotic’ species (species not normally domesticated in the UK). However, the performance of the collection varies considerably depending of which animals are exhibited, and the general reasons for keeping them.

Zoological collections were divided into groups of collections with a similar approach and structure, so the analysis of their performance could be put into context.

Classification of zoological collections does not currently exist but as discussed, it was necessary for this study in order to analyse the complete spectrum of collections that exist; from farm parks to aquaria. Therefore, in accordance to this study separate zoo ‘types’ were defined and criteria standardised so that all parties are able understand and follow the analysis within this report.

Standardisation of the criteria is important so that newly discovered collections can be easily classified in one of the eight zoo ‘types’.

For the purpose of our study, a **zoological collection** is any collection of captive animals in a particular site, in which one individual or more belongs to an exotic species (species not normally domesticated in the country where the collection is), and it is open to the public seven or more days in 12 consecutive months. All such collections are required by law to have a current zoo licence under the Zoo Licensing Act 1981. The following zoo ‘types’ have been standardised

1. Zoos
 - a. Large zoos (LZ)
 - b. Small zoos (SZ)
2. Aquaria (A)
3. Wildlife/Safari Park (W)
4. Amusement Parks (AP)
5. Farms (F)
6. Sanctuaries (S)
7. Specialised collections (SP)

The definitions were standardised using the following *dyadic* key:

Zoological Collections

- ❖ Composed mainly by farm animals normally domesticated in the UK (although at least one ‘exotic’ individual is present).....**Farms**
- ❖ Not composed mainly by farm animals normally domesticated in the UK
 - Composed mainly by fish and aquatic invertebrates..... **Aquaria**
 - Not composed mainly by fish and aquatic invertebrates
 - Composed mainly by rescued animals that will be rehabilitated to their natural habitat.....**Sanctuaries**
 - Not composed mainly by rescued animals that will be rehabilitated to their natural habitat
 - Part of a centre/park mainly formed by non-life-animal attractions **Amusement Parks**
 - Not part of a centre/park mainly formed by non-life-animal attractions
 - ◆ Mainly composed by animals that roam free among the visitors/cars.....**Wildlife/Safari Parks**
 - ◆ Not mainly composed by animals that roam free among the visitors/cars
 - Specialised in a particular animal group (other than vertebrates) in terms of number of species and individuals**Specialised collections**
 - Composed at least of mammals, birds, and reptiles similarly represented in number of species.....**Zoo**
 - ◆ With a ZD index bigger than 300.....**Large Zoo**
 - ◆ With a ZD index equal or smaller than 300.....**Small Zoo**

In order to properly apply the above key, the following points should be applied:

The 'mainly' factor

In several definitions used above, the word 'mainly' was used. In the classification of the collections into the zoo 'types', there may be occasions when it is not clear if one collection is composed mainly of a type of animal or not, and therefore it is necessary to use some quantitative criteria for the meaning of the term 'mainly'.

For the cases where it was not evident which was the type 'mainly' represented in the collection, both the number of species and the number of individuals of a particular type were used, and multiplied by both numbers to compare the different types. For example, if there was a collection that could be a farm, classification was made by comparing the number of farm species multiplied by the number of farm individuals, with the number of non-farm species multiplied by the number of non-farm individuals. If the first result was bigger than the second, the collection would be classified as a Farm. The same method can be used to define Aquaria, Sanctuaries, and Wildlife/Safari Parks. As far as the definition of Amusements Parks is concerned, in this case mainly means 'the majority'.

The Zoo Discriminator index (ZD)

Large zoos, because of their size, are often run quite differently to smaller zoos and therefore it was necessary to find a method of discriminating between the two. The main difference between the two 'types' is mainly quantitative, and therefore a quantitative method was used to discriminate between them.

The Zoo Discriminator is an index, using the zoo variables below to classify zoos into the category Large Zoo or Small Zoo.

The variables used were:

Annual Attendance (number of visitors)	Att
Area of the collection site (hectares)	Ar
Staff normally working in the centre (number)	St
Number of Mammal species kept	M
Number of Mammal individuals kept	m
Number of Bird species kept	B
Number of Bird individuals kept	b
Number of Reptile species kept	R
Number of Reptile individuals kept	r
Number of Amphibian species kept	M
Number of Amphibian individuals kept	m
Number of Fish species kept	M
Number of Fish individuals kept	m
Number of Invertebrate species kept	I
Number of Invertebrate individuals kept	I

The ZD index can be calculated as following:

$$ZD = 10^{-9} (Ar Att St (Mm+Bb+Rr+Aa+Ff+Ii))$$

The criteria to classify a zoo using the ZD index is:

ZD > 300.....Large Zoo
 ZD ≤ 300.....Small Zoo

If the number of species or individuals of each kind is not known, a provisional classifying decision can still be made using the following formula:

(Ar Att St) < 1704545.455 -----Large Zoo
 (Ar Att St) > 1704545.455 -----Small Zoo

The method used to create the ZD index is as follows:

- Initially, before a formula to discriminate large zoos from small zoos was devised, the available information on the establishments was used to classify zoos intuitively into both categories.
- Using volume 36 of the International Year Book published in 1998 (the latest issue which contains the required values of the variables used in the ZD), an index was created that better matches the unified intuitive classification for the UK zoos. This implied both the creation of a formula and a threshold that discriminates into the two types (which turned out to be 300)
- The average value of the factor '(Mm+Bb+Rr+Aa+Ff+Ii)' was calculated for all the UK zoos in the volume 36 of the International Year Book. Large Zoos were classified with the criteria $ZD > 300$, and the average was used to calculate the provisional classification formula.

The Specialised Collection Discriminator (SCD)

Discrimination of the Specialised zoo from the other types of zoological collection was in some cases difficult. When a particular collection did not fit the description of Farms, Aquaria, Sanctuaries, Amusement Parks, and Wildlife/Safari Parks, and mammals, birds, and reptiles were present in it, if one of these groups was much more represented than the others, the collection should be classified as 'specialist collection'.

In order to determine the boundary between 'much more' of a particular animal type and just 'more', a formula was created to classify between a Specialised Collection and a zoo, in cases where mammals, birds and reptiles were present.

The variables used are:

Number of Mammal specimens kept	M
Number of Bird specimens kept	B
Number of Reptile/Amphibian specimens kept	R

The three values of the three variables ranged from higher to smaller were renamed S_1 , S_2 , and S_3 (where $S_1 > S_2 > S_3$).

The SCD is then:

$S_1 > 10 S_2$Specialised Collection
 $S_1 \leq 10 S_2$Zoo

The zoological collection population (lists A and B)

LIST B5

<u>TYPE OF COLLECTION</u>	<u>ABSOLUTE POPULATION</u>	<u>RELATIVE POPULATION</u>	<u>SAMPLE (25%)</u>
AQUARIA (A)	58	14%	15
AMUSEMENT PARKS (AP)	9	2%	2
FARMS (F)	61	15%	15
LARGE ZOOS (LZ)	22	5%	6
SANCTUARIES (S)	29	7%	7
SPECIALISED COLLECTIONS (SP)	153	37%	38
SMALL ZOOS (SZ)	68	16%	17
WILDLIFE/SAFARI PARKS (W)	18	4%	4
TOTAL	418		104

Table 1. Numbers of Types of zoological collections from list B5. The column 'sample' shows the number of collections that cover 25% of each type

NOTE:

The number of Farms was estimated following the method described in point 11 of the chapter about Selection of zoological collections. A survey of 87 farms was conducted, from which 50 (57%) answered the questionnaire. The percentage of farms with

exotics from the survey was 62%, which applied to the total of possible farms from list B4 results in an estimated population of 61 farms.

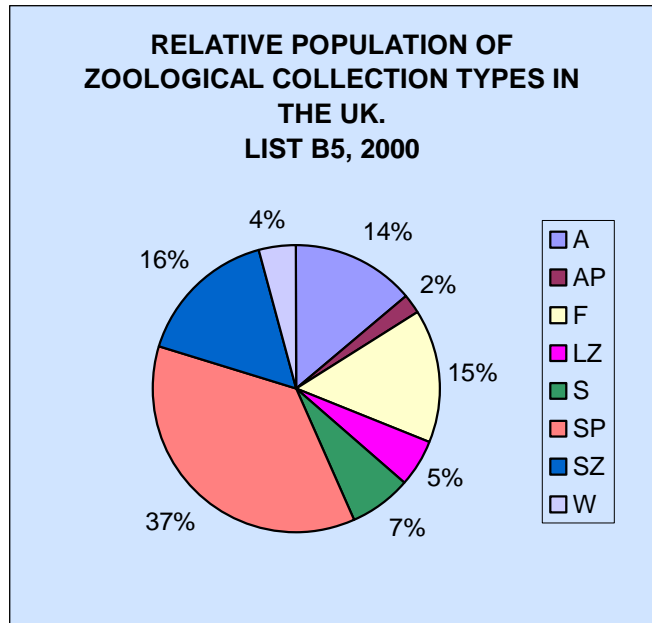


Figure 1. Relative population of zoological collection types in the UK, list b5, 2000. A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

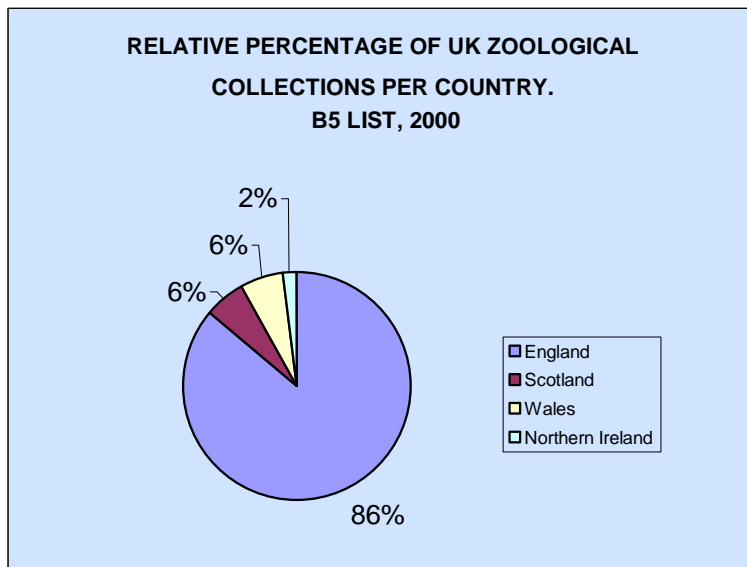


Figure 2. Relative Percentage of UK Zoological Collections per country. B5 List, 2000.

The selected zoological collections (list S5)

The following table shows the list of the 104 selected zoos used in this study (list S5), with information about their random selection following the method explained above.

<u>RANDOM</u>	<u>INTEGER</u>	<u>REJECTED</u>	<u>SELECTED</u>	<u>TYPE</u>	<u>NAME</u>	<u>TOWN</u>	<u>COUNTY</u>	<u>COUNTRY</u>	<u>DATE</u>
0.0126	1		ABE002	A	Aberaeron Sea Aquarium	Aberaeron	Ceredigion	Wales	08/08/00
0.8728	59 STA334		ANG011	A	Anglesey Sea Zoo	Anglesey	Gwynedd	Wales	12/08/00
0.9253	63 THE351		AQU016	A	Aquarium of the Lakes	Lakeside, Newby Bridge	Cumbria	England	26/09/00
0.9458	64 THE353		BRI067	A	Brixham Aquarium	Brixham	Devon	England	29/06/00
0.9997	68 WEY393		CON464	A	Conwy Harbour Aquarium	Conwy	Conwy	Wales	15/08/00
0.2034	14		EAM131	A	Eamley Gardens	Chichester	West Sussex	England	11/10/00
0.5789	39 PEN274		FOW151	A	Fowey Town Aquarium	Fowey	Cornwall	England	19/06/00
0.3731	25		LON203	A	London Aquarium	London	London	England	15/06/00
0.3972	27		MAC212	A	MacDuff Marine Aquarium	MacDuff	Aberdeenshire	Scotland	01/09/00
0.4159	28 MAR217		NEW248	A	Newquay Sea Life Aquarium	Newquay	Cornwall	England	21/06/00
0.5898	40		PLY281	A	Plymouth Aquarium	Plymouth	Devon	England	08/06/00
0.6019	41		RHY291	A	Rhyl Sea Life Centre	Rhyl	Clwyd	Wales	19/08/00
0.6964	47		SEA309	A	Sea Life Centre	Scarborough	North Yorkshire	England	25/07/00
0.7889	54		SEA314	A	Sea Life Centre	Great Yarmouth	Norfolk	England	22/08/00
0.8518	58		SOU329	A	Southend Sea Life Aquarium	Southend	Essex	England	19/07/00
0.2676	2		CHE095	AP	Chessington World of Adventures	Chessington	Surrey	England	16/05/00
0.7298	7 SWA345		FLA147	AP	Flamingo Land Theme Park and Zoo	Malton	North Yorkshire	England	12/09/00
0.0838	3		ALS006	F	Alstone Wildlife Park	Highbridge	Somerset	England	13/07/00
			BEV507	F	Beveridge Park	Kirkcaldy	Fife	Scotland	12/09/00
0.313	14		CRA112	F	Craigavon Leisure Centre	Craigavon	Armagh	N. Ireland	21/09/00
0.2491	18		ELS136	F	Elsham Hall Country Park	Brigg	Lincolnshire	England	19/09/00
0.343	16 DAN117		FOL149	F	Folly Farm	Begelly, Kilgetty	Pembrokeshire	Wales	07/08/00
0.4367	20		GRE159	F	Green Acres Farm	Mancot, Deeside	Flintshire	Wales	22/08/00
0.3025	21		HOR175	F	Horniman Museum/Gardens	London	London SE23	England	24/06/00
			LET509	F	Lethan Glen	Leven	Fife	Scotland	13/09/00
0.5742	26		LOW210	F	Low Knock Farm	Newton Stewart	Dumfries and Galloway	Scotland	17/09/00
0.6258	29		MIN230	F	Minster Agricultural and Rural Museum	Margate	Kent	England	05/07/00
			NEW246	F	The Secred World. The badger and wildlife rescue centre.	East Huntspill	Somerset	England	13/07/00
0.851	61		ODD459	F	Odds Farm Park	High Wycombe	Buckinghamshire	England	23/08/00
0.6702	31		PAL263	F	Palacerigg Country Park	Cumbernauld, Nr. Glasgow	Lanarkshire	Scotland	09/09/00
0.9103	42		WAL382	F	Walton Hall Gardens Children Zoo	Warrington	Cheshire	England	27/08/00
0.8581	39 SUN343		WHI528	F	White Post Modern Farm Centre	Farnsfield, nr. Mansfield	Nottinghamshire	England	04/10/00
0.08	2 BAS029		COL104	LZ	Colchester Zoo	Stanway Hall	Essex	England	05/09/00
0.2253	8		COT110	LZ	Cotswold Wildlife Park	Burford	Oxfordshire	England	25/07/00
0.479	10		DUD127	LZ	Dudley and West Midlands Zoological Society	Dudley	West Midlands	England	07/10/00
0.5347	11		GLA156	LZ	Glasgow Zoo	Uddington	Glasgow	Scotland	10/09/00
0.8413	17		SAN298	LZ	Sandown Zoo	Sandown	Isle of Wight	England	13/08/00
0.7699	27		SUF341	LZ	Suffolk Wildlife Park	Kessingland, nr Lowestoft	Suffolk	England	31/08/00
0.3462	9 MAR218		BUC071	S	Buckfast Butterfly Farm & Dartmoor Otter Sanctuary	Buckfastleigh	Devon	England	28/06/00
0.6108	15 POL282		COR107	S	National Seal Sanctuary	Helston	Cornwall	England	15/06/00
0.2833	8		HER169	S	Heronfield Animal Rescue Centre	Solihull	West Midlands	England	29/09/00
0.4313	11		NAT243	S	Natureland Seal Sanctuary	Skegness	Lincs.	England	14/09/00
0.5568	14		OTT258	S	Otter Trust	Launceston	Cornwall	England	10/06/00
0.8662	22		THE358	S	Ramsey Raptor Rescue Centre	Ramsey	Cambridshire	England	25/09/00
0.1953	6 EAS132		WOO410	S	Wood Green Animal Shelter	Godmanchester	Cambridgeshire	England	27/09/00
0.0172	3		ANG010	SP	Anglesey Bird World	Dwyran,	Anglesey	Wales	13/08/00
						Llanfairpwll			

0.0712	11	BEN034	SP	Bentley Wildfowl	Halland	East Sussex	England	25/09/00
0.1119	17	BIR042	SP	Birdworld	nr Farnham	Surrey	England	12/06/00
0.4333	65 GWY161	BOD051	SP	Bodelwyddan Castle Hotel	Bodelwyddan	Clwyd	Wales	18/08/00
0.2175	33	BUT074	SP	MacFarlanes Butterfly Centre	Swingfield	Kent	England	06/07/00
0.2814	42	CHI098	SP	Child Beale Wildlife Gardens	Lower Basildon, Reading	Berks	England	26/06/00
0.3024	46	CON106	SP	Conwy Butterfly House	Conwy	Gwynedd	Wales	15/08/00
0.0426	14 BIR039	DUT129	SP	Duthie Park Trust	Aberdeen	Aberdeenshire	Scotland	02/09/00
		EDI504	SP	Edinburgh Butterfly and Insect world	Edinburgh	Midlothian	Scotland	06/09/00
0.4348	66	HAR166	SP	Harewood Bird Garden	Leeds	W Yorkshire	England	03/10/00
0.4469	67	HAW167	SP	Hawk Conservancy	Weyhill, nr Andover	Hants	England	22/06/00
0.9369	141 WIL403	HES171	SP	Hesketh Park Aviaries	Southport	Merseyside	England	29/09/00
0.7974	120 TAT350	HIL474	SP	Hillside Bird Oasis	Mobberley, nr.Knutsford	Cheshire	England	23/08/00
0.4732	71	HOR176	SP	Hornsea Pottery	Hornsea	North Humberside	England	13/09/00
0.4813	73	ISL180	SP	Isle of Wight Butterfly World	Wooton, Ryde	Isle of Wight	England	14/08/00
0.4882	74	ISL181	SP	Isle of Wight Rare Breed and Waterfowl Park	St. Lawrence	Isle of Wight	England	11/08/00
0.5421	82	LLO202	SP	LLoyd Park Aviary	Walthamstow	London	England	15/06/00
0.6056	91	MON234	SP	Monkey World Ape Rescue Centre	Wareham	Dorset	England	11/07/00
0.6136	93	NAT239	SP	National Birds of Prey Centre	Newent	Gloucester	England	23/07/00
0.5994	38	NAT241	SP	Natural History Centre	Godshill	Isle of Wight	England	10/08/00
0.6427	97	OWL259	SP	Owl Centre	Ravenglass	Cumbria	England	25/09/00
0.9548	144 WIL404	PEN273	SP	Pensthorpe Waterfowl Park	Fakenham	Norfolk	England	04/10/00
0.629	95 NEW247	PRI286	SP	Prinknash Bird Park	Cranham	Gloucestershire	England	22/07/00
0.5895	89 MID229	SCR301	SP	Screech Owl Sanctuary	Nr. Indian Queens, St. Colomb	Cornwall	England	22/06/00
0.0624	9	SEA315	SP	Seaforde Butterfly House	Seaforde	Down	N. Ireland	20/09/00
0.7253	110	SHE319	SP	Sherwood Farm Park	Edwinstowe, Nr. Mansfield	Nottinghamshire	England	20/09/00
0.3722	111	SHI320	SP	West Lodge Rural centre	Desborough	Northamptonshire	England	23/09/00
		THE500	SP	The Scottish Deer Centre	Cupar	Fife	Scotland	04/09/00
0.8161	123	TRO364	SP	Tropic House	Newton Stewart	Dumfries and Galloway	Scotland	17/09/00
0.8244	124	TRO365	SP	Tropical Bird Garden	Desford	Bedfordshire	England	22/09/00
0.5371	81 LIT200	TRO366	SP	Tropical Rainforest	Lodmoor, Weymouth	Dorset	England	09/07/00
0.8571	129 TRO370	TRO587	SP	Tropical Butterfly Gardens & Falconry Centre	Great Ellingham, Attleborough	Norfolk	England	05/10/00
0.8571	30 WEL387	WEL388	SP	Welsh Hawking Centre & Wildlife park	Barry	South Glamorgan	Wales	04/08/00
0.8933	135	WET392	SP	Wetlands Waterfowl Reserve	Retford	Nottinghamshire	England	18/09/00
0.9004	136	WIC395	SP	Wicksteed Poole Aviary	Kettering	Northamptonshire	England	23/09/00
0.6361	96 ORB256	WIL402	SP	Wildfowl & Wetlands Trust	Martin Mere	Burscough nr Ormskirk	England	30/09/00
0.9662	146	WIL406	SP	Waterfowl World & Gardens	Peakirk	Cambridgeshire	England	26/09/00
0.0893	13 BIC038	WOR414	SP	Worldwide Butterflies, Sherborne	Sherborne	Dorset	England	12/07/00
0.9452	60 ROB294	AMA431	SZ	Amazon World	Newchurch	Isle of Wight	England	12/08/00
		AMA495	SZ	Amazonian Live Tropical Zoo	Greay Yarmouth	Isle of Wight	England	22/08/00
0.0528	3	ANI013	SZ	Animal Gardens	Mablethorpe	Lincolnshire	England	14:09:00
0.1174	5	BAT030	SZ	Battersea Park Children's Zoo	London	London	England	11/06/00
0.8072	52 STE336	BOR054	SZ	Borth Animalarium	Borth	Ceredigion	Wales	10/08/00
0.3309	21	DAR118	SZ	Dartmoor Wildlife Park	Sparkwell	Devon	England	26/06/00
0.3646	23	DRU126	SZ	Drusillas Zoo Park	Alfriston	Sussex	England	07/08/00
0.2384	16	ESC137	SZ	Escot Aquaculture	OtteryStMary	Devon	England	01/07/00
0.2338	15 CAR089	HAM164	SZ	Hamerton Wildlife Park	Huntingdon	Cambridgeshire	England	29/09/00
		HAZ501	SZ	Hazelhead Park Pets and Walk-in Aviary	Aberdeen	Aberdeenshire	Scotland	02/09/00
0.5554	84	LON206	SZ	Long Sutton Butterfly Park	Spalding	Lincolnshire	England	28/09/00
0.5277	34	MAR222	SZ	Marlon Wilson Animal Park	Charlton, Nr.Greenwich	London	England	15/06/00
0.5435	35	MOF231	SZ	Moffat and MacKay Ltd	Collessie	Fife	Scotland	04/09/00
0.9986	58 TRE363	PIL463	SZ	Pili Palas	Menai Bridge	Anglesey	Wales	14/08/00
0.724	25	RIB292	SZ	Riber Castle Wildlife Park	Matlock	Derbyshire	England	20/09/00
0.7698	49	SHA316	SZ	Shaldon Wildlife Trust Ltd.	Shaldon nr. Teignmouth	South Devon	England	30/06/00

0.6367	41	NOR252	STE337	SZ	Stewart Park	Marion, Nr. Middlesborough	Middlesborough	England	12/09/00
0.4442	8	KNO194	W	Knowsly Safari Park	Prescot	Merseyside	England	02/10/00	
0.5334	9	LON207	W	Longleat Safari Park	Longleat	Wilts.	England	15/07/00	
0.7611	13	POR284	W	Port Lympne Zoo	Hythe	Kent	England	25/08/00	
0.9545	17	WHI394	W	Whipsnade Wild Animal Park	Dunstable	Bedfordshire	England	20/08/00	

Table 2. List of selected zoological collections of this study (list S5). RANDOM= Computer generated random number. INTEGER= Integer of the product between the computer generated number and the total number of collections of a particular 'type'. SELECTED= Code for the Selected collection, TYPE= type of zoological collection, DATE= date of the visit to the collection. See notes below for information about italics and bold entries.

NOTES:

Collections with a code not in bold have been selected from list A using the methods described in point 4 of the chapter: Sampling zoological collections

Collections with a bold code and non-italics were selected following the point 7 of the chapter: Sampling zoological collections. The code on the left of those (under the 'rejected' column) represent the collections initially selected with methods described in point 4 that were eventually rejected because they were closed, mis-classified, or otherwise.

Collections with bold code and italics were selected following the point 10 of the chapter: Sampling zoological collections.

Collections with the 'type' in bold were initially mis-classified in list A, and were selected for S1. Changes in list B that required the selection of more collections allowed them to remain as selected although representing a different type.

Comparing the distribution of the frequency of zoological collections per country in both the total population (B5) and the selected sample (S5), there are not significant statistical differences for considering the sample not representative of the population (Chi-square test, $p= 0.234$, 3 d.f.)

DO UK ZOOLOGICAL COLLECTIONS CONSERVE ENDANGERED SPECIES?

INTRODUCTION

Zoological collections often justify themselves as ‘conservation organisations’, or at least as centres where valuable conservation is taking place. The public impression is that zoos and conservation are linked and, in particular, through the concept of saving species in danger of extinction.

Many of the zoological collections use the words ‘conservation’ and ‘saving’ species from extinction in their advertising slogans and mission statements however, there are not many zoological collections that actually define the meaning of these words. The concept of ‘saving’ animals in zoos seem to be keep them and breed them in a co-ordinated way, and perhaps, if possible, returning them into the wild. To investigate these claims, it is necessary to investigate the frequency of endangered species in UK zoological collections, the frequency of which have been part of a coordinated captive breeding programme, and the frequency of which have been returned into the wild.

METHOD

- 1) During the visits to the randomly selected zoos, all the taxa displayed were recorded
 - a) All the signs for each enclosure were filmed
 - b) All visible animals in the enclosures were filmed
- 2) Records of the taxa displayed were entered into a database on a computer.
 - a) The common names of all the taxon were entered onto the database using the filmed signs as reference. The zoo code and the ‘type’ of zoological collection was also entered.
 - b) If the sign specified sub-species rather than a species, the sub-species common name was entered.
 - c) If the sign only specified scientific name, then the scientific name was entered.
 - d) If there was no sign on the enclosure, the taxon was identified from the tape and the common name and family was entered onto the database.
- 3) The terms entered were standardised in the following way:
 - a) All the entered names were merged in a single database.
 - b) All the names were ordered alphabetically.
 - c) All the names were rewritten standardising spelling, use of hyphens and punctuation.
- 4) A list of the different taxa was created.
 - a) A general alphabetical taxon list was created, eliminating the repetitions.
- 5) The conservation status of each of the taxon was entered.
 - a) The IUCN red list 2000 CD-ROM was used to cross reference each name on taxa list, assigning each a code following the IUCN categories of conservation status.
 - b) The categories describing the conservation status of species are as follows:

EXTINCT (EX) - when there is no reasonable doubt that the last individual has died.

EXTINCT IN THE WILD (EW) - when the taxon is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed extinct in the wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record any individual. Surveys should be over a time frame appropriate to the taxon’s life cycle and life form.

CRITICALLY ENDANGERED (CR) - when taxon is facing an extremely high risk of extinction in the wild in the immediate future as defined by any of the criteria (A to E), described below.

ENDANGERED (EN) - when the taxon is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the criteria (A to E), described below.

VULNERABLE (VU) - when the taxon is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future as defined by any of the criteria (A to E), described below.

LOWER RISK (LR) - when the taxon has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. **Conservation Dependent (cd)**. Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
2. **Near Threatened (nt)**. Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
3. **Least Concern (lc)**. Taxa which do not qualify for Conservation Dependent or Near Threatened.

DATA DEFICIENT (DD) A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well

known, but appropriate data on abundance and/or distribution is lacking. Data Deficient is therefore not a category of threat or Lower Risk. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and threatened status. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
NOT EVALUATED (NE) when the taxon has not yet been assessed against the criteria.

- c) If a taxon was not listed in the IUCN CD-ROM, it was assigned the category 'NL' (not listed).
 - d) If there were doubts about which category to assign a taxon, it was assigned the category '?' (Unknown).
- 6) Calculating frequencies and totals
- a) Using the merged database of taxa and the list of different taxa, the frequency of each different taxa per collection, type of collection, and the whole sample were calculated.
 - b) The total number of different taxa for the whole sample and types of collection were calculated.
- 7) Calculating percentages of threatened taxa
- a) Percentages were calculated using the categories defined in the IUCN red list 2000 CD-ROM, plus the category 'NL' and '?'.
 - b) The frequencies of each category of conservation status from the lists of different taxa, per collections, types of collections, and the whole sample were calculated.
 - c) Percentages were calculated using the total numbers.
 - d) Merged categories were created and their frequencies and percentages calculated.
 - (1) The category 'Vulnerable or worse' was created by joining VU, EN, CR, EW, EX, and DD
 - (2) The category 'Endangered or worse' was created by joining EN, CR, EW, EX, and DD
 - (3) The category 'Critically Endangered or worse' was created by joining CR, EW, EX, and DD
- 8) Calculating the percentage of zoological collections with particular percentages of endangered taxa.
- a) The frequencies of zoological collections with particular percentages of endangered taxa per types of collections and the whole sample were calculated, using the total number of zoos sampled and total number of kind of zoological collections.
- 9) Using the list of zoological collections belonging to the Federation of Zoological Gardens of Great Britain and Ireland published by the Federation in June 1998, the same values as above were calculated, but only using Federation zoos.
- 10) Using the list of taxa that are involved in the European Endangered Species Programme (EEP) published by the European Association of Zoos and Aquaria in April 2000, the same values as above were calculated but only using species belonging to EEP.
- 11) Through a bibliographic and Internet search, any successful reintroduction into the wild of the critically endangered species present in the zoos sampled, was carried out.

RESULTS

Taxa in UK zoological collections

89% of the taxa kept in British Zoological collections are not even listed in the IUCN 2000 red list book, and therefore are not considered threatened (n=2370)

Less than 10% of the taxa kept in British Zoological collections are classified as vulnerable or worse by IUCN (n=2370)

Less than 5% of the taxa kept in British Zoological collections are classified as endangered or worse by IUCN (n=2370)

About 1 % of the taxa kept in British Zoological collections are classified as critically endangered or extinct in the wild by IUCN (n=2370)

Less than 0.1 % of the taxa kept in British Zoological collections are classified as extinct in the wild by IUCN (n=2370)

Percentage of threatened taxa in UK zoological collections

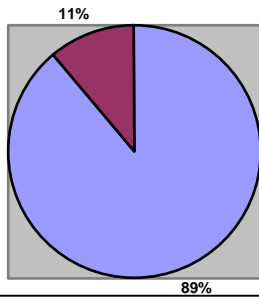


Figure 3. In red, percentage of threatened taxa in UK zoological collections

Percentage of vulnerable or worse taxa in UK zoological collections

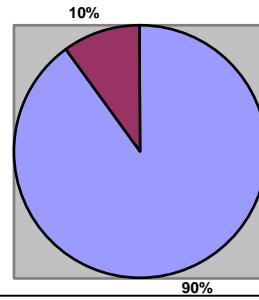


Figure 4. In red, percentage of vulnerable or worse taxa in UK zoological collections

Percentage of endangered or worse taxa in UK zoological collections

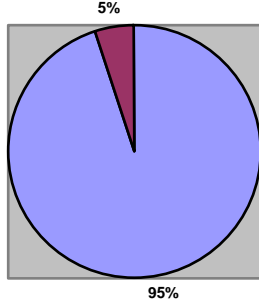


Figure 5. In red, percentage of endangered or worse taxa in UK zoological collections

Percentage of critically endangered or worse taxa in UK zoological collections

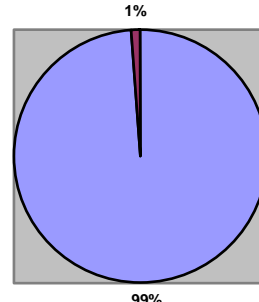


Figure 6. In red, percentage of critically endangered or worse taxa in UK zoological collections

Percentage of extinct in the wild taxa in UK zoological collections

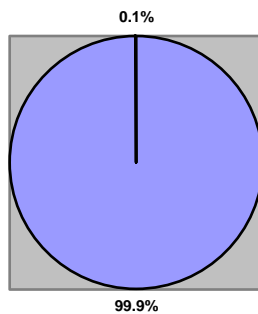


Figure 7. In red, percentage of extinct in the wild taxa in UK zoological collections

World's Threatened Taxa

More than 90% of the taxa with some risk of extinction (the taxa published in the IUCN 2000 red list) are not present in the UK zoological collections (n=8262).

Less than 3% of the taxa classified as endangered or worse by the IUCN are present in the UK zoological collections (n=2670).

Percentage of the World's taxa listed in the 2000 IUCN Red List present in the UK zoological collections

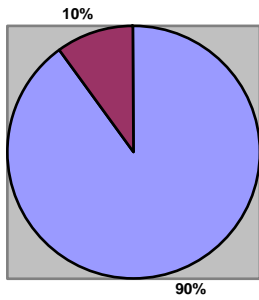


Figure 8. In red, percentage of the World's taxa listed in the 2000 IUCN Red List present in the UK zoological collections

Percentage of the World's taxa classified as endangered or worse by IUCN present in the UK zoological collections

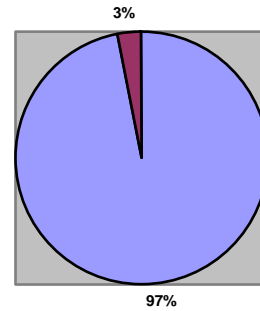


Figure 9. In red, percentage of the World's taxa classified as endangered or worse by IUCN present in the UK zoological collections

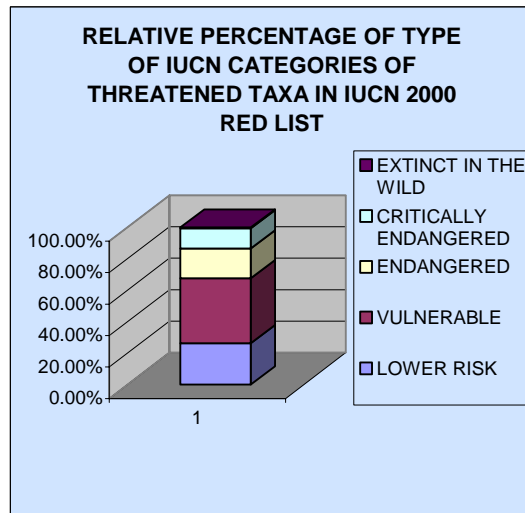


Figure 10. In red, relative percentage of type of IUCN categories of threatened taxa in IUCN 2000 red list.

Taxa part of 2000 European Endangered Species Programme

Less than 3% of the taxa in the UK zoological collections are part of any 2000 European Endangered Species Programme (n=2670).

More than 34% of the critically endangered or worse taxa present in the UK zoological collections are not part of any 2000 European Endangered Species Programme (n=26).

Percentage of the taxa in the UK zoological collections that are part of any 2000 European Endangered Species Programme

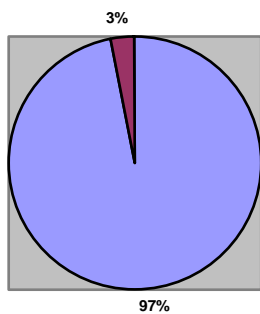


Figure 11. In red, Percentage of the taxa in the UK zoological collections that are part of any 2000 European Endangered Species Programme

Percentage of the critically endangered or worse taxa in the UK zoological collections that are not part of any 2000 European Endangered Species Programme

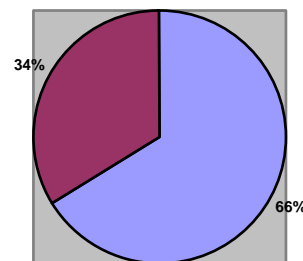


Figure 12. In red, percentage of the critically endangered or worse taxa in the UK zoological collections that are not part of any 2000 European Endangered Species Programme

UK zoological collections with no threatened taxa

25% of the UK Zoological collections do not keep any taxon listed in the IUCN 2000 red list book, which are the taxa with certain risk of extinction (n=104).

29% of the UK Zoological collections do not keep any taxon classified as vulnerable or worse by IUCN (n=104).

63% of the UK Zoological collections do not keep any taxon classified as endangered or worse by IUCN (n=104).

82% of the UK Zoological collections do not keep any taxon classified as critically endangered or extinct in the wild by IUCN (n=104).

Less than 2 % of the UK Zoological collections keep any taxon classified as extinct in the wild by IUCN (n=104).

Percentage of UK zoological collection with no threatened taxa

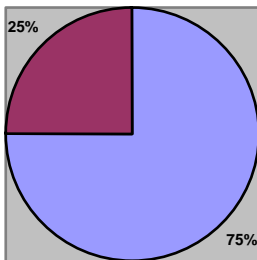


Figure 13. In red, percentage of UK zoological collection with no threatened taxa

Percentage of UK zoological collection with no 'vulnerable or worse' taxa

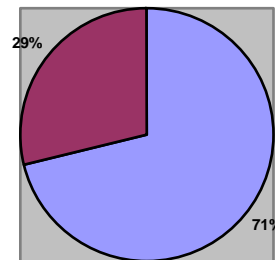


Figure 14. In red, percentage of UK zoological collection with no 'vulnerable or worse' taxa

Percentage of UK zoological collection with no 'endangered or worse' taxa

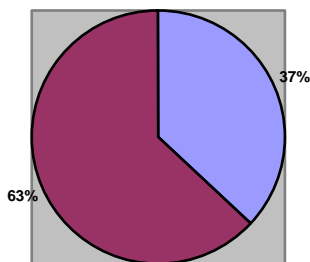


Figure 15. In red, percentage of UK zoological collection with no 'endangered or worse' taxa

Percentage of UK zoological collection with no 'critically endangered or worse' taxa

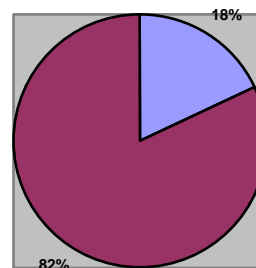


Figure 16 In red, percentage of UK zoological collection with no 'critically endangered or worse' taxa

UK zoological collections with threatened taxa

93% of the UK Zoological collections have less than 10% of the taxa kept is classified as endangered or worse by IUCN (n=104).

99% of the UK Zoological collections have less than 25% of the taxa kept is classified as endangered or worse by IUCN (n=104).

Less than 0.1% of the UK Zoological collections have more than 50% of the taxa kept is classified as endangered or worse by IUCN (n=104).

Percentage of UK zoological collection with 10% or more of their taxa classified as endangered

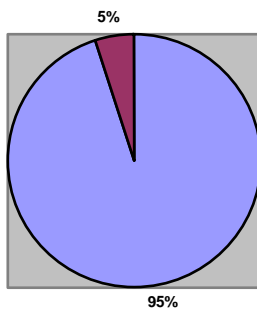


Figure 17. In red, percentage of UK zoological collection with 10% or more of their taxa classified as endangered

Percentage of UK zoological collection with 25% or more of their taxa classified as endangered

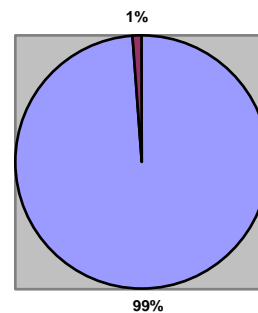


Figure 18. In red, percentage of UK zoological collection with 25% or more of their taxa classified as endangered

Percentage of UK zoological collection with 50% or more of their taxa classified as endangered

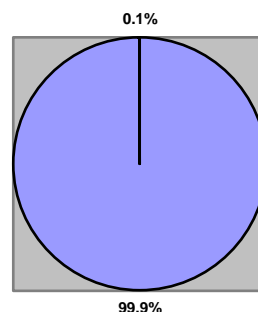


Figure 19. In red, percentage of UK zoological collection with 50% or more of their taxa classified as endangered

Taxa in UK Large Zoos

77% of the taxa kept in UK Large Zoos are not even listed in the IUCN 2000 red list book, and therefore are not considered threatened (n=504).

18% of the taxa kept in UK Large Zoos are classified as 'vulnerable or worse' by IUCN (n=504)

About 7% of the taxa kept in UK Large Zoos are classified as 'endangered or worse' by IUCN (n=504)

Less than 3% of the taxa kept in UK Large Zoos are classified as 'critically endangered or extinct in the wild' by IUCN (n=504)

Percentage of threatened taxa in UK Large zoos

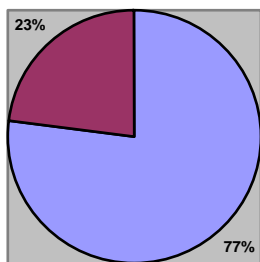


Figure 20. In red, percentage of threatened taxa in UK Large zoos.

Percentage of 'vulnerable or worse' taxa in UK Large zoos

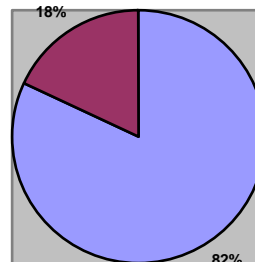


Figure 21. In red, percentage of 'vulnerable or worse' taxa in UK Large zoos.

Taxa in UK Small zoos

89% of the taxa kept in UK small Zoos are not even listed in the IUCN 2000 red list book, and therefore are not considered at any risk (n=628).

Less than 9% of the taxa kept in UK small Zoos are classified as 'vulnerable or worse' by IUCN (n=628).

Less than 3% of the taxa kept in UK small Zoos are classified as 'endangered or worse' by IUCN (n=628).

Less than 1 % of the taxa kept in UK small Zoos are classified as 'critically endangered or extinct in the wild' by IUCN (n=628).

Percentage of threatened species in UK small zoos

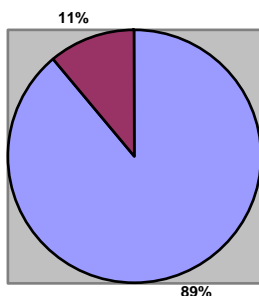


Figure 22. In red, percentage of threatened taxa in UK Small zoos.

Percentage of 'vulnerable or worse' taxa in UK Small zoos

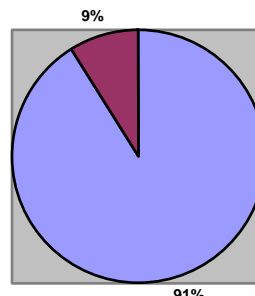


Figure 23. In red, percentage of 'vulnerable or worse' taxa in UK Small zoos.

Percentage of 'endangered or worse' taxa in UK Small zoos

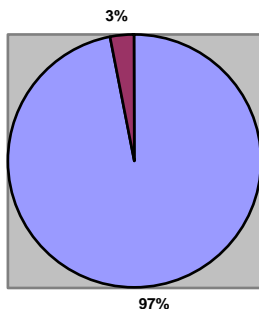


Figure 24. In red, percentage of 'endangered or worse' taxa in UK Small zoos.

Percentage of 'critically endangered or worse' taxa in UK Small zoos

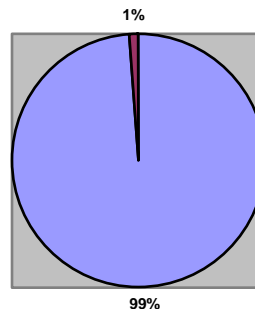


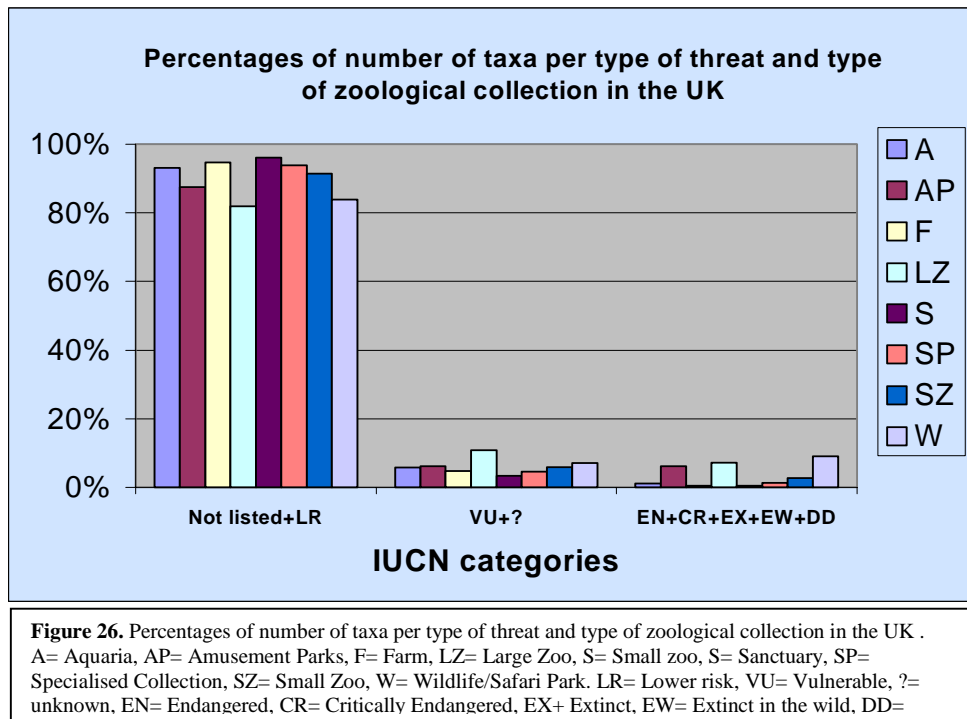
Figure 25. In red, percentage of 'critically endangered or worse' taxa in UK Small zoos.

Taxa per 'type' of zoo

More than 75% of the taxa of any 'type' of UK zoological collections (aquariums, safari parks, farms with 'exotics', sanctuaries, small zoos, large zoos or amusements parks) are not listed in the IUCN 2000 red list book, and therefore are not considered threatened.

Wildlife/safari parks are the 'type' of zoological collection in the UK with higher percentage of endangered taxa, but they still represent less than 10% of their taxa.

Sanctuaries, with less than 4%, show the smallest proportion of taxa classified as 'vulnerable or worse' by IUCN.



Large and Small zoos with threatened taxa

More than 90% of the UK large Zoos have less than 15% of the taxa they keep classified as 'endangered or worse' by IUCN (n=504).

About 50% of the UK large Zoos have less than 10% of the taxa they keep classified as 'endangered or worse' by IUCN (n=504).

About 16% of the UK large Zoos do not have any taxon classified as 'endangered or worse' by IUCN (n=504).

Over 85% of the UK small Zoos have less than 10% of the taxa they keep classified as 'endangered or worse' by IUCN (n=504).

Over 90% of the UK small Zoos have less than 5% of the taxa they keep classified as 'critically endangered or extinct in the wild' by IUCN (n=628).

A quarter (25%) of the UK small Zoos have no one taxon classified as 'critically endangered or extinct in the wild' by IUCN (n=628).

Over 10% of the UK small Zoos do not have any taxon classified as endangered or worse by IUCN (n=628).

Percentage of UK large zoos with no taxon classified as 'endangered or worse'

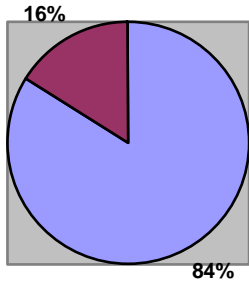


Figure 27. In red, percentage of UK large zoos with no taxon classified as 'endangered or worse'

Percentage of UK Large zoos with less than 10% of their taxa classified as 'endangered or worse'

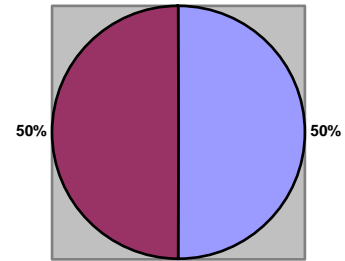


Figure 28. In red, percentage of UK large zoos with less than 10% of their taxa classified as 'endangered or worse'

Percentage of UK Large zoos with more than 15% of their taxa classified as 'endangered or worse'

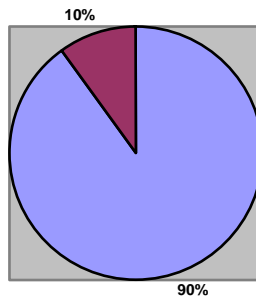


Figure 29. In red, percentage of UK Large zoos with less than 15% of their taxa classified as 'endangered or worse'

Percentage of UK small zoos with no taxon classified as 'endangered or worse'

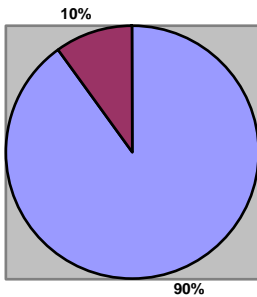


Figure 30. In red, percentage of UK Small zoos with no taxon classified as 'endangered or worse'

Percentage of UK small zoos with more than 10% of their taxa classified as 'endangered or worse'

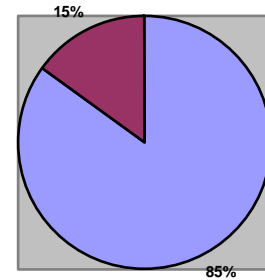


Figure 31. In red, percentage of UK Small zoos with less than 10% of their taxa classified as 'endangered or worse'

Percentage of UK small zoos with more than 5% of their taxa classified as endangered or worse

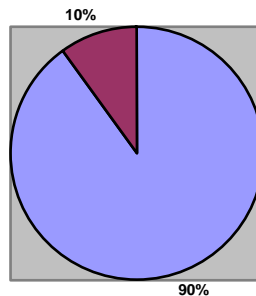


Figure 32. In red, percentage of UK Small zoos with less than 5% of their taxa classified as 'endangered or worse'

UK Federation zoological collections with threatened taxa

89% of the UK Federation zoological collections have less than 10% of the taxa they keep classified as 'endangered or worse' by IUCN (n= 18).

Over 66% of the UK Federation zoological collections have less than 5% of the taxa they keep classified as 'critically endangered or extinct in the wild' by IUCN (n= 18).

44% of the UK Federation zoological collections do not have any taxon classified as 'critically endangered or extinct in the wild' by IUCN (n= 18).

Over 35% of the UK Federation zoological collections do not have any taxon classified as endangered or worse by IUCN (n= 18)

Percentage of UK Federation zoological collections with more than 10% of their taxa classified as 'endangered or worse'

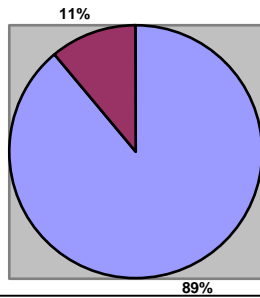


Figure 33. In red, percentage of UK Federation Zoological collections with more than 10% of their taxa classified as 'endangered or worse'

Percentage of UK Federation zoological collections with more than 5% of their taxa classified as 'endangered or worse'

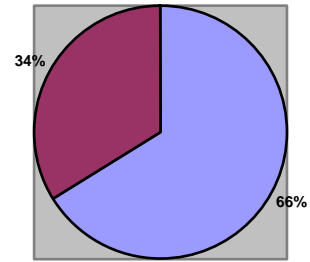


Figure 34. In red, percentage of UK Federation Zoological collections with more than 5% of their taxa classified as 'endangered or worse'

Percentage of UK Federation zoological collections with no taxa classified as 'endangered or worse'

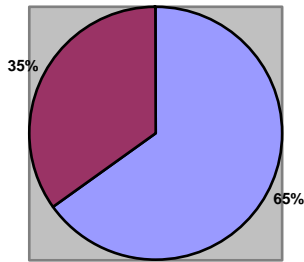


Figure 35. In red, percentage of UK Federation Zoological collections with no taxon classified as 'endangered or worse'

Percentage of UK Federation zoological collections with no taxa classified as 'critically endangered or worse'

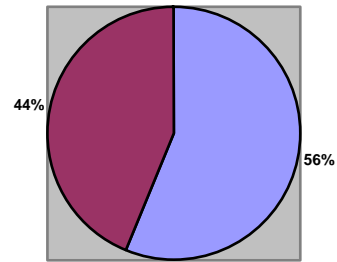


Figure 36. In red, percentage of UK Federation Zoological collections with no taxon classified as 'critically endangered or worse'

Taxa in UK Federation zoological collections

Over 80% of the taxa kept in UK Federation zoological collections are not even listed in the IUCN 2000 red list book, and therefore are not considered threatened (n=1472).

Less than 15% of the taxa kept in UK Federation zoological collections are classified as 'vulnerable or worse' by IUCN (n=1472)

About 5% of the taxa kept in UK Federation zoological collections are classified as 'endangered or worse' by IUCN (n=1472)

Less than 2 % of the taxa kept in UK Federation zoological collections are classified as 'critically endangered or extinct in the wild' by IUCN (n=1472)

Percentage of threatened taxa in UK Federation zoological collections

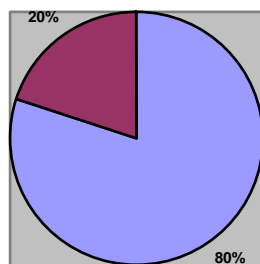


Figure 37. In red, percentage of threatened taxa in UK Federation Zoological collections

Percentage of taxa in UK Federation zoological collections classified as 'vulnerable or worse'

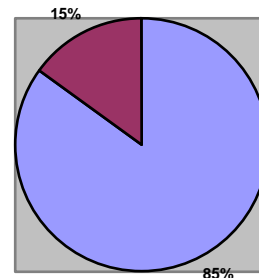


Figure 38. In red, percentage of taxa in UK Federation Zoological collections classified as 'vulnerable or worse'.

Percentage of taxa in UK Federation zoological collections classified as 'endangered or worse'

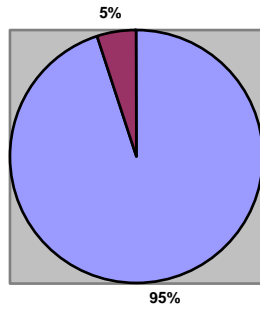


Figure 39. In red, percentage of taxa in UK Federation Zoological collections classified as 'endangered or worse'.

Percentage of taxa in UK Federation zoological collections classified as 'critically endangered or worse'

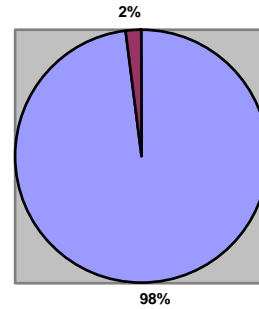


Figure 40. In red, percentage of taxa in UK Federation Zoological collections classified as 'critically endangered or worse'.

Taxa in UK Large Federation Zoos

About 73% of the taxa kept in UK Large Federation Zoos are not even listed in the IUCN 2000 red list book, and therefore are not considered threatened (n= 484).

About 21% of the taxa kept in UK Large Federation Zoos are classified as 'vulnerable or worse' by IUCN (n= 484).

About 8% of the taxa kept in UK Large Federation Zoos are classified as 'endangered or worse' by IUCN (n= 484).

About 3 % of the taxa kept in UK Large Federation Zoos are classified as 'critically endangered or extinct in the wild' by IUCN (n= 484).

Percentage of taxa in UK Large Federation zoos listed in the IUCN Red List

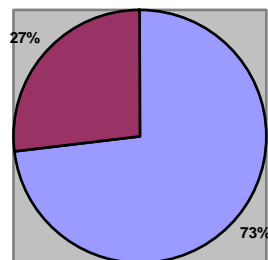


Figure 41. In red, percentage of taxa in UK Large Federation Zoological collections listed in IUCN Red list.

Percentage of taxa in UK Large Federation zoos classified as 'vulnerable or worse'

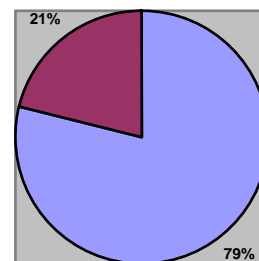


Figure 42. In red, percentage of taxa in UK Large Federation Zoological collections classified as 'vulnerable or worse'.

Percentage of taxa in UK Large Federation zoos classified as 'endangered or worse'

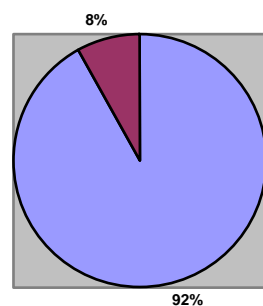


Figure 43. In red, percentage of taxa in UK Large Federation Zoological collections classified as 'endangered or worse'.

Percentage of taxa in UK Large Federation zoos classified as 'critically endangered or worse'

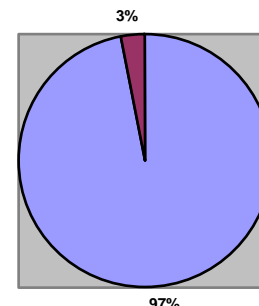


Figure 44. In red, percentage of taxa in UK Large Federation Zoological collections classified as 'critically endangered or worse'.

Type of endangered animals kept in UK zoological collections

25% of the 'critically endangered or worse' taxa of the IUCN 2000 Red List are mammals (n=1122), while 76% of the 'critically endangered or worse' taxa in UK zoological collections are mammals (n=17).

32% of the 'critically endangered or worse' taxa of the IUCN 2000 Red List are invertebrates (n=1122), while 0% of the 'critically endangered or worse' taxa in UK zoological collections are invertebrates (n=17).

15% of the 'critically endangered or worse' mammal taxa of the IUCN 2000 Red List are Carnivores (n=13), while 50% of the 'critically endangered or worse' mammal taxa in UK zoological collections are Carnivores (n=283).

Less than 2% of the 'critically endangered or worse' taxa of the IUCN 2000 Red List are Carnivores (n=8262), while 43% of the 'critically endangered or worse' taxa in UK zoological collections are carnivores (n=2370).

Percentage of 'critically endangered or worse' taxa in the IUCN 2000 Red List and in UK zoological collections per type of animal

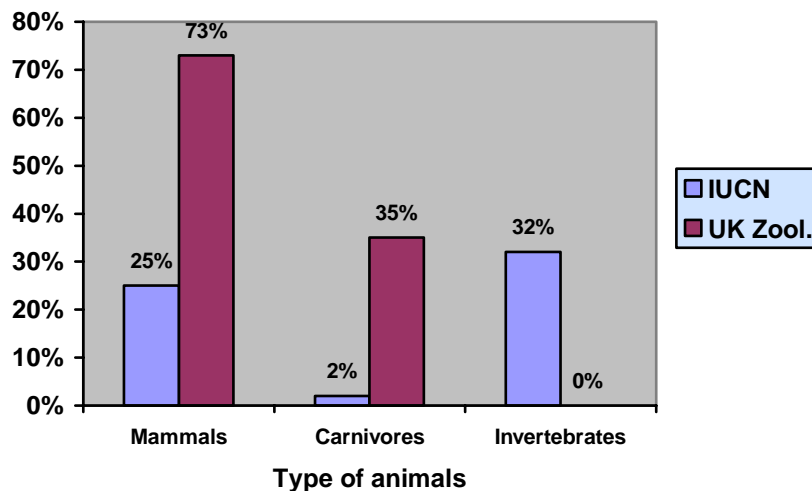


Figure 45 Percentage of 'critically endangered or worse' taxa in the IUCN 2000 Red List and in UK zoological collections per type of animal. UK Zool. =UK zoological collections. IUCN= World Conservation Union

Taxa in UK zoological collections that has been reintroduced into the wild

About 0.3% of the taxa kept in UK zoological collections are 'critically endangered' taxa where at least one individual has ever been reintroduced successfully into the wild (n=2370).

About 0.2% of the taxa kept in UK zoological collections are 'critically endangered' taxa that have been reintroduced successfully into the wild as successful populations (n=2370).

Less than 0.01% of the taxa kept in UK zoological collections are 'critically endangered' taxa of Carnivores that at have been reintroduced successfully into the wild as successful populations (n=2370).

Table 3 Taxa of UK zoological collections (S5) classified as 'endangered or worse' with at least one successful reintroduction into the wild.

Arabian oryx	EN	Citron crested cockatoo	CR
Asian water buffalo	EN	Egyptian tortoise	EN
Asiatic lion	CR	European bison	EN
Bali starling	CR	Golden headed lion tamarin	EN
Black and white ruffed lemur	EN	Golden lion tamarin	CR
Black rhinoceros	CR	Gorilla	EN
Brown teal	EN	Mauritius pink pigeon	EN
Chimpanzee	EN	Onager	EN

Orangutan	EN	Ruffed lemur	EN
Oryx	EN	Scimitar horned oryx	EW
Pere david's deer	CR	Waldrapp ibis	CR
Przewalski's horse	EW	Western lowland gorilla	EN
Red crowned crane	EN	White winged wood duck	EN

Less than 1% of the taxa present in UK zoological collections have representatives that have ever been reintroduced, at least once, into the wild (n=2370).

Less than 0.4% of the taxa present in UK zoological collections have ever been reintroduced, at least once, into the wild in successful reintroduction projects (n=2370).

Less than 0.01% of the taxa kept in UK zoological collections are 'endangered or worse' taxa of Carnivores that have been reintroduced successfully into the wild as successful projects (n=2370).

Percentage of taxa from UK zoological collections where at least one individual has ever been reintroduced into the wild

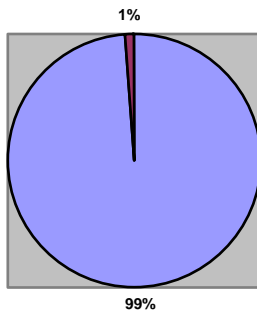


Figure 46. In red, percentage of taxa in UK zoological collections where at least one individual has ever been reintroduced into the wild

Percentage of taxa from UK zoological collections where at least one individual has ever been successfully reintroduced into the wild

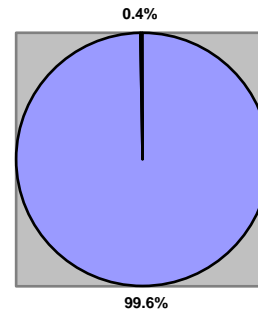


Figure 47. In red, percentage of taxa in UK zoological collections where at least one individual has ever been successfully reintroduced into the wild

Less than half (48%) of the taxa classified as 'endangered or worse' by IUCN present in UK zoological collections, have been ever reintroduced, at least once into the wild (n= 2670).

Less than 15% of the taxa classified as 'endangered or worse' by IUCN present in UK zoological collections, have ever been reintroduced at least once into the wild in successful reintroduction projects (n= 2670).

Less than 35 % of the 'endangered or worse' taxa ever reintroduced into the wild have had at least one successful reintroduction project (n= 23).

Percentage of endangered or worse taxa from UK zoological collections where at least one individual have ever been reintroduced into the wild

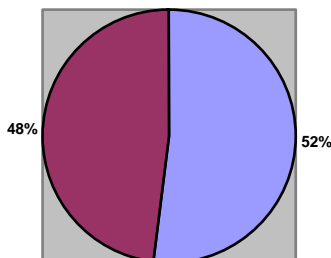


Figure 48. In red, percentage of endangered or worse taxa in UK zoological collections where at least one individual has ever been reintroduced into the wild

Percentage of 'endangered or worse' taxa from UK zoological collections ever reintroduced into the wild with at least one successful reintroduction project

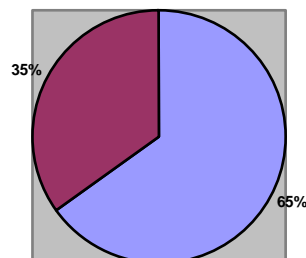


Figure 49. In red, percentage of 'endangered or worse' taxa in UK zoological collections ever reintroduced into the wild with at least one successful reintroduction project

Percentage of endangered or worse taxa from UK zoological collections that at least once have ever been successfully reintroduced into the wild

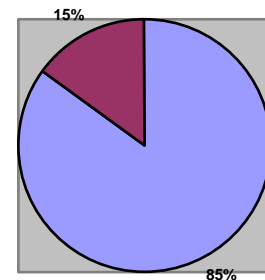


Figure 50. In red, percentage of 'endangered or worse' taxa in UK zoological collections that at least once have ever been successfully reintroduced into the wild

Reintroduction by UK zoological collections

Less than 4% of the UK zoological collections opened during the year 2000, have ever been directly involved with reintroducing any animal classified as 'endangered or worse' back into the wild (n=104).

Less than 1% of the UK zoological collections were directly involved with the reintroduction of any of their animals classified as 'endangered or worse' back into the wild during the year 2000 (n=104).

The average number of individuals belonging to taxa classified in the year 2000 as endangered or worse that have been reintroduced into the wild by UK zoological collection during all their history is less than one.

Percentage of UK zoological collections operative in the year 2000 that have ever been directly involved in reintroducing any of their 'endangered or worse' animals

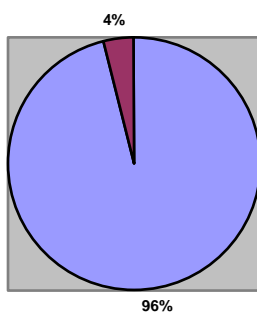


Figure 51. In red, Percentage of the year 2000 UK zoological collections that have ever been directly involved in reintroducing any of their 'endangered or worse' animals

Percentage of UK zoological collections that were directly involved in reintroducing into the wild any of their 'endangered or worse' animals during the year 2000

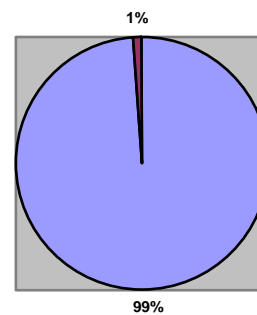


Figure 52. In red, Percentage of the year 2000 UK zoological collections that have ever been directly involved in reintroducing any of their 'endangered or worse' animals during the year 2000.

Summary of results concerning taxa in UK zoological collections

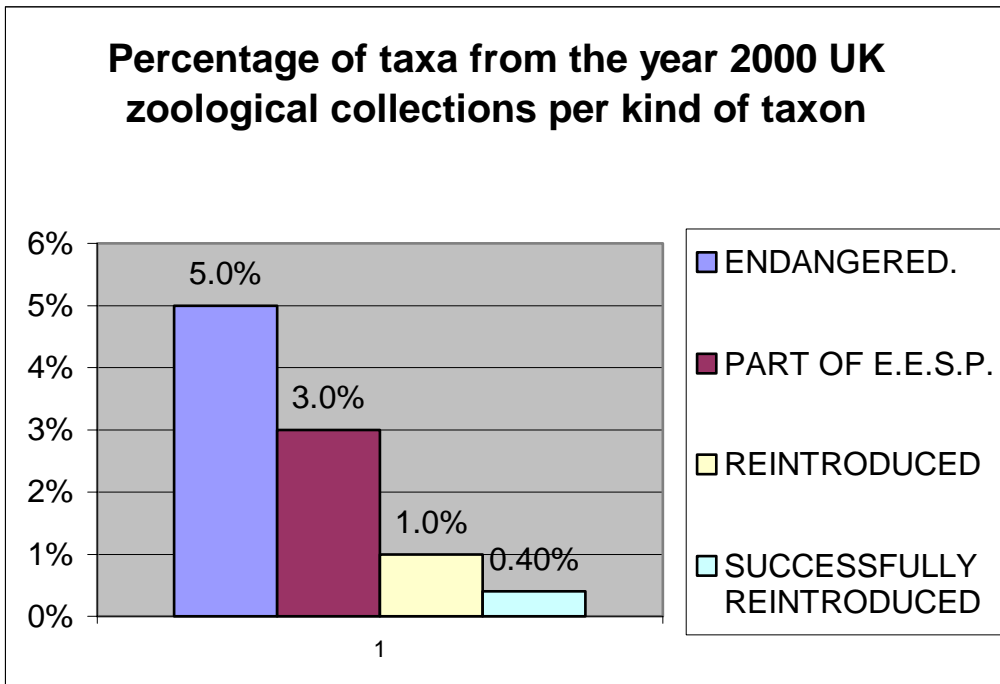


Figure 53 Percentage of taxa from the year 2000 UK zoological collections per type of taxon regarding its conservation management. EESP= European Endangered Species Programme.

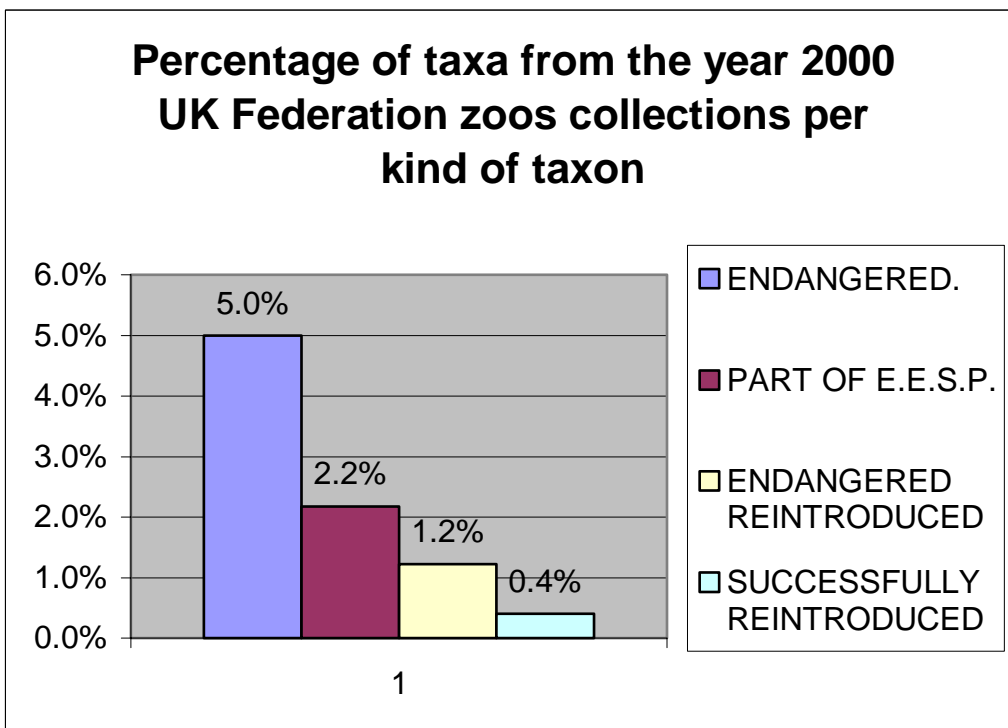


Figure 54 Percentage of taxa from the year 2000 UK Federation zoos per type of taxon regarding its conservation management. EESP= European Endangered Species Programme.

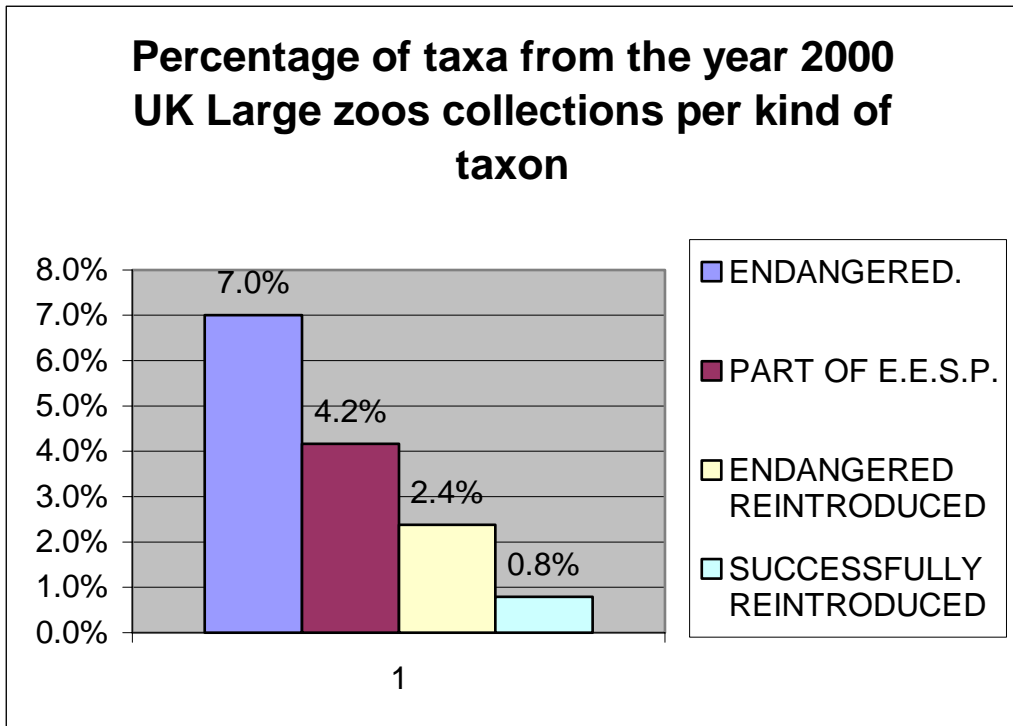


Figure 55 Percentage of taxa from the year 2000 UK Large zoos per type of taxon regarding its conservation management. EESP= European Endangered Species Programme.

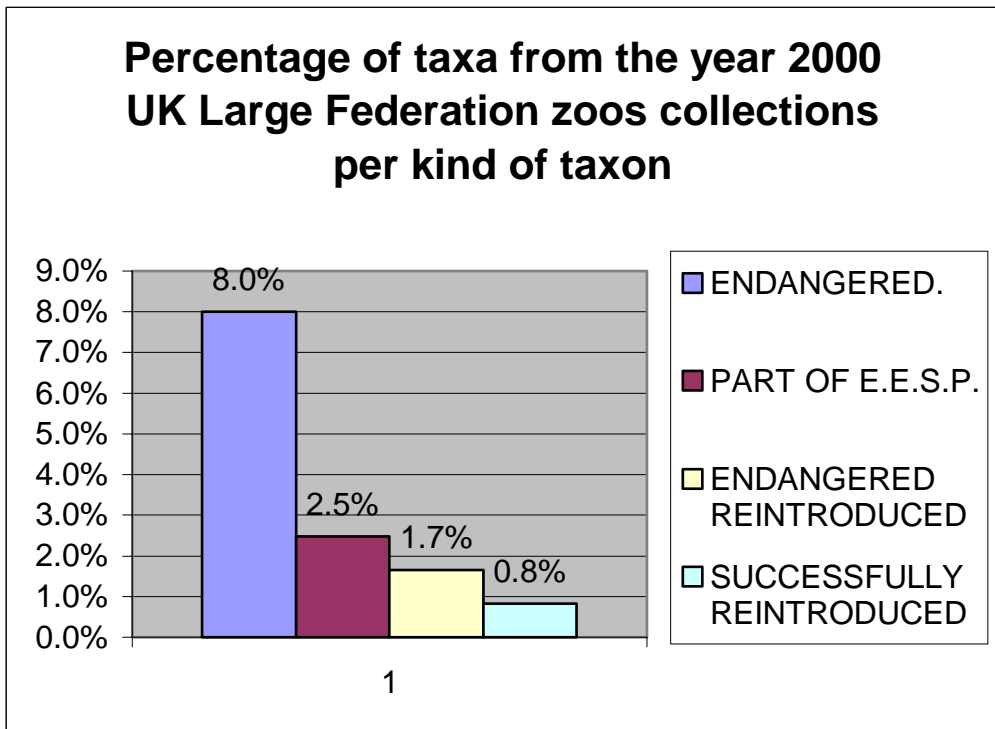


Figure 56 Percentage of taxa from the year 2000 UK Large Federation zoos per type of taxon regarding its conservation management. EESP= European Endangered Species Programme.

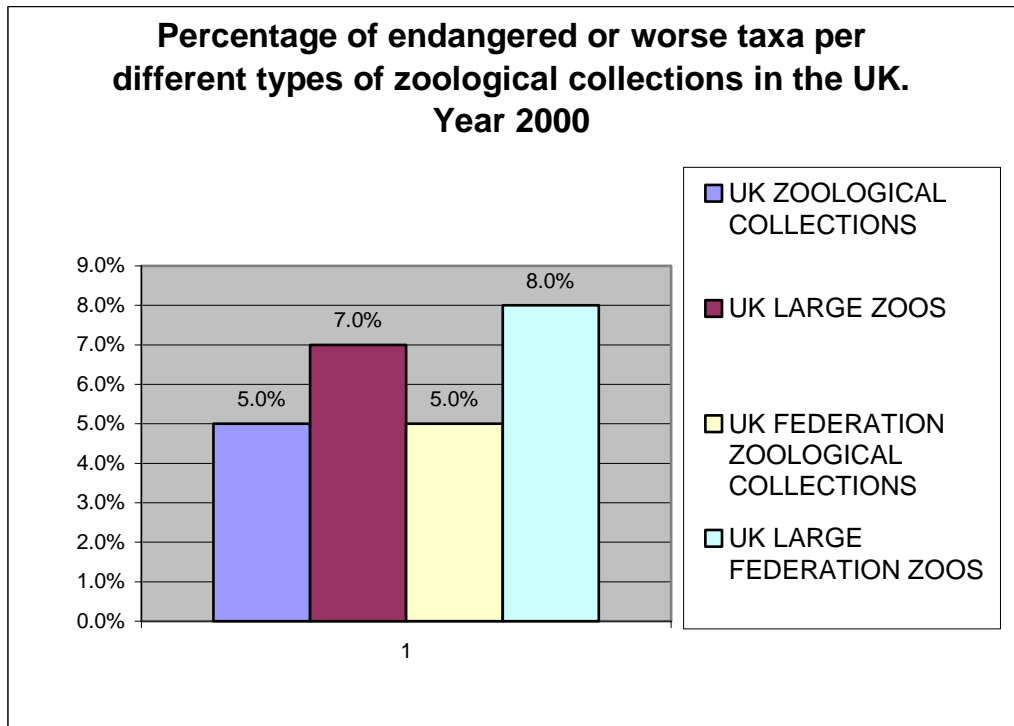


Figure 57. Percentage of endangered or worse taxa per different types of zoological collections in the UK (year 2000)

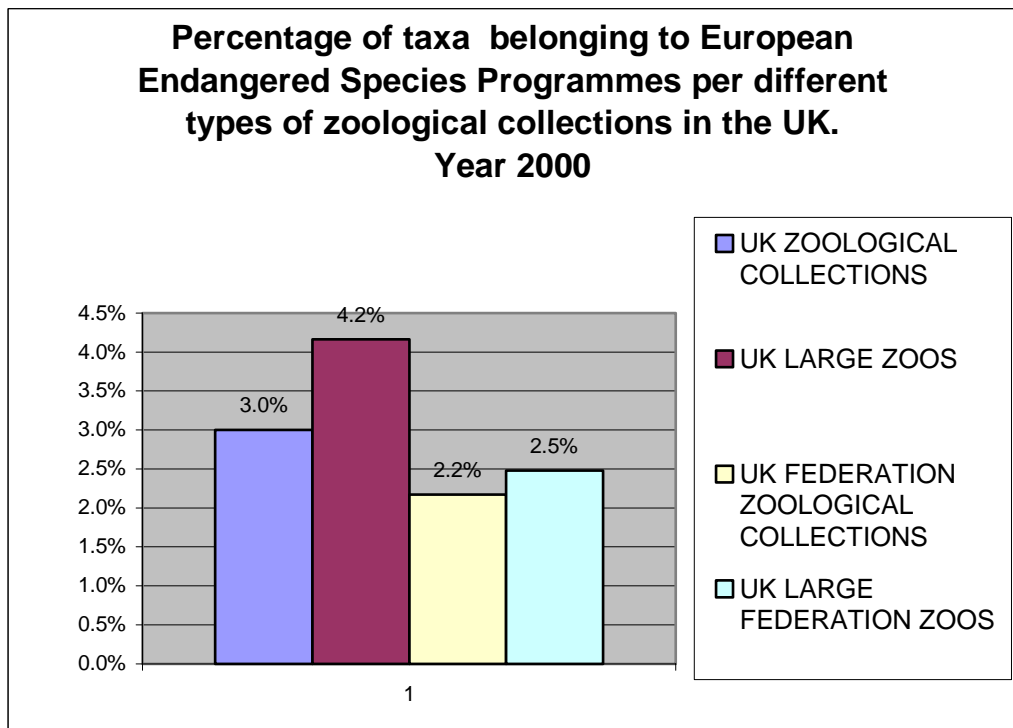


Figure 58. Percentage of taxa belonging to European Endangered Species Programmes per different types of zoological collections in the UK. Year 2000

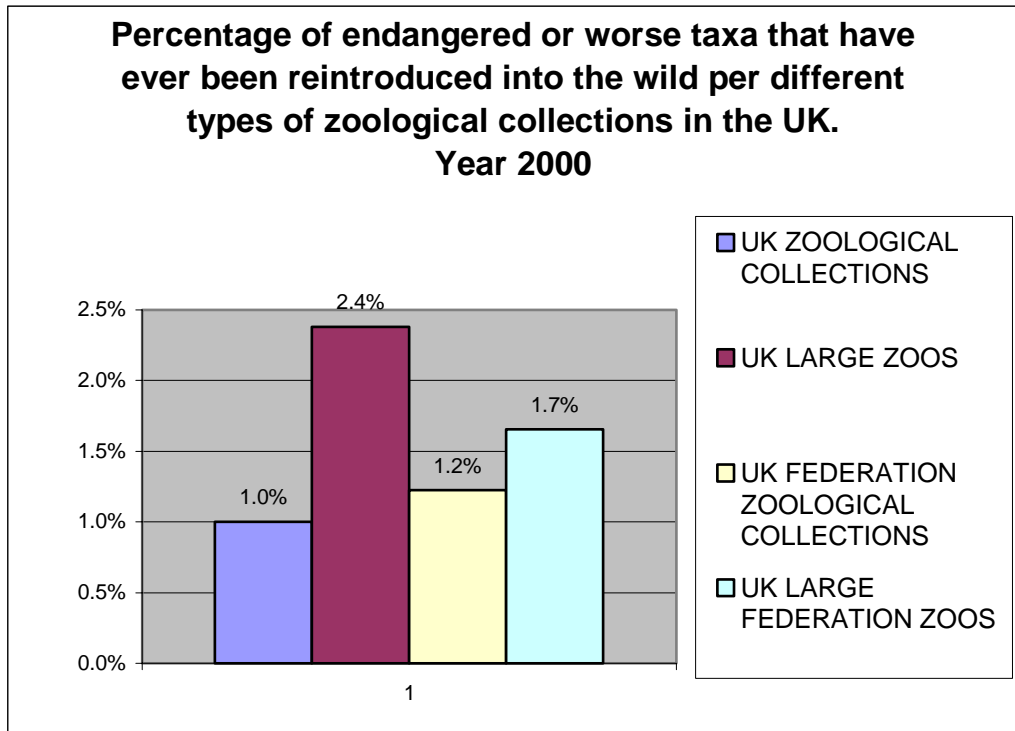


Figure 59. Percentage of endangered or worse taxa ever been reintroduced into the wild per different types of zoological collections in the UK. Year 2000

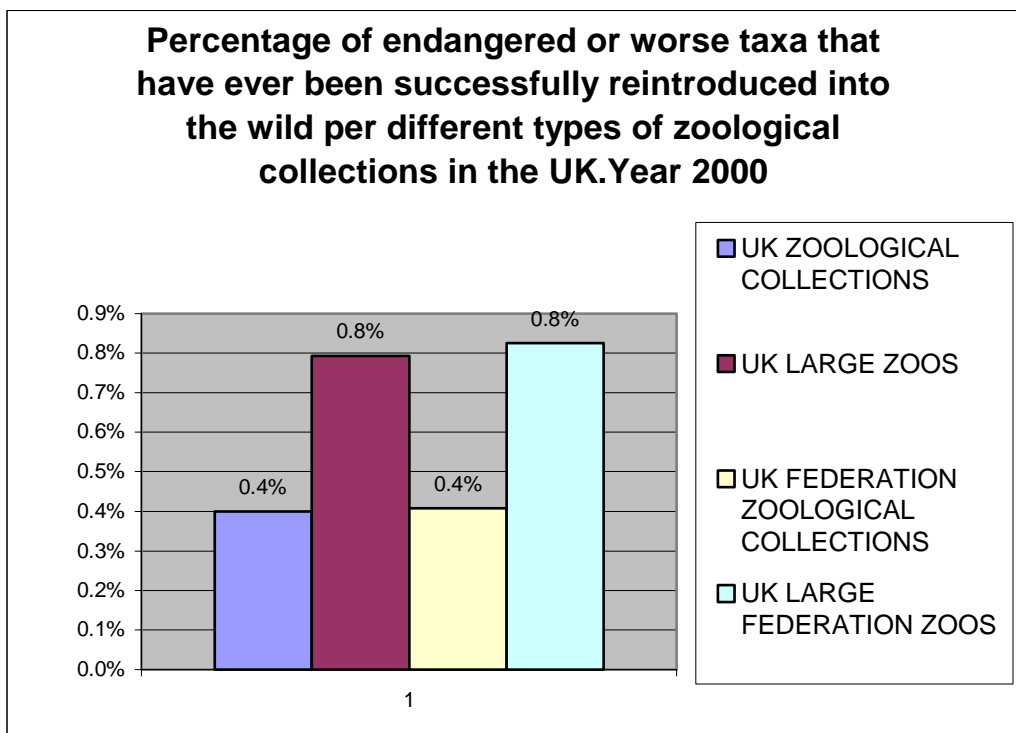


Figure 60. Percentage of endangered or worse taxa ever been successfully reintroduced into the wild per different types of zoological collections in the UK. Year 2000

Most common taxa in the UK zoological collections

The 50 most common taxa in the UK zoological collections investigated, follow (in order of higher frequency):

Table 4. Most common taxa present in the UK zoological collections during the year 2000

1 Rabbits	NL	26 Harris hawk	NL
2 Peacock	NL	27 Plaice	NL
3 Chickens	NL	28 Pigs	NL
4 Barn owl	NL	29 Mandarin duck	NL
5 Goats	NL	30 Chinchilla	NL
6 Cockatiel	NL	31 Turkey	NL
7 Snowy owl	NL	32 Tawny owl	NL
8 Guinea pig	NL	33 Grey mullet	NL
9 Ducks	NL	34 Giant African land snail	NL
10 Chipmunk	NL	35 Yellow backed chattering lory	NL
11 Sheep	NL	36 Ballan wrasse	NL
12 Pygmy goat	NL	37 Asian short clawed otter	NL
13 Carp	NL	38 Horse	NL
14 Green iguana	NL	39 Emperor scorpion	NL
15 European eagle owl	NL	40 Mexican red kneed tarantula	NL
16 Blue and yellow macaw	NL	41 Madagascan hissing cockroach	NL
17 Golden pheasant	NL	42 Little owl	NL
18 Llama	NL	43 Fallow deer	NL
19 Guinea fowl	NL	44 Conger eel	NL
20 Bass	NL	45 Common buzzard	NL
21 Common starfish	NL	46 Chilean rose tarantula	NL
22 Geese	NL	47 Royal python	NL
23 Zebra finch	NL	48 Ringed teal	NL
24 Wallaby	NL	49 Red eared terrapin	NL
25 Vietnamese pot bellied pigs	NL	50 Kookaburra	NL

This 50 taxa represent 2% of the total number of different taxa (n=2670), although they cover 18% of all taxa entries (n=6165).

DISCUSSION

General

The World Conservation Union (IUCN) is the globally recognised institution that assesses the conservation status of the species, which animals are threatened, and to what degree. The organisation uses the concept of 'taxa' to group and label groups of animals. This concept is quite synonymous of species, as well as incorporating sub-species, or any other sort of practical grouping based in taxonomical classification. Figure 10 shows the relative frequency of taxa of different 'categories of danger' present in the IUCN 2000 Red List.

Under the guidelines of the IUCN, zoological collections all over the world use and recognise both the scientific and the common name in the description of taxa. It is therefore seen as sensible that in this study, the unit to use to group the different kinds of animal is also 'taxa'. Since the chosen taxa in this study are those defined precisely by the zoological collections investigated, and accepted by IUCN, any possible bias created by different classification systems has been avoided.

Presence of threatened taxa.

Figures 3 to 8 show that the percentage of threatened taxa (any taxa listed in the IUCN 2000 Red List) in UK zoological collections to be low. The more threatened the type of taxa (following the IUCN classification), the smaller its percentage of representation. However, this has been partially caused by the fact that the categories were grouped so they include higher risk categories (i.e. 'vulnerable or worse' etc.).

Particularly significant are the percentages of the categories 'Endangered-or-worse', or 'Critically-Endangered-or-worse', as these were the categories closest to the general perception of the concept of species in danger of extinction. Is it this kind of taxa that the zoological collection literature refers to as species to 'save'? If it is, why then do the results show that the percentage of representation of these particular taxa in zoological collections is less than 5%?

The concept of the 'ark', often quoted when describing the work of a zoo, seems to imply that zoos do keep species that have become extinct in the wild. However, the results indicate that in actual fact, zoological collections only keep 0.1% of taxa that is 'extinct in the wild'.

The most significant result is that the highest percentage representation of taxa in UK zoological collections are those not listed in the IUCN Red List (figure 3), therefore those that are neither lower risk, vulnerable, endangered, critically endangered nor extinct in the wild. Since none of these species (89% of total taxa in zoological collections) fall into any classification of 'threatened', is it therefore justified for zoological collections to keep and breed these taxa in the name of conservation?

In fact, table 3 shows that the most common taxa in UK collections are mainly 'domesticated animals' (farm/pet animals), which have little conservation value.

The presence of threatened taxa in zoological collections can also be quantified by counting the number of zoological collections that either do not have any taxa belonging to any of the categories of danger or, have a low percentage of taxa belonging to such categories (categories as stipulated by IUCN). Figures 13 to 16 show that 82% of collections do not have any taxa classified as 'Critically endangered or worse' and 93% of the collections have only 10% of their taxa classified as 'Endangered or worse'. Surely, one would expect zoological collections to have a majority of threatened/endangered species if zoological collections justify their existence as an 'ark' to 'save' those species? As the results suggest, this is hardly the case with less than 0.1% of the collections having half or more of their taxa classified as 'Endangered or worse' (figure 19).

It could be argued that the lower percentages are caused by the presence of small zoological collections that are not large conservation minded zoos. Figures 20, 21, and from 27 to 29 show that if we only consider Large Zoos, the percentages still remain small. It could also be argued that not all Large Zoos follow the modern conservation standards that 'Federation' zoos claim to uphold. However, figures 33 to 40, and figure 54, show that if only the Federation zoos were considered, the percentages again remain small. Concentrating on the large Federation zoos (figures 41 to 45, and figure 55), does show a slightly higher percentage of 'Endangered or worse' classified taxa, but this still remains under 10%.

In fact, as shown in figure 26 and 57, every type of zoological collection in the UK has a low percentage of threatened species.

The presence of threatened taxa in the UK zoological collections can also be evaluated by assessing how many of the world's threatened species are to be found in UK collections. Figure 8 shows that actually 90% of the all recognised threatened species in the world (excluding all threatened species still to discovered or evaluated), are not to be found in any of the UK collections investigated.

Evaluating the type of animals the UK collections kept is also interesting to see if any trend exists with the type of animals 'threatened' under IUCN. Figure 45 explains that the majority of threatened taxa in UK zoological collections are mammals, as compared with only 25% of all the known 'to be threatened' taxa are mammals. The majority of those mammals are Carnivores, but out of the known 'to be threatened' taxa in the world only 15% are carnivores. This shows that criteria in selecting which animals to keep in zoological collections do not appear to follow any trend in the 'conservation status' of the animal. Therefore is it justified for a zoological collection to claim that they select keep and 'save' a majority of endangered animals when clearly the majority of taxa are not even listed as endangered?

Participation in co-ordinated captive breeding programmes

If an endangered species is kept in a zoological collection but does not breed or, is bred in an uncontrolled way that generates genetically inadequate individuals, it is difficult to justify their presence in the collection in the name of conservation. There are international programmes that prevent this by co-ordinating the breeding of endangered taxa.

In theory, such a control would be beneficial. However, figures 11 and 12 show that only 3% of the taxa kept in UK zoological collections are part of such a co-ordinated captive breeding programme (in this case the European Endangered Species Programme). Alarming, at least a third of the 'Critically Endangered or worse' taxa in UK zoological collections are not bred following these programmes.

If we analyse how many taxa there are in co-ordinated breeding programs in UK large zoos, UK Federation zoos, and UK large Federation zoos (figure 58), the percentages are less than 5%.

Reintroduction of taxa.

Zoos claim to conserve and preserve species, endangered or otherwise by breeding and increasing their numbers in captivity, in the hope that, one day, those animals will be reintroduced into the wild and restock depleted wild populations. A number of attempts have been made to reintroduce endangered species into the wild, but for this report, a reintroduction is only deemed successful if the reintroduced individuals survive long enough to reproduce to a second generation (Kleiman et al., 1991; Stuart, 1991).

Figure 51 and 52 and table 3 show that reintroduction of taxa from UK collections is extremely rare. Considering only the S5 zoological collections assessed in this report, species reintroduction was negligible.

Figures 59 and 60 consider Large zoos, Federation zoos, or Large Federation zoos but, again the percentages of success remain very small, despite the fact the values in large zoos are double than that of the others.

The 'saving' of a species should therefore only be regarded as those that are successfully released into the wild where they breed and carry out a natural existence. With this as the understanding, it would appear that describing zoological collections as institutions that regularly 'save' threatened species is in fact, extremely inaccurate.

DO UK ZOOLOGICAL COLLECTIONS CONTRIBUTE TO SCIENTIFIC RESEARCH?

INTRODUCTION

Research constitutes a significant concept modern zoological collections use to justify their existence. The presence of exotic species might be of interest to researchers looking for subjects to investigate, but it is also possible that the conditions in which those species are kept do not facilitate researchers work.

Abnormal behaviour or visitors presence might make zoos less attractive to researchers than the general public might think. Is there a great deal of scientific research happening in UK zoological collections? Does this research produce scientific papers that contribute to the scientific knowledge?

This study will try to answer this questions by analysing the scientific papers published about research performed in zoological collections.

METHODS

The method to quantify the contribution of zoological collections to scientific research was based on analysing the final stage of any research investigation: the publication of papers in scientific books or journals.

There are reference publications aimed to aid bibliographic research which compile records of references of all published material on a whole range of topics. Due to the diverse nature of types of research that can be conducted in a zoological collection, one of the few common topics is the 'non-domestic animal'. In order to investigate the research that has been undertaken, the best publication to use is the *Zoological Records*, which exists in both hard copy and as an electronic database. This is a well-known and widely used reference work published by BIOSIS (Biological Abstracts, Inc.) since 1865. The database provides powerful searching features for quick retrieval of references from over 6,500 international journals, review annuals, monographs, meeting proceedings, books, and reports, from over 100 countries. The database has an international coverage and has no geographical or linguistic restrictions.

The criteria to include entries of publications in the *Zoological Record* stated by BIOSIS in its website follows:

“Zoological Record Coverage and Subject Criteria

Zoological Record products cover publications on all aspects of zoology.

BIOSIS aims to comprehensively cover traditional areas of zoology, such as ecology, physiology, taxonomy, evolution, life history, morphology, and nomenclature. More experimental applied topics, such as applied biology, biochemistry, immunology, toxicology and veterinary medicine are covered selectively. An item is relevant for coverage if it contains material on the biology of an animal, but particular emphasis is given to natural biology and systematics. BIOSIS attempts to be exhaustive in its coverage of systematic zoological literature.

Papers dealing with commercial activities such as fishing or fisheries, farming or agriculture etc., are included in *Zoological Record* only if some aspect of the biology of the animal is discussed, or if historical or conservation aspects of such activities are covered.

Source documents dealing with experimental or domestic animals usually are not indexed in *Zoological Record* unless the systematics, evolution, distribution, or biology of the animal in the wild is discussed in some detail. Purely experimental papers are not included. However, source documents which deal with unusual animals used in laboratory experiments are indexed.

Zoological Record coverage normally excludes *Homo sapiens*, but papers which discuss humans and animals will be covered for the animals provided that they are within general scope. Papers discussing extinct relatives of man (eg., *Homo erectus*, *Homo neanderthalensis*) will be included.

Parasitology studies are included in *Zoological Record* provided that some zoological aspect (eg., taxonomy or physiology) of either the parasite or the host is discussed. Both the parasite and host receive index entries in the appropriate sections.

Papers discussing techniques or methods used in areas which are not covered, but having definite implications for use by zoologists are indexed in *Zoological Record*. For example, a paper discussing a new method of determining basal metabolic rate could be considered important to an animal physiologist. Therefore, the paper

would generally be included, as long as the technique is performed on an animal. If the technique discussed in the paper is performed on a human, it would not be included.”

The analysis of the information contained in *Zoological Records* followed the following stages:

- The CD-ROM version of *Zoological Records* was used, which covers publications from 1976 to the year 2000.
- Using the search engine of the CD-ROM programme, a search was carried out to count the items that contain the words ‘Zoological-Record’ in the volume field. Each item is published in a volume which entry starts with the words ‘Zoological Record’. The search produced a list of all entries and the total number of papers was itemised. The number of the last entry of such a list is the total of items.
- The total number of items of particular periods of time by following the procedure mentioned on the previous point was calculated, but this time for each *Zoological Record* database, which cover different time periods. There are three available databases: 1977-1991, 1992-1998, 1999-2000.
- The CD-ROM search engine was used to count the number of items of research made at the UK zoological collections selected (those of S5 list). In searching for the zoological collections, both current name and any former names were used. The search was repeated for each *Zoological Record* database.
- The CD-ROM search engine was used to count number of items of research made in all the UK Large Zoos and Wildlife/Safari parks know (from B5) by using the current and former name of each collection in the general word search. Again the search was repeated for each *Zoological Record* database.
- The CD-ROM search engine was used to count numbers of items that contain research on captive animals by using the word ‘captiv*’ (this will count entries containing words like ‘captive’, ‘captivity’, etc.) in the general word search, covering all fields of each entry. Due to the fact that despite some papers are not written in English all the key words are, the search covered papers written in all possible languages. The search was repeated for each *Zoological Record* database.
- Following the procedure above, the items of research produced in zoological collections were counted, using the following key words: *Zoo*, *Zoological collection*, *Zoological garden*, *Zoological-garden*, *Zoological park*, *Safari park*, *Aquarium*, *Aquaria*. The total of entries for zoological collections was calculated adding all the items produced in the search of each word.

RESULTS

General

The number of entries in the *Zoological Record* databases from 1977 to 2000 is 1,537,659, which represents an average of 64,070 papers a year. This period is the only period available in the electronic version of *Zoological Record*.

Research in UK zoological collections

Table 5. Number of entries mentioning particular zoological collections in the Zoological Records CD-ROM database. SELECTED= code for selected zoological collections, see chapter about random sampling. Columns from second to fourth indicate databases only covering the years stated in the top, while TOTAL columns indicates all the three databases.

<u>SELECTED</u>	<u>1977-1991</u>	<u>1992-1998</u>	<u>1999-2000</u>	<u>TOTAL</u>
ABE002	0	0	0	0
ALS006	0	0	0	0
AMA431	0	0	0	0
AMA495	0	0	0	0
ANG010	0	0	0	0
ANG011	0	0	0	0
ANI013	0	0	0	0
AQU016	0	0	0	0
BAT030	0	0	0	0
BEN034	0	0	0	0
BEV507	0	0	0	0

BIR042	3	8	0	11
BOD051	0	0	0	0
BOR054	0	0	0	0
BRI067	0	0	0	0
BUC071	0	0	0	0
BUT074	0	0	0	0
CHE095	4	3	3	10
CHI098	1	2	0	3
COL104	0	1	4	5
CON106	0	0	0	0
CON464	0	0	0	0
COR107	0	0	0	0
COT110	18	0	0	18
CRA112	0	0	0	0
DAR118	0	0	0	0
DRU126	0	5	0	5
DUD127	1	0	0	1
DUT129	0	0	0	0
EAM131	0	0	0	0
EDI504	0	0	0	0
ELS136	0	0	0	0
ESC137	0	0	0	0
FLA147	1	0	0	1
FOL149	0	0	0	0
FOW151	0	0	0	0
GLA156	15	14	0	29
GRE159	0	0	0	0
HAM164	0	0	0	0
HAR166	0	0	0	0
HAW167	1	0	0	1
HAZ501	0	0	0	0
HER169	0	0	0	0
HES171	0	0	0	0
HIL474	0	0	0	0
HOR175	3	4	0	7
HOR176	0	0	0	0
ISL180	0	0	0	0
ISL181	0	0	0	0
KNO194	0	0	0	0
LET509	0	0	0	0
LLO202	0	0	0	0
LON203	0	0	0	0
LON206	0	0	0	0
LON207	4	1	0	5
LOW210	0	0	0	0
MAC212	0	0	0	0
MAR222	0	0	0	0
MIN230	0	0	0	0
MOF231	0	0	0	0
MON234	0	0	1	1
NAT239	0	0	0	0
NAT241	0	0	0	0
NAT243	1	0	0	1
NEW246	0	0	0	0
NEW248	0	0	0	0
ODD459	0	0	0	0

OTT258	0	0	0	0
OWL259	0	3	0	3
PAL263	1	1	0	2
PEN273	0	0	0	0
PIL463	0	0	0	0
PLY281	0	0	0	0
POR284	5	7	1	13
PRI286	0	0	0	0
RHY291	0	0	0	0
RIB292	0	0	0	0
SAN298	0	0	0	0
SCR301	0	1	0	1
SEA309	0	0	0	0
SEA314	0	0	0	0
SEA315	0	0	0	0
SHA316	1	0	0	1
SHE319	0	0	0	0
SHI320	0	0	0	0
SOU329	0	0	0	0
STE337	0	0	0	0
SUF341	0	0	1	1
THE358	0	0	0	0
THE500	0	0	0	0
TRO364	0	0	0	0
TRO365	0	0	0	0
TRO366	0	0	0	0
TRO587	0	0	0	0
WAL382	0	0	0	0
WEL388	0	0	0	0
WET392	0	0	0	0
WHI394	26	3	1	30
WHI528	0	0	0	0
WIC395	0	0	0	0
WIL402	5	11	0	16
WIL406	0	0	0	0
WOO410	0	0	0	0
WOR414	0	0	0	0
TOTAL	90	64	11	165

From 1977 to 2000, the percentage of today's UK zoological collections with at least one publication mentioned in the Zoological Record is about 21% (n=104).

From 1977 to 1991, the percentage of today's UK zoological collections with at least one publication mentioned in the Zoological Record is about 15% (n=104).

From 1992 to 1998, the percentage of today's UK zoological collections with at least one publication mentioned in the Zoological Record is about 14% (n=104).

From 1999 to 2000, the percentage of today's UK zoological collections with at least one publication mentioned in the Zoological Record is about 6% (n=104).

Percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1977-2000

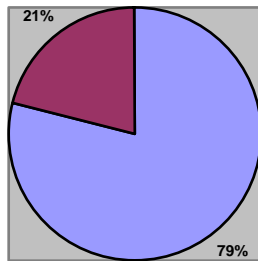


Figure 61. In red, percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1977-2000

Percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1977-1991

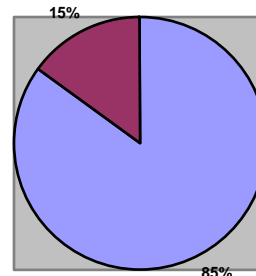


Figure 62. In red, percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1977-1991

Percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1992-1998

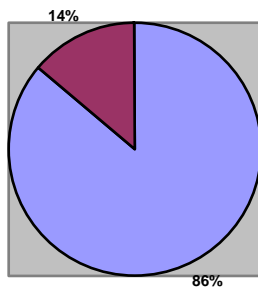


Figure 63. In red, percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1992-1998

Percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1999-2000

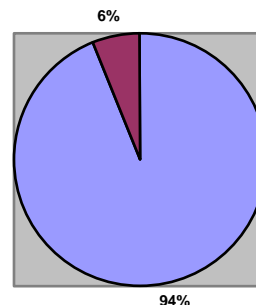


Figure 64. In red, percentage of today's UK zoological collections with at least one publication mentioned in the *Zoological Record* database 1999-2000

The number of papers published from 1977 to 2000 about the UK Zoological collections visited is 165, which represents 7.2 papers a year ($n=24$ years), or 0.07 papers per year and collection.

World's research in captive animals and zoological collections

Less than 3% of all papers on zoological matters published between 1977 and 2000 all over the world are about captive animals ($n=1,537,659$), which represent an average of 1654 publication a year ($n=24$ years).

About 2% of all papers on zoological matters published between 1977 and 2000 all over the world are about captive animals in zoological collections ($n= 1,537,659$).

Less than 3% of all papers on zoological matters published between 1999 and 2000 all over the world are about captive animals ($n= 94651$).

About 3% of all papers on zoological matters published between 1999 and 2000 all over the world are about captive animals in zoological collections ($n= 94651$).

Percentage of papers published on captive animals included in the *Zoological Record* database 1977-2000

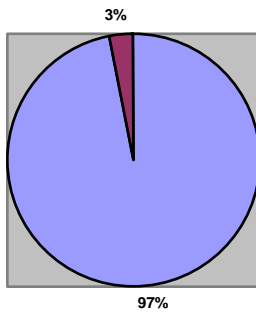


Figure 65. In red, percentage of papers published on captive animals included in the *Zoological Record* database 1977-2000

Percentage of papers published on captive animals included in the *Zoological Record* database 1999-2000

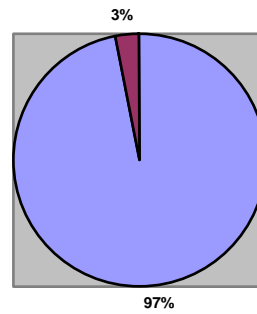


Figure 66. In red, percentage of papers published on captive animals included in the *Zoological Record* database 1999-2000

Percentage of papers published on captive animals in zoological collections included in the *Zoological Record* database 1977-2000

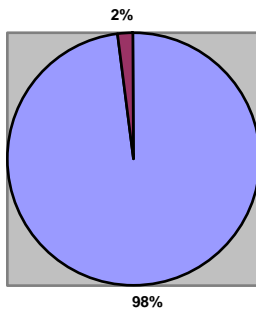


Figure 67. In red, percentage of papers published on captive animals in zoological collections included in the *Zoological Record* database 1977-2000

Percentage of papers published on captive animals in zoological collections included in the *Zoological Record* database 1999-2000

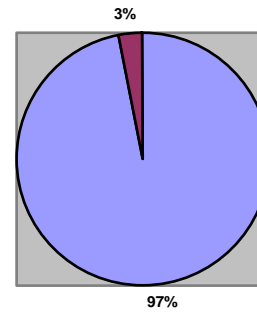


Figure 68. In red, percentage of papers published on captive animals in zoological collections included in the *Zoological Record* database 1999-2000

Research in UK large zoos and wildlife/safari parks

All the scientific papers published from 1977 to 2000 about research made on all today's Large Zoos and Safari Parks in the UK only represent 0.05% of the zoological papers published during the same period (n=1,537,659).

All the scientific papers published from 1999 to 2000 about research made on all today's Large Zoos and Safari Parks in the UK only represent 0.04% of the zoological papers published during the same period (n=1,537,659).

Percentage of scientific papers mentioned in the *Zoological Record* database 1977-2000 about research done in today's UK large zoos and wildlife/safari parks.

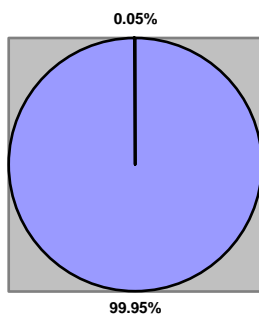


Figure 69. In red, percentage of scientific papers mentioned in the *Zoological Record* database 1977-2000 about research done in today's UK large zoos and wildlife/safari parks.

Percentage of scientific papers mentioned in the *Zoological Record* database 1999-2000 about research done in today's UK large zoos and wildlife/safari parks.

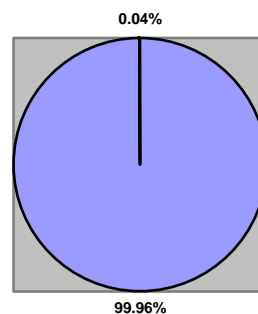


Figure 70. In red, percentage of scientific papers mentioned in the *Zoological Record* database 1999-2000 about research done in today's UK large zoos and wildlife/safari parks.

Researchers working in UK zoological collections

During our 245 hours of visiting time to UK zoological collections, only on 3 occasions was witnessed a researcher taking notes on the animals. These were working in Chessington World of adventures, Port Lympne Wild Animal Park and the Cotswold Wildlife Park. Together they only represent less than 3% of the UK zoological collections (n=104).

DISCUSSION

Validity of the method

On a whole, scientific research has no real value to society if it is not made public and available for scientific scrutiny. Any research carried out in a zoo by non-qualified researchers in a non-scientific manner, or research carried out only for internal use, it is unlikely to ever be published. Therefore, this type of research cannot make a real contribution to science. Only those investigations that result in being published in a scientific journal or book, once being accepted by the publisher and a peer as being original and valid work, could be considered a contribution to science. Hence, the best way to evaluate the contribution to science of particular types of institution is by quantifying the number of scientific publications accepted.

The use of a reference publication to quantify number of scientific papers was a good way to prevent bias, since the selection of papers was undertaken by somebody else who was unaware of this research and the criteria of selection is well established. The fact that the quantification is made by analysing the presence of particular key words in the records, rather than by reading the papers and therefore judging the relevance of each, also prevent further bias.

The fact that the *Zoological Record* databases cover over 18,000 entries with the selected words to describe zoological collections indicates that work in zoological collections are accepted in the selective criteria of the publication. The same can be said about work with captive animals, due to the over 39,000 entries with the *string word* 'captive'.

With regards to the selective criteria used in the inclusion of papers in the *Zoological Record* database, the selection is independent of institution, site or place where the research was carried out. Any possible selection made by the publishers is unlikely to change the percentages obtained in the results section. *Zoological Record*'s editors might have not included some veterinary research for example ,however, it is unlikely that this will affect research undertaken at zoos which deal predominately with 'exotic', and would therefore be included in the databases since this would be of interest of zoologists.

It is unlikely that research covering exotic animals were missed in the search using the *string word* 'captive' as the listings contain fields about title, author, publication and descriptor , as well as an abstract of the paper. It is therefore, unlikely that any research made in connection to a captive population would not have the *string* anywhere in the record at least once. Furthermore, the 'Descriptor' field tends to be quite comprehensive, often with over 10 key words, and always in English, regardless of the language of the paper.

As far as the effectiveness of the method to identify research done in a particular zoological collection. It is unlikely that research on captive animals does not mention the site where the work was carried out, since it would either be included in the 'descriptor' (a part of the species and the main research topic, the site of the research is one of the most common entries in a 'descriptor' field), the 'abstract' or 'author's contact address'.

The method used takes into account repetitions of the words used in the search since the values analysed are not the number of words, but the number of records, and a record with several repetitions of the words would result in one single entry. Only when different searches are made with different words that could be synonymous (like 'zoo' and 'zoological garden'), a record could be counted twice, but since the main hypothesis is to test the small contribution of zoological collections to research, this possible error still continues to reinforce the hypothesis.

An important point to stress is that research might be a new activity recently undertaken for first time by many zoological collections, and therefore using a database that reaches periods well beyond any research was common in zoos would affect the results giving smaller percentages. In this case, no information prior 1976 was used, and therefore the database covers a modern period were research is been regarded as part of a normal zoological collections work.

Estimation of the contribution to Science of research in zoological collections

With an estimated 10,000 zoos in the world (WZCS, 1993), a figure that only covers centres keeping large numbers of exotics and classified by the public as zoos, the amount of scientific papers published by zoos per year is only about 1600. This represents 0.2 papers per zoo, per year. It is therefore apparent that a centre with several hundreds of exotic

animals will only produce on average, one scientific paper every five years. Compared to the number of research papers produced every year of a zoological nature, which averages 64,000 papers, the zoo community seems to make a very small contribution to science.

Even by comparing the research carried out on captive animal not kept in a zoological collection, the amount of scientific publications still remains a small percentage of all listed zoological research papers. If the search was only carried out on all captive (non-experimental) research, only captive research in zoological collections or over a different time period (i.e. from one extreme of 24 years to 1999-2000), the number of research papers on captive animals still remains lower than 4% (Figure 65 to 68).

If all today's UK large zoos and wildlife/safari parks are investigated, not just the ones selected in S5, figures 69 and 70 show that these still make a small contribution to scientific publication, regardless of the period, and despite the fact that in theory they may have the expertise and resources to produce scientific research.

It is clear from the results (table 5 and figures 61 to 64) that the relative contribution to published scientific work from the UK zoological collections is very small. The majority of the collections (79%) have not produced any publishable research since 1977 and between 1999-2000 only 6% of the UK zoological collections published any research. The contribution by the UK zoological collections studied was 0.07 published papers per collection a year, which gives an overall annual contribution of less than 30 papers a year. This means that as an average of UK zoological collections produce one scientific paper every 15 years. These results are under the assumption that the publications are valid and the information produced is useful. If by the contrary, as often happens in science, results published become invalid after further research contradicts results of a published work, the conclusion in this study may well be inaccurate with the real contribution by UK zoological collections to scientific knowledge a great deal smaller.

This very small contribution to research can be supported by the fact that during the zoo scans carried out in the year 2000 of the S5 collections, only on three occasions was somebody observed taking notes in a research-fashion. In fact, these three cases could well be students on training, and their work may never have been published.

DO UK ZOOLOGICAL COLLECTIONS CARE FOR THEIR ANIMALS?

Animal welfare in UK zoological collections

INTRODUCTION

The keeping of animals in an artificial environment where the animals have not naturally evolved can generate serious animal welfare problems. The question is how to identify and quantify these problems.

Poor animal welfare describes a variety of conditions from obvious signs of physical injury or disease to other conditions that may not be so obvious like stress, for instance. Similarly to humans, animals under severe stress can succumb to disease, fail to reproduce or fail to fully develop (Moberg, 1985).

A number of environmental stimuli common to zoo environments have been empirically identified as potential stressors. One of the most obvious causes of chronic stress in confined wild animals is the inability to respond to fearful situations with active avoidance and/or escape responses (Carlstead and Shepherdson, 2000). Olfactory and auditory cues (which we may not perceive) from predators and prey situations, neighbouring species or competing conspecifics may well be fear inducing (Carlstead and Shepherdson, 2000). Other stress related factors may include sound. Persistent acoustic stimuli with particular intensity, frequency distribution, infrasound and content may be common stressors for captive animals (Stoskopf, 1983).

The daily human contact from both staff and the visitors to the zoological collection may also have an effect on the animal. A number of behavioural changes have been recorded and acknowledged as possibly linked to human interference. These include increased vigilance, closer social spacing, reductions in affiliative behaviour and increases in aggression (Glatson et al. 1984; Hosey and Druck, 1987; Chamove et al., 1988; Thompson, 1989).

Stress can also be a result of preventing access to stimuli within the perceptual field of an animal, such as food items, potential mates, oestrus females or prey species. Stereotypic behaviour is often described as increasing under such circumstances (Meyer-Holzappel, 1968; Boorer, 1972; Mason, 1993).

Survival in the wild can also be stressful to an animal but in captivity, when the duration and intensity of stress might be different than in the wild, stress can often develop into pathology. To distinguish between normal stress and potentially pathological one, other terms have been defined. When the stress response truly threatens the animal's well being, then the animal experiences what is called 'distress' (Moberg, 2000).

One of the key issues to qualify the effects of a particular environment in animal welfare, is how to measure 'distress', 'stress', or any other psychological animal welfare problem. Unfortunately, all endocrine, behavioural, autonomic nervous system, and immunological methods used in the past to measure 'stress' and 'distress', has proven to be relatively unreliable methods for all scenarios. Nevertheless, some of these methods do help to detect the presence of animal welfare problems associated with stress, and they do give a general idea of the dimension of the problem.

According to some authors, the risk to the welfare of an animal by an environment challenge can be assessed at two levels: firstly the magnitude of the behavioural and physiological responses and secondly, the biological cost of the responses (Broom and Johnson, 1993; Hemsworth and Coleman, 1998). In this study only the first level was assessed.

An overview of the scope of behavioural responses of the animals in UK zoological collections was undertaken by quantifying the occurrence of indicators of poor animal welfare in forms of either physical handicaps or response to common stressors.

METHODS

- The randomly selected zoological collections were visited and all the animals visible in all the enclosures were filmed.
- If an animal showed any sign that indicated a possible welfare problem, the animal and its behaviour was filmed long enough to allow full analysis and identification. In order to identify signs of animal welfare these signs, the following *Indicators of poor welfare* were defined:

- *Physical Health:*
Any animal showing a physical injury, wound, deformity, excess or defect in size or weight, sensory disability, senility, infection, or other physical diseases whose symptoms can be perceived through observation (excluding lost of hair or feathers by overgrooming/overpreening).
 - *Psychological Health:*
Any animal showing signs of boredom or depression through excessive passivity, or any sign of stress that is not stereotypic behaviour (i.e. lack of hair/feathers, restless behaviour, etc.).
 - *Stereotypic:*
Any animal performing a repetitive behavioural pattern with no obvious function (see definition in specific chapter below)
 - *Uncomfortable:*
Any animal stressed or unsettled unable to escape from a particular physical constraint (i.e. bird trying to get rid of tether)
 - *Disturbed:*
Any animal interrupted of its sleep, relaxation or privacy from a visitor or keeper. This does not include animal/human interactions that do not show signs of being aversive to the animal.
 - *Dead:*
Any animal that has stopped living.
 - *Escaping attempt:*
Any animal trying to leave its enclosure (or any other form of constraint), independently of the success in the action (i.e. climbing the fence, or trying to fly away when tied)
 - *Tantalised:*
Any animal focused on or interested in something that is unobtainable or withheld (i.e. unsuccessfully trying to eat grass outside the enclosure).
 - *Calling in distress:*
Any animal vocalising intensively with the apparent function of calling another animal or human that is absent (the length of the calling plus the orientation towards the outside of the enclosure can help to identify these cases).
 - *Physical Distress:*
Any animal that shows signs of a certain degree of anxiety or suffering (past or present) caused by physical health problems. This indicator is the sum of *Physical Health* and *Dead*:
 - *Psychological Distress:*
Any animal showing signs of a certain degree of anxiety or suffering (past or present) not directly caused by physical health problems. This indicator is the sum of *Stereotypic*, *Uncomfortable*, *Psychological Health*, and *Disturbed*.
 - *Frustration:*
Any animal that has been prevented from doing or achieving something the animal actively wants to achieve. This indicator is the sum of *Uncomfortable*, *Tantalising*, *Escape attempt*, and *Calling in Distress*.
- The potential cases of animal welfare problems filmed, following the indicators mentioned, were divided in two main categories:
 - **State:** existing condition or a being which persist for a relatively long period of time
 - **Event:** thing that happens in a relatively short period of time
 - Having divided the cases into the different categories, the number of cases per 'type' of zoological collection was counted. From this, the value estimated per 1000 visible individuals of each type of collection was calculated by dividing the number of indicators recorded by the number of visible individuals in the particular 'type' of collection. The result was then multiplied by 1000.

RESULTS

UK zoological collections with obvious signs of poor welfare

More than 70% of the UK zoological collections showed signs of poor welfare (n=104) in at least one of their animals.

In all the types of UK zoological collections, the most common sign of poor welfare was the presence of stereotypic behaviour.

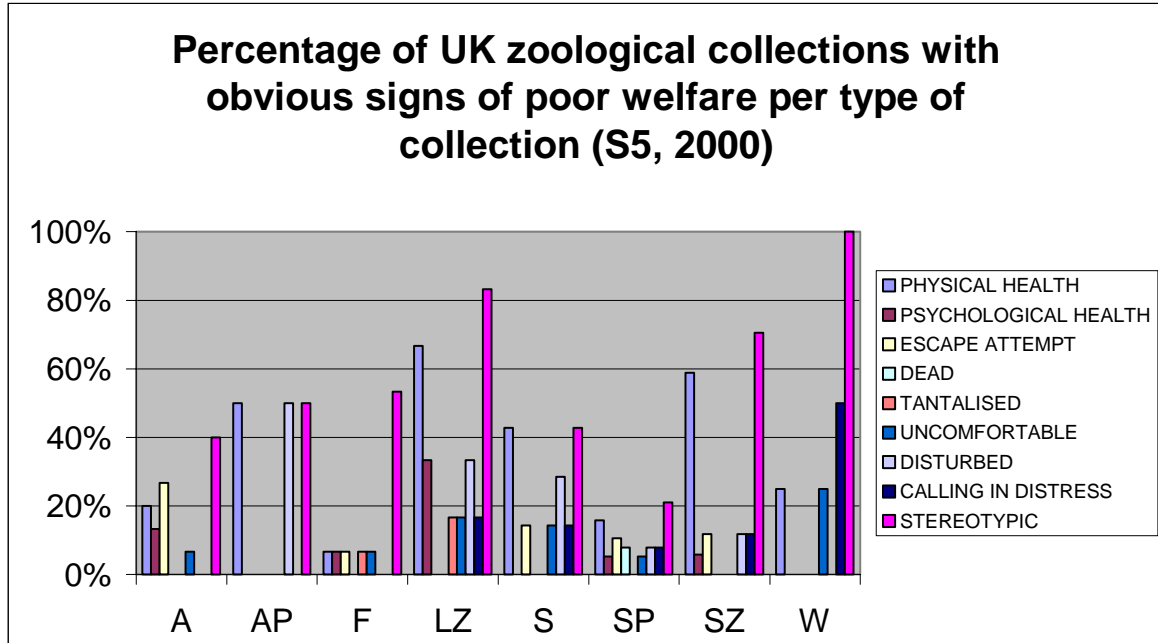


Figure 71. Percentage of UK zoological collections with obvious signs of poor welfare per type of collection (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park. See text for definitions.

In all the 'types' of zoological collections, in the majority of the collections had at least one animal that showed obvious signs of poor welfare.

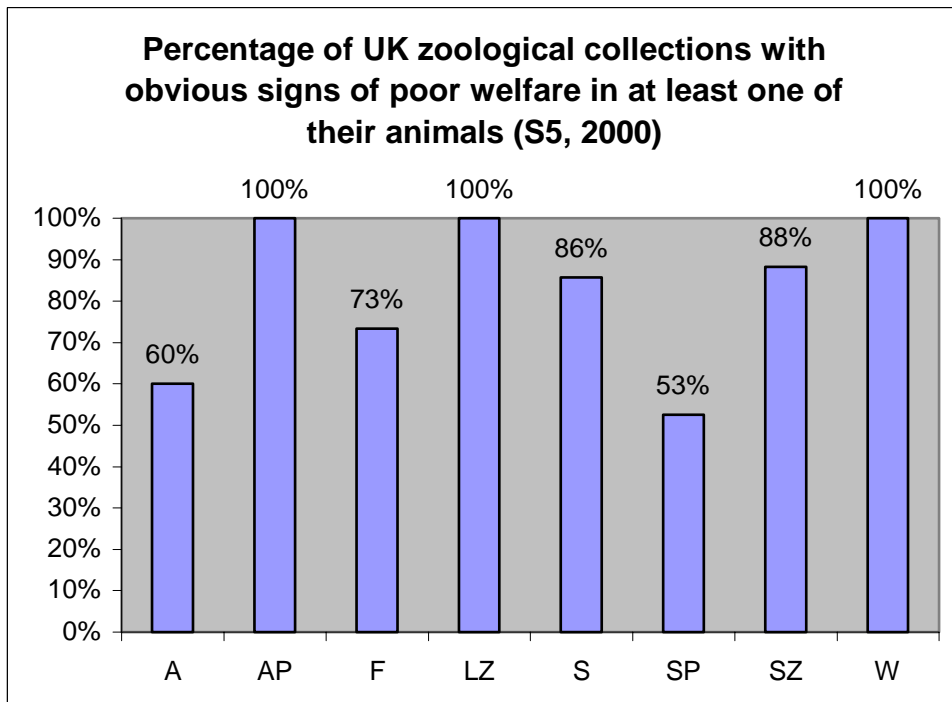


Figure 72. Percentage of UK zoological collections with obvious signs of poor welfare in at least one of their animals (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park..

Occurrence of indicators of poor welfare in UK zoological collections

269 obvious signs of poor welfare were filmed during the zoo scans. From those, 66% correspond to *states* and 24% correspond to *events*.

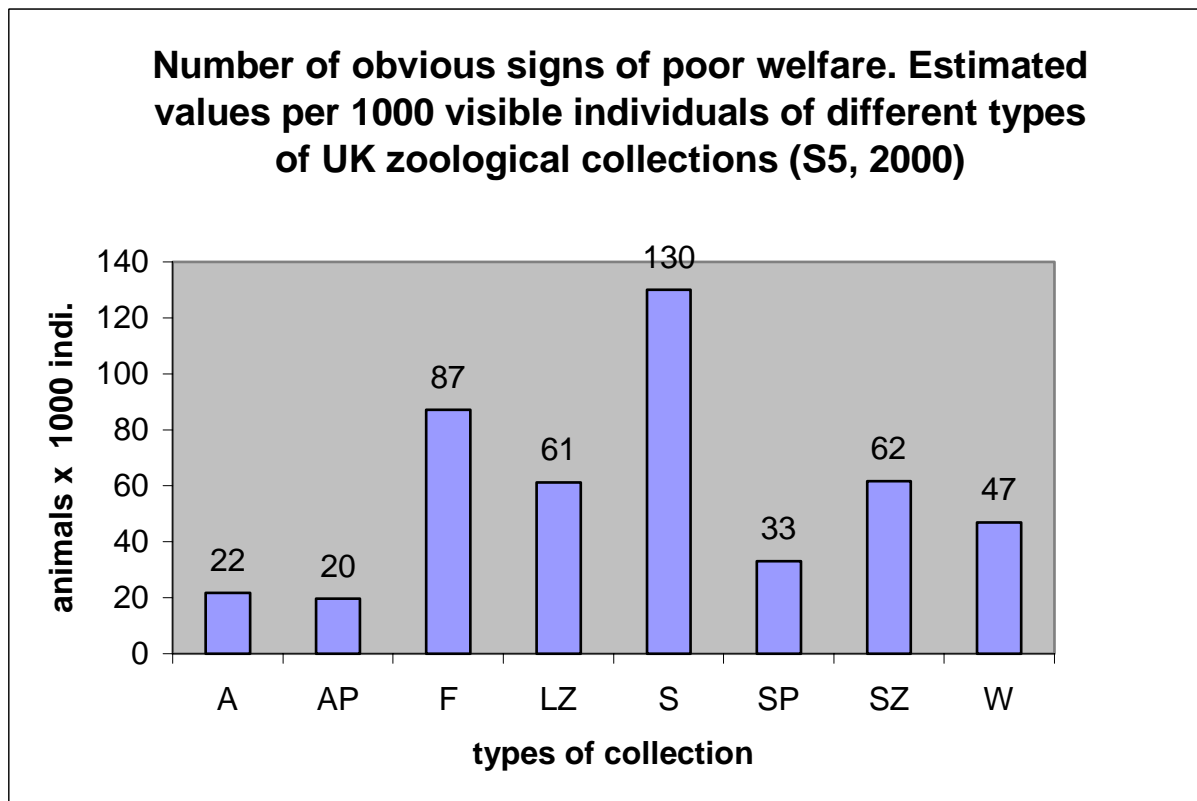


Figure 73. Number of obvious signs of poor welfare. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park.

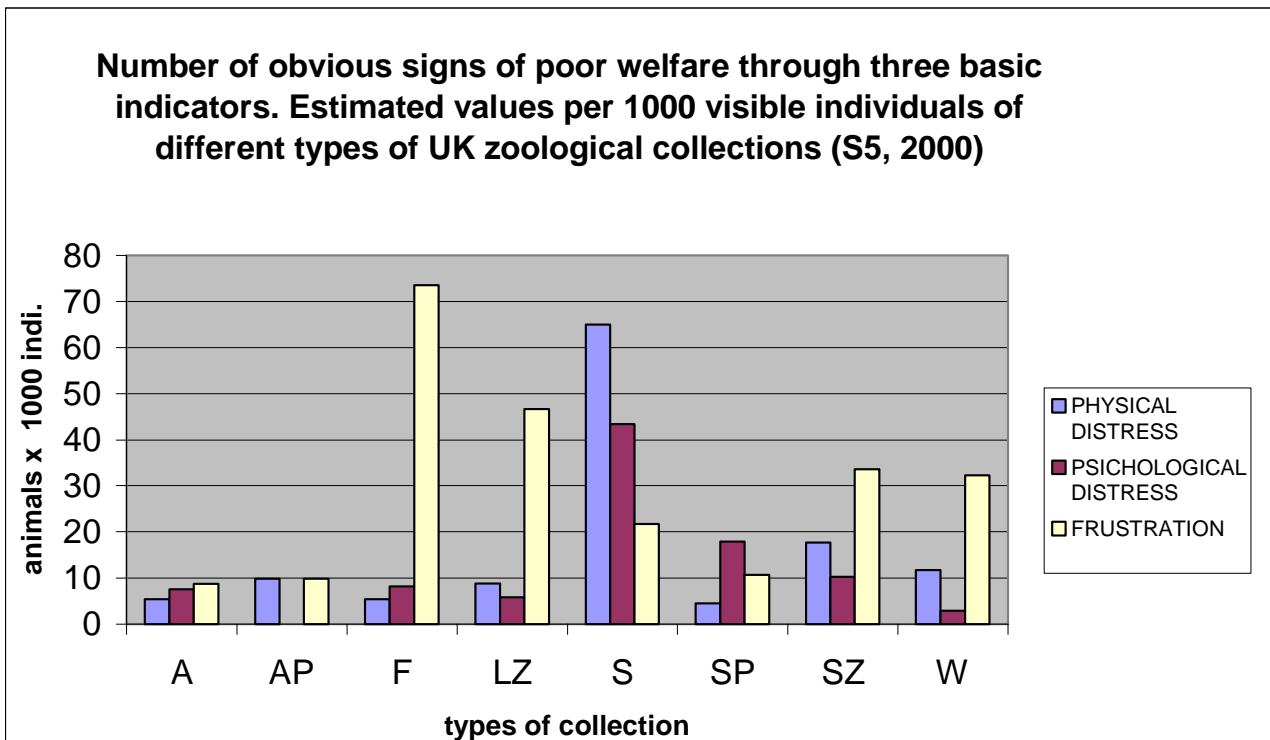


Figure 74. Number of obvious signs of poor welfare through three basic indicators. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park. See text for definitions.

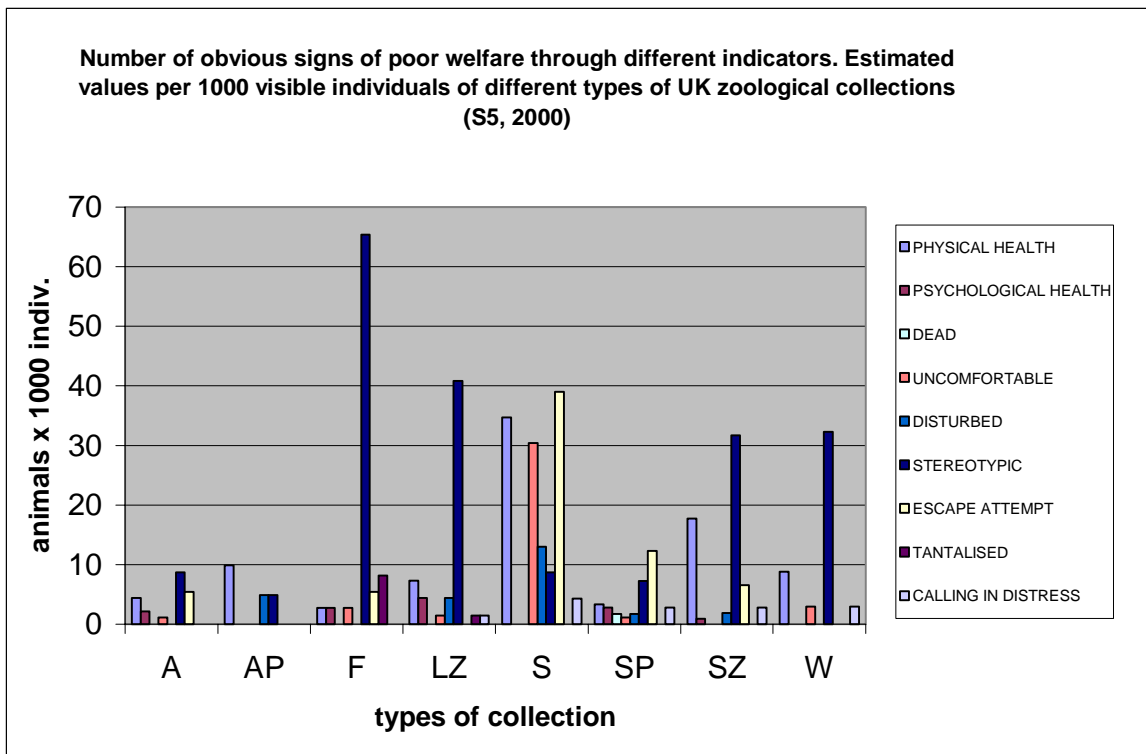


Figure 75. Number of obvious signs of poor welfare through different indicators. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park. See text for definitions.

Animals showing obvious signs of poor welfare in UK zoological collections

178 individual animals were filmed showing signs of being in a state of poor welfare, 43 of which (24%) showed signs of physical health problems.

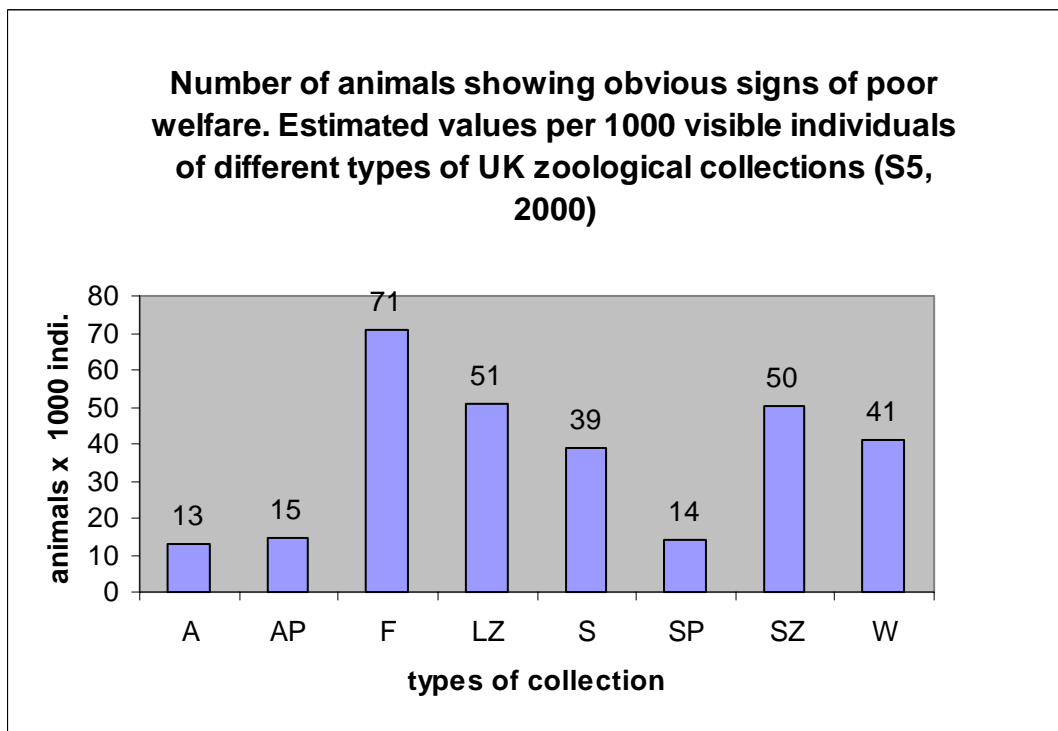


Figure 76. Number of individual animals showing signs of poor welfare. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park.

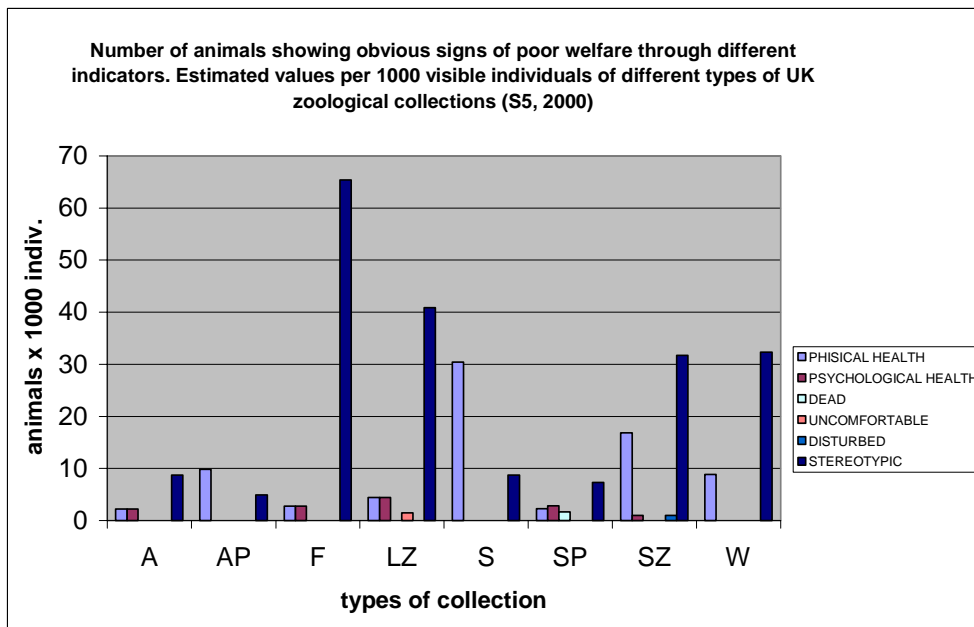


Figure 77. Number of individual animals showing signs of poor welfare through different indicators. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park. See text for definitions.

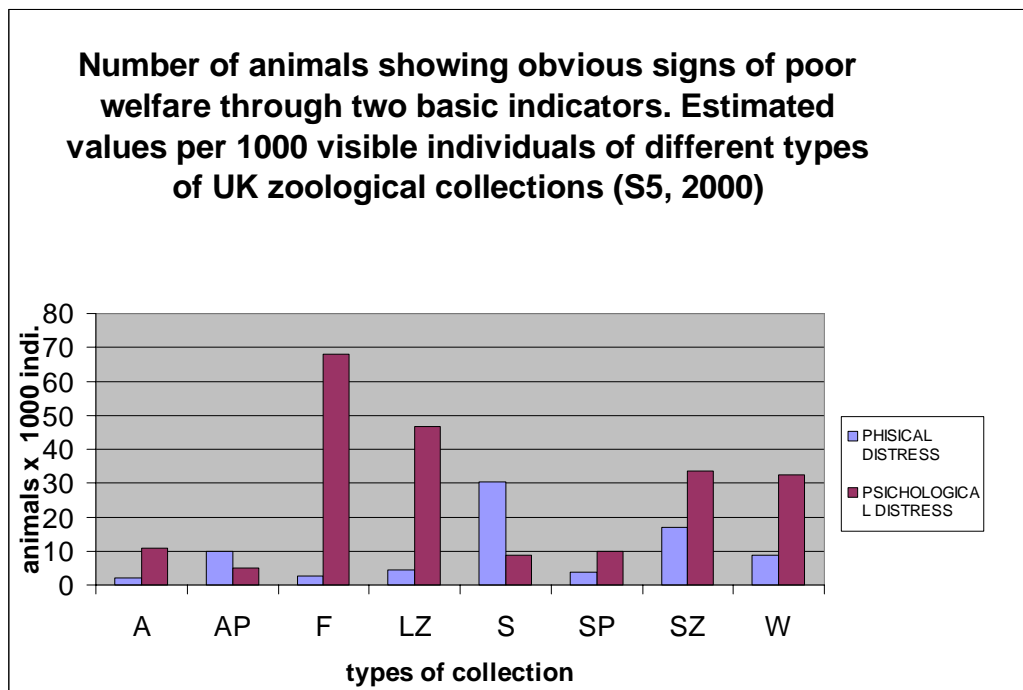


Figure 78. Number of individual animals showing signs of poor welfare through two basic indicators. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park. See text for definitions.

Events that show signs of poor welfare in UK zoological collections

91 events that indicated poor welfare performed by animals that otherwise did not show obvious signs of poor welfare were filmed in this study. 79% of those events were considered indicators of *frustration*.

In 23% of the UK zoological collections at least a case of *frustration* was filmed (n=104).

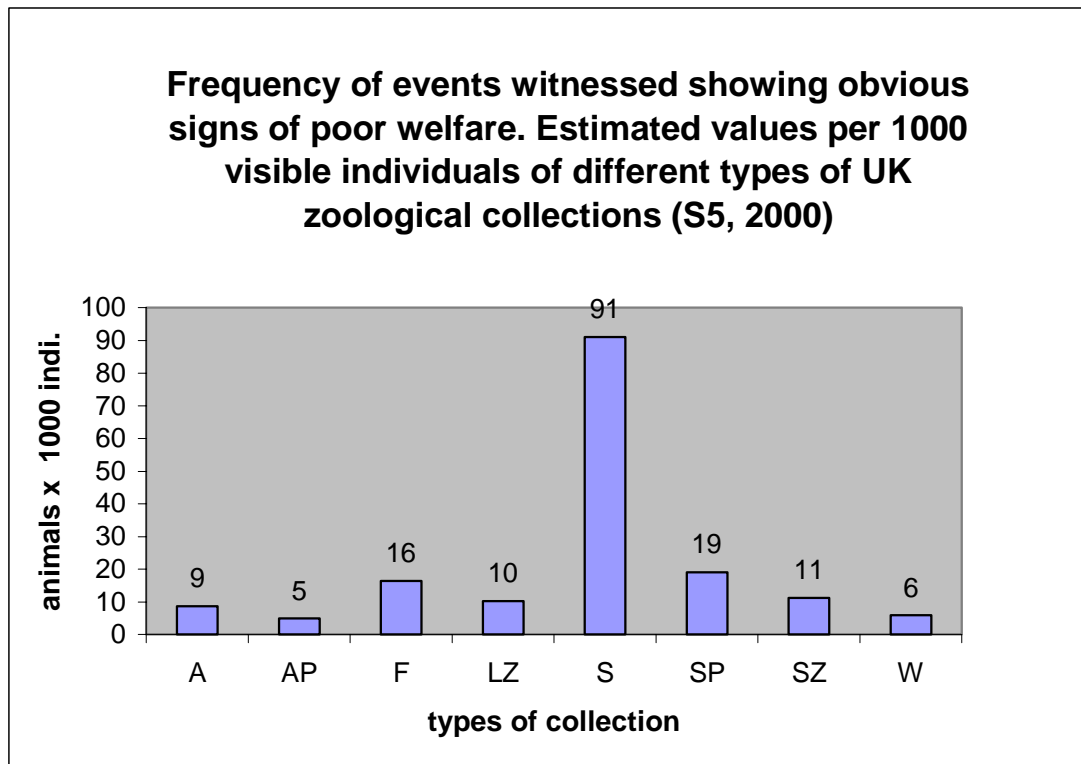


Figure 79. Frequency of events witnessed showing obvious signs of poor welfare. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park.

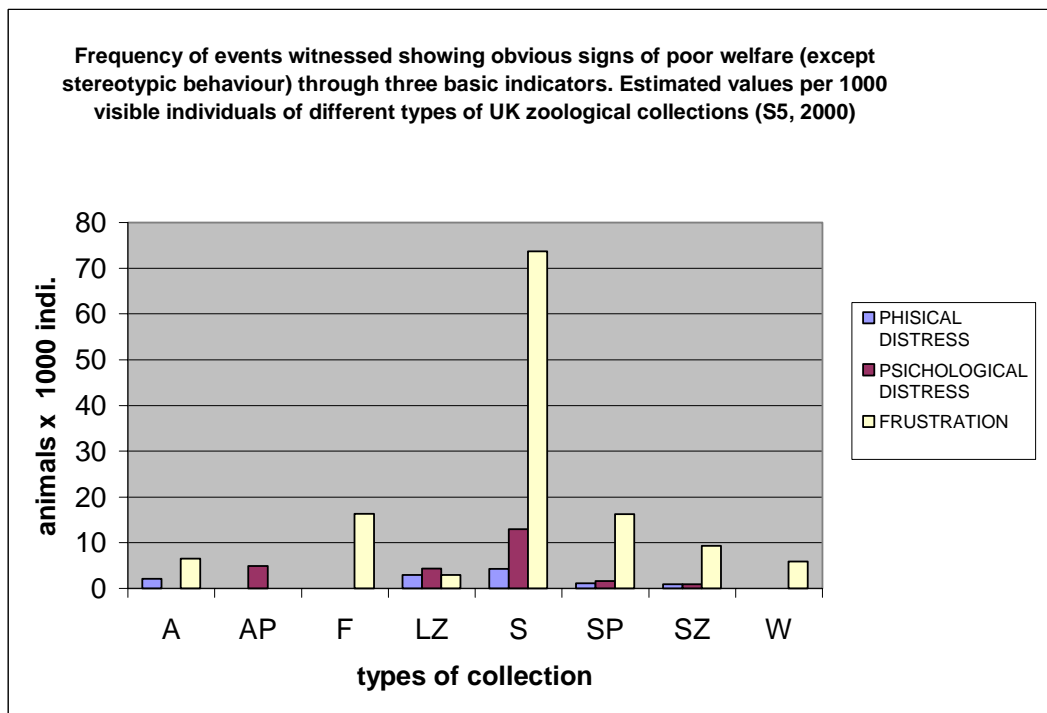


Figure 80. Frequency of events witnessed showing obvious signs of poor welfare (except stereotypic behaviour) through three basic indicators. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park. See text for definitions.

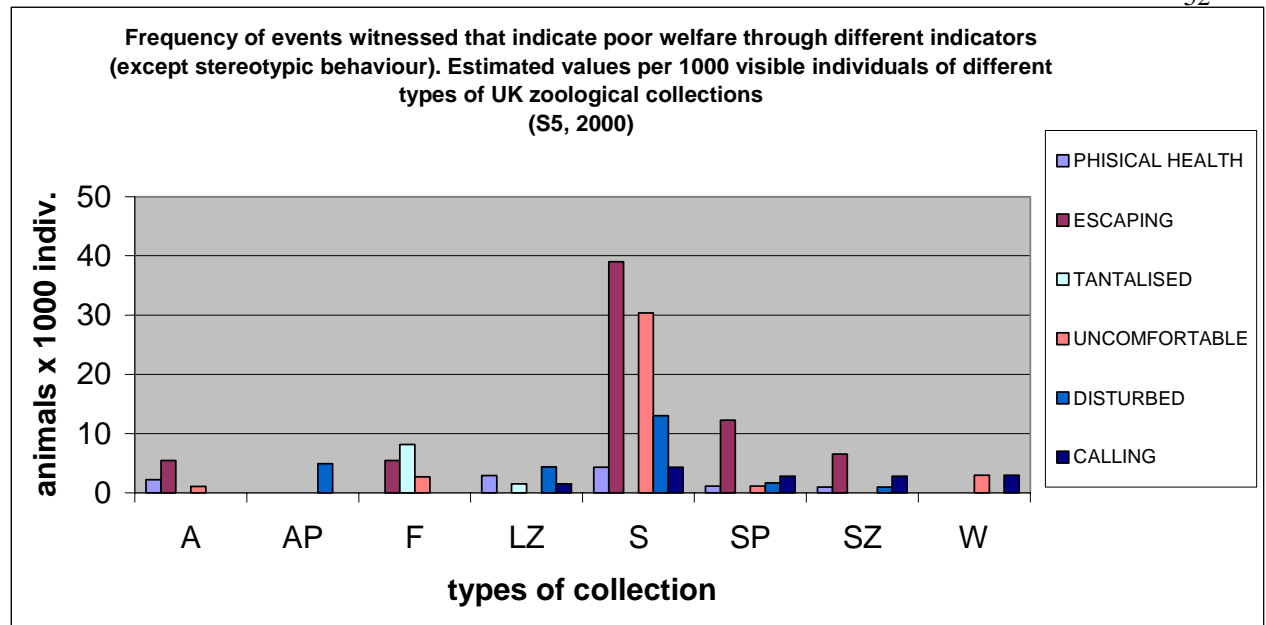


Figure 81. Frequency of events witnessed showing obvious signs of poor welfare (except stereotypic behaviour) through different indicators. Estimated values per 1000 visible individuals of different types of UK zoological collections (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park. See text for definitions.

DISCUSSION

General

Broom and Johnson (2000) define 'Welfare' as "the state of an individual as regards its attempts to cope with its environment", and they define 'cope' as having "control of mental and bodily stability"

Despite the fact that some of the indicators of poor welfare used in this study had room for subjectivity, all refer to states or events indicating that the individual's environment is forcing the animal to make an effort to cope with a lack of stability in one of its normal functions.

Nevertheless, a distinction should be made over which indicators refer to *states* and which refer to *events*. Welfare is defined as "the state of an individual" however; it does not specify how long this state must last to be regarded as relative to welfare. The constant interaction of organisms with their environment has different effects usually fluctuating between stability and instability. However, if the period of instability outlasts the period of stability then the concept of welfare is used as a synonymous of a 'handicap'. Therefore duration of instability is the key element to detect welfare problems.

In this study the indicators of welfare were separated in two categories, *states* and *events*. The reasons for this are firstly, to separate the cases where it is obvious that the animal has been affected with instability outlasting the stability (*states*), from the cases where is less obvious (*events*). Secondly, to detect events in a zoological collection, which may not have an effect on the state of an animal when observed individually but when occurring repetitively, may have an affect on an the animal's welfare.

Occurrence of signs of poor welfare in UK zoological collections

The occurrence of potential signs of poor animal welfare in UK zoological collections, shown in figures 71, 72 and 73, is not negligible. They appear in all collections 'types'.

As seen in figures 76 to 78, when only *states* are observed, and therefore when the indicators of poor welfare are stronger, the occurrence of poor welfare signs remain not negligible, as well as represented in all types of collections.

It is interesting to point out that most 'types' of zoological collections show more signs of psychological welfare problems than physical ones (figure 78). However, this difference may be because animals with physical problems are kept away from public view and therefore, not visible during the zoo scans.

The most common and numerous indicator of poor welfare during the visiting of the selected zoological collections was stereotypic behaviour, a type of abnormal behaviour (figure 76). Stereotypic behaviour has been considered as a relatively good indicator of poor welfare by many researchers, although how well the degree of stereotypia correlates to the degree of welfare is still in discussion (Mason, 1991). Due to the importance and relative high occurrence of this kind of behaviour, it will be treated separately in the next chapter.

Sanctuaries and Farms were the two 'types' of zoological collections with most 'signs' of poor welfare, although the difference in sample size might have affected the comparisons (especially between Amusement Parks and Sanctuaries where the sample is relatively small). Figures 71 to 74 show us that there is a heterogeneity respect the type of indicator that is more present in the different types of zoological collections. The reason that Farms have a higher occurrence of signs is probably because they have the highest occurrence of stereotypic animals (see figure 75 and the chapter on Abnormal Behaviour). A high occurrence of *Physical Health*, *Escape attempts*, and *Uncomfortable* indicators in the Sanctuaries has caused this zoo 'type' to also have the highest occurrence of signs of poor welfare. Sanctuaries are also one of the two types of collection with the most signs of *Physical Health* indicators than *Psychological Health* indicators (Figure 78). These results however, may be due to the lower sample size and the fact that most Sanctuaries primarily work is theoretically based on animals with compromised welfare.

Events that might have a negative impact in the welfare of individuals

From the results (Figures 79 to 81) it is clear that *events* do occur in all types of UK zoological collections that affect the individual animals in an aversive way. These events, when put into context might well be the cause of long term poor welfare, especially when the individuals are exposed to them for life. Since these events occur in a short period of time, it is very likely that their frequency is much more higher than witnessed during the zoo scans when each visible animal was observed only for an average of 2.5 minutes.

Any human/animal interaction that might have an adverse effect on the animal either short or long term but no evidence was recorded to substantiate this possibility. One such interaction is zoonoses (or other types of disturbance), which are dealt with in other chapters in this report, but their existence contribute even more to the hypothesis that events that have a negative impact in the welfare of the animals do occur significantly in UK zoological collections.

Sanctuaries again showed higher frequencies of *events* linked to poor welfare, i.e. *escape attempts* (Figure 81). It is likely that this particular result is a consequence of the sampling, since in one particular Sanctuary the highest frequency of *escape attempts* were witnessed.

The existence of abnormal behaviours in individuals can be explained by the accumulative effect of long periods of inappropriate accommodation, for example individuals which have been rescued from laboratories or other situations. This study shows that both abnormal behaviour and frustration does occur in UK zoological collections with such a frequency and intensity that the chances of witnessing a case of either of these in a randomly selected visit to a randomly selected collection, is high. As seen in figure 80 and 82, the chances of seeing *abnormal behaviour* in a collection are 1:1, and the chances of witnessing an obvious event that indicates *frustration* are at least 1:3.

All the results only focus on obvious signs that can be clearly detected with a few minutes of observation. It is very likely that the states of poor welfare, or aversive *events* that produce *frustration* may not be so obvious. Examples of this may include an animal frustrated, wanting to mate with a conspecific that may be kept in another enclosure. However, this frustration may not be easily detected and in this example, the zoo checker may not observe the missing mate. As seen in the introduction to this chapter, there are numerous examples of stressors in zoos that have been empirically tested.

The data shown in this study only refers to minimum values, and therefore it is fair to state that poor welfare is not uncommon in today's UK zoological collections.

Abnormal behaviour in UK zoological collections

INTRODUCTION

Repetitive and stereotyped behaviours are one of the most important indicators of long-term welfare problems. Odberg (1978) defines stereotypy as “morphologically similar patterns or sequences of behaviour, performed repetitively, and having no obvious function”. The best known examples are the route-tracing steps of human prisoners and of animals kept in cages, for example. Scientific studies of human prisoners are few, but Charriere (1969) in his novel about convicts in the prisons of the French West Indies gives vivid accounts of repeated movements of prisoners kept in solitary confinement over long periods. The rocking and weaving movements of children with autism or other psychiatric disorders are also well known (Levy, 1944. Hutt and Hutt, 1970). Levy described various stereotypes in other species. Crib biting and wind-sucking by horses are described by Brion (1964), bar biting by sows is reported by Fraser (1975), and there are reviews of stereotypies by Odberg (1978), Broom (1981, 1983), Dantzer (1986), Fraser and Broom (1990) and Mason (1991a).

The question of how to decide whether an apparent stereotypy has a function is usually quite easily answered; whilst a single movement may be part of a normal functional system, frequent repetitions of movements are necessary only for certain limited purposes (Broom & Johnson, 2000). These purposes include locomotion to a particular place, and repeated feeding, respiratory, cleaning or display movements. A brief period of observation is usually sufficient to distinguish stereotypies from such movements (Broom & Johnson, 2000).

Most stereotypies, even those which involve little movement, such as sham chewing in pigs, or those which are prolonged such as the elaborate movement routines of some caged mink for example, are easy to recognise if behaviour is observed carefully (Broom & Johnson, 2000). Often those who keep animals ignore such behaviours, and may even believe that these behaviours are normal to the animal. For example, zoo keepers may see route tracing by cats or bears, laboratory staff see movements of rodents around drinking devices, and farmers may see bar biting by stall housed sows, nobody realising that these behaviours indicate poor animals welfare. However, it is true that in some cases distinguishing between stereotypies and other forms of behaviour can be problematic (Mason, 1991), and for this reason it is always important to observe the animal and define with precision, which is the criteria that has been used.

As discussed by Dantzer (1986) and Mason (1991a), in most cases we do not know whether a stereotypy is helping the individual to cope with the conditions, has helped in the past but is no longer doing so, or has never helped and has always been a behavioural pathology. But in all cases the stereotypy indicates that the individual has some difficulty in coping with its conditions or situation and is an indicator of poor welfare (Broom & Johnson, 2000).

“Whatever their causation, stereotypies are shown in situations that are difficult, sometimes extremely difficult, for the animal, and so they indicate that the welfare of the animal is poor. A great deal of stereotypy indicates poorer welfare than an occasional stereotypic action”. (Broom, 1991)

Despite the fact that an individual or population’s degree of stereotypy does not necessary correspond to the degree to which its welfare is impaired (Mason, 1991a), measuring the occurrence rather than the degree of stereotypia is a good indication of the existence of welfare problems, even if the degree of these problems cannot be measured.

It is important to note that a observed abnormal behaviour, including stereotypic behaviour, can be as a result of historical circumstances; as such it constitutes a behavioural scar, which may cause permanent damage, despite the fact that the animal’s subsequent captive conditions, including its present conditions, may be a substantial improvement.

METHODS

To study the frequency of stereotypic behaviour in UK zoological collections:

- All the randomly selected zoological collections were visited and all the animals visible in the enclosures were filmed as described above.
- When an animal showed any sort of repetitive behaviour with no apparent function (called stereotypic behaviour), the animal was recorded for a sufficient period to allow identification of a complete cycle of repetition. It was considered repetitive if:
 - A particular movement, normally with a certain recognisable function, was repeated consecutively at least 5 times in an apparent lack of the normal function (i.e. walking endlessly without destination, becomes a repetitive pacing).

- An abnormal movement of the animal's body occurs at least three times in a period of consecutive three minutes (i.e. unusual twisting of the neck)
- An animal with clear bald patches or lack of hair/feathers.
- During the zoo scan, if stereotypic behaviour was observed, it was recorded for as long as possible at different times throughout the visit.
- The tapes with the recorded animal behaviour were analysed as follows:
 - The consecutive periods filmed uninterrupted where the repeated behaviour was performed continuously were called '*bouts*', and the number of *bouts* per case was counted. Different bouts were normally filmed at different times of the visit.
 - Any complex behavioural sequence (behaviour that could be sub-divided in identifiable repetitive components) that was repeated while stereotyping was called a '*cycle*'. The number of cycles of each bout was recorded (i.e. a cycle in pacing would be walking to one point and turning back, re-tracing the route to the initial point). If a repetitive behaviour stopped during a '*cycle*' for a period longer than twice the average duration of this particular animals' *cycles*, the *bout* when the repetition took place was considered finished.
 - Each identifiable simple individual movement repeated within a cycle was called a '*step*'. The number of steps was counted.
- A individual animal was considered '*possible-stereotypic-animal*' if:
 - the animals have bald patches or hair/feather lost suggesting possible overgrooming, or
 - during the Zoo Scan visit at least one case of *stereotypic behaviour* as defined above composed of at least one *bout* with at least three *cycles* with at least five *steps* per cycle was filmed.
- Considering the available information in the tapes, possible-stereotypic-animal cases were classified into different types according to the certainty of being established rather than incidental cases,. The product between the number of *bouts* and the number of *steps* was called *stereotypia index (S.I =bouts*steps)*, and was used as a criteria of classification as follows
 - Possible overgrooming cases, the certainty of stereotypia been established was considered low
 - S.I. less (or equal) than 10,000, the certainty of stereotypia been established was considered medium
 - S.I. between 10,000 and 1,000,000, the certainty of stereotypia been established was considered high
 - S.I. more (or equal) than 1,000,000, the certainty of stereotypia been established was considered very high
- The stereotypic behaviour filmed was classified into the following different 'types':
 - **Pacing:** Continuous walking back and forth, following the same path (or several similar paths), from one point to another. Signs of regular pacing include definite paths worn in the ground. Other versions of this behaviour when performed in or on the water, and through the air, would be referred here as **swimming** and **flying** respectively (*cycle*: displacement from one end of the path, to the other end, and back to the initial end. *Step*: each step, flap of wings or, flap of fins).
 - **Circling:** A form of pacing where the animal continues around a circular path with no points easily singled out of where it ends or begins. (*cycle*: displacement from any point of the path, to the opposite point, and back to the initial point. *Step*: each step, flap of wings, or flap of fins)
 - **Tongue playing:** The continual licking of walls, bars, gates of other objects in the enclosure (*cycle*: between the longest and most conspicuous licks *Step*: each licking action)
 - **Bar biting or wire-gnawing:** The repeated biting, rubbing the mouth, or sucking on the bars of the enclosure (*cycle*: between any pause longer than two average bites *Step*: each bite). This behaviour can be distinct from functional teeth filing because the bar is held in the diastema, behind the incisors.
 - **Neck-Twisting:** Unnatural twisting and rolling of the neck, often flicking the head around or bending the neck back, normally combined with a pacing behaviour, and often appears as the animal is turning (*Cycle*: pacing between two neck-twists. *Step*: each step or neck-twist). When both pacing and neck twisting occurred simultaneously, the behaviour was classed as 'neck-twisting'.
 - **Swaying:** Standing in one place and swaying the head and shoulders, often the whole body from side to side. Often seen in bears and elephants (*Step*: each complete head sway)
 - **Head bobbing & weaving:** Standing in one place and continuously moving the head up and down, or weaving to and from. Often seen in bears and elephants (*cycle*: between any pause longer than two average complete head movement *Step*: each head movement)

- **Rocking:** Sitting, sometimes hugging the legs, rocking forwards and backwards (*cycle:* between any pause longer than two average complete body movements *Step:* each body movement)
- **Spinning:** Revolving the body around the axis along its the main symmetry plain (*Step:* each complete body revolution).
- **Playing object:** moving an object about in a repetitive manner (*cycle:* between the longest and most conspicuous movement *Step:* each playing manipulation)
- **Looping:** Vertical circling in which the animal's body moves in a somersaulting manner. If performed with the aid of a spinning wheel, the behaviour was called **wheeling**. (*Step:* each complete body/wheel revolution).
- **Pecking:** Repeatedly pecking an object, often a wire or fence (*Cycle:* between any pause longer than two pecks *Step:* each pecking action)
- **Digging:** Repeatedly digging a floor, or trying to dig a floor. Often performed on floors too hard for the animal to succeed in digging (*cycle:* between any pause longer than two average digging actions *Step:* each digging action)
- **Overgrooming/Overpreening:** Grooming to an excessive extent, pulling out hair or feathers, often leaving bald patches, irritated or broken skin. (*cycle:* between any pause longer than two average grooming actions *Step:* each grooming action)

RESULTS

Possible stereotypic animals in UK zoological collections

During this study, a total of 4087 different enclosures where the animals were visible, and 2291 enclosures where the animals were not visible were filmed. In total more than 5812 individual animals were filmed. This represents an average filming time of 3.6 minutes per enclosure with visible animals, or 2.5 minutes per individual animal. A total of 121 cases of possible-stereotypic-animals were recorded and filmed.

47 different UK zoological collections (45%, n=104) showed at least one case of possible-stereotypic-animals..

Percentage of UK zoological collections with at least one case of possible stereotypic animal (S5, 2000)

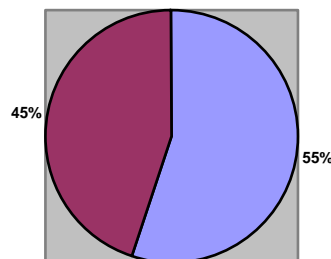


Figure 82. In red, percentage of UK zoological collections with at least one case of 'possible stereotypic animal' (see text for definitions)

20% of the UK zoological collections had in the year 2000 at least 3 cases of possible stereotypic animals (n=104)

Percentage of UK zoological collections with at least three cases of possible stereotypic animal (S5, 2000)

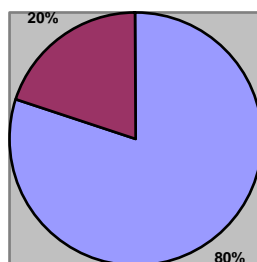


Figure 83. In red, percentage of UK zoological collections with at least three case of 'possible stereotypic animal' (see text for definitions)

4% of the UK zoological collections had in the year 2000 at least 10 cases of possible stereotypic animals (n=104)

Possible stereotypic cases per type of zoological collection

More than 80% of the Large Zoos and Wildlife/Safari Parks visited in this study showed at least one case of possible stereotypic animals (n=40).

Over 70% of the Small Zoos visited showed at least a case of possible stereotypic animals (n=68)

About 50% of the Farms and the Amusement Parks visited showed at least one case of possible stereotypic animals (n=61).

About 40% of the Aquaria and Sanctuaries visited showed at least one case of possible stereotypic animals (n=97).

About 20% of the Specialised collections visited showed at least one case of possible stereotypic animals (n=153).

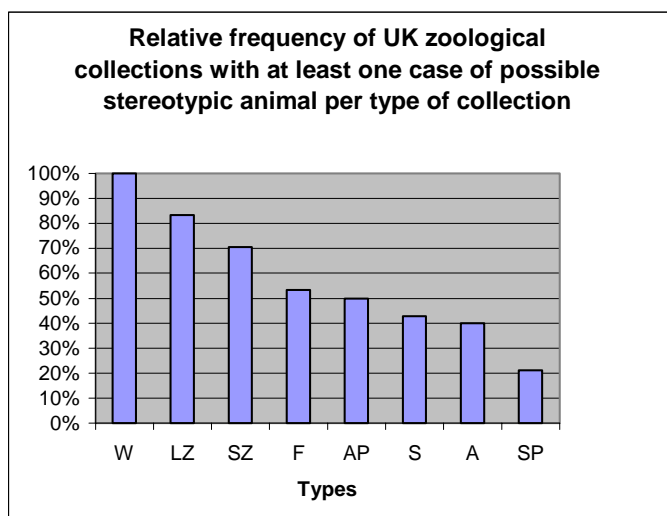


Figure 84. Relative frequency of UK zoological collections with at least one case of 'possible stereotypic animal' per type of collection (see text for definitions) A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

The average number of possible stereotypic animals per zoological collection is 1.2 (n=104)

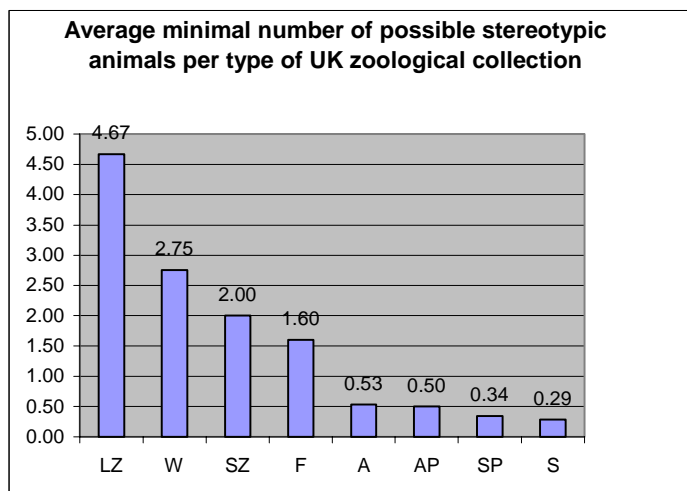


Figure 85. Average minimal number of 'possible stereotypic animals' per type of UK zoological collection (see text for definitions) A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

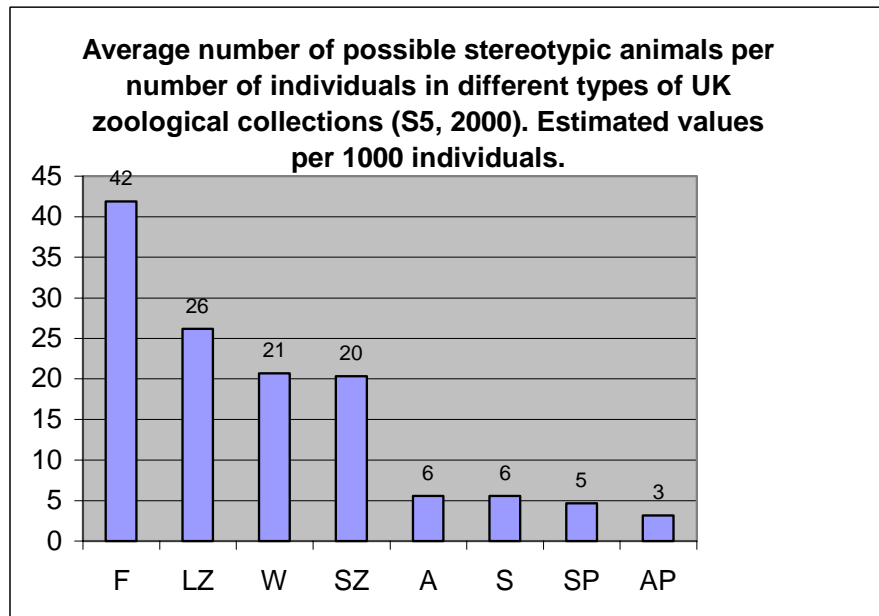


Figure 86. Average number of 'possible stereotypic animals' per number of individuals in different types of UK zoological collections (S5, 2000). Estimated values per 1000 individuals(see text for definitions) A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

Established stereotypia in possible stereotypic animals

In the majority (58%, n=121) of the cases considered in this study as possible-stereotypic-animals the certainty of being established cases was considered high or very high

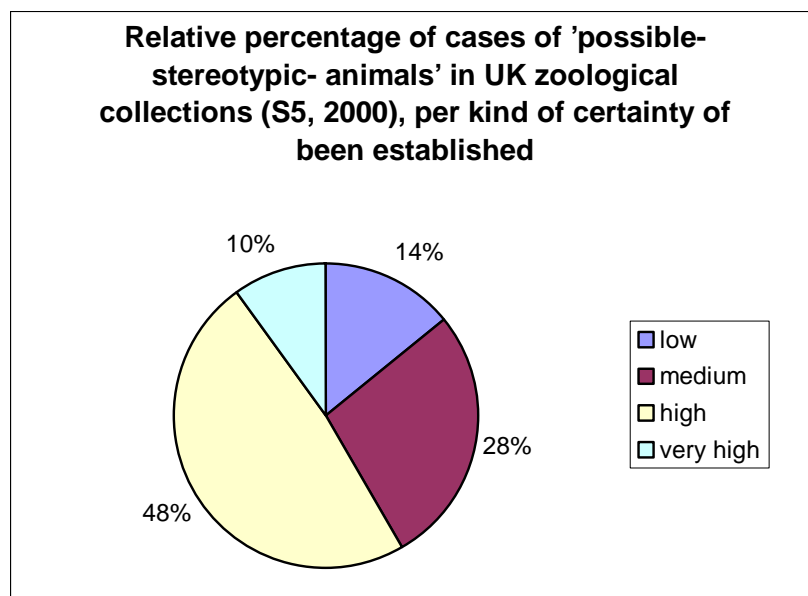


Figure 87. Relative percentage of cases of 'possible- stereotypic-animals' in UK zoological collections (S5, 2000), per kind of certainty of been established (see text for definitions)

Table 6. 'Possible-stereotypic-animals' found during zoo scans (S5, 2000). COLLECTION= code of the collection visited (see sampling chapter), TAXA= taxa of the individuals involved in the stereotypia, TYPE= type of stereotypic behaviour (see text for definition), NUMBER OF BOUTS= bouts filmed (see text), NUMBER OF CYCLES= number of cycles per each bout filmed (see text), S.I.= Stereotypia Index (see text).

Collection	Taxa	Type	Number Bouts	Bouts							S.I.
				Number Cycles							
PIL463	Gerbil	bar biting	2	64	10						21904
SHA316	Degu	bar biting	3	5	31	11					79524
DUD127	Black lemur	Circling	2	7	3						11680
GLA156	Rhino	Circling	2	4	5						40212
HAZ501	Chipmunk	Circling	4	2	3	13	17				130200
NAT243	Lipstick tank	Circling	2	3	2						2020
WAL382	Chipmunk (b)	Circling	1	3							486
WAL382	Chipmunk	Circling	4	11	31	16	23				300024
WET392	Chipmunk	Circling	3	6	5	7					12636
BOR054	Gerbil	Digging	4	8	5	20	2				78400
PIL463	Gerbil (b)	Digging	3	5	16	15					46656
ISL181	Bird	Flying	1	9							3888
ISL181	Fairy bluebird	Flying	4	7	14	15	14				106800
KNO194	Scarlet macaw	Head bobbing	5	3	4	10	5	3			15625
DAR118	Chipmunk	Looping	5	24	18	35	10	14			255025
NEW246	Harvest mice	Looping	3	34	7	5					61824
AMA431	Short tailed squirrel monkey	Neck twisting	2	7	4						10296
AMA431	Vervet monkey	Neck twisting	5	1	3	4	2	1			31350
AQU016	European otter	Neck twisting	4	9	35	2	3				268520
BEV507	Llama/guanaco	Neck twisting	3	26	2	15					259032
BOR054	Brown capuchin	Neck twisting	4	3	6	5	13				11664
GRE159	Red deer	Neck twisting	1	22	20	19					176412
AMA431	Blue and yellow macaw	Pacing	1	26							6812
AMA431	Banded mangoose	Pacing	3	5	6	2					17862
AMA431	Coati	Pacing	3	1	5	16					28116
ANG010	Emu	Pacing	6	7	8	11	2	3	3		362712
ANI013	Northern lynx	Pacing	2	2	5						2156
BEV507	Teal	Pacing	1	11							8404
BEV507	Donkey	Pacing	3	4	5	5					59388
BOR054	Black and whit ruffed lemur	Pacing	2	12	19						24552
BOR054	Turkey	Pacing	4	6	7	4	13				68640
COL104	Kea	Pacing	3	14	17	6					57720
COT110	Leopard	Pacing	2	1	18						26980
DAR118	Serval	Pacing	1	16							2016
DAR118	Brown bear	Pacing	2	4	4						9632
DRU126	Emu	Pacing	1	3							336
DUD127	Lynx (c)	Pacing	1	14							924
DUD127	Lynx (b)	Pacing	2	5	4						3600
DUD127	Lynx	Pacing	3	3	2	5					4140
DUD127	Lion	Pacing	4	3	5	1	1				18400
DUD127	Lynx (d)	Pacing	3	3	4	4					20658
GLA156	Lion	Pacing	1	23							3220
GLA156	Lion (b)	Pacing	1	22							30492
GRE159	Red deer (c)	Pacing	1	19							18316
GRE159	Red deer (b)	Pacing	1	20							19280
HAM164	Crested fireback	Pacing	1	7							1190
HAM164	Crested seriema	Pacing	1	7							1344
HAR166	Palawaan	Pacing	7	7	10	20	4	3	12	3	394002

WHI528	Chipmunk (d)	Wheeling	5	957	30	168	195	18	104544
WHI528	Chipmunk (c)	Wheeling	5	957	30	168	195	18	52272
WHI528	Chipmunk (b)	Wheeling	5	957	30	168	195	18	268128
WHI528	Chipmunk	Wheeling	5	957	30	168	195	18	134064
RIB292	Meerkat	Overgrooming	0						
BAT030	Emperor tamarin	Overgrooming	0						
BOR054	Weeping capuchin	Overgrooming	0						
BOR054	Weeping capuchin (b)	Overgrooming	0						
BOR054	Brown capuchin(b)	Overgrooming	0						
BOR054	Squirrel monkey	Overgrooming	0						
DUD127	Orang utan	Overgrooming	0						
DUD127	Orang utan (b)	Overgrooming	0						
DUD127	Cotton top tamarin	Overgrooming	0						
DUD127	Cotton top tamarin (b)	Overgrooming	0						
LON207	Macaw	Overgrooming	0						
MOF231	Capuchin	Overgrooming	0						
MOF231	Capuchin (b)	Overgrooming	0						
MOF231	Capuchin (c)	Overgrooming	0						
POR284	Black capped capuchin	Overgrooming	0						
SAN298	Brown capuchin	Overgrooming	0						
WHI394	Chimpanzee	Overgrooming	0						

Types of stereotypic behaviour

16 types of stereotypic behaviour were filmed, performed by 66 different taxa from fish to mammals.

The majority (64%, n=121) of the stereotypic cases recorded corresponded to locomotor pacing-like stereotypies (pacing, swimming, flying, neck-twisting and circling).

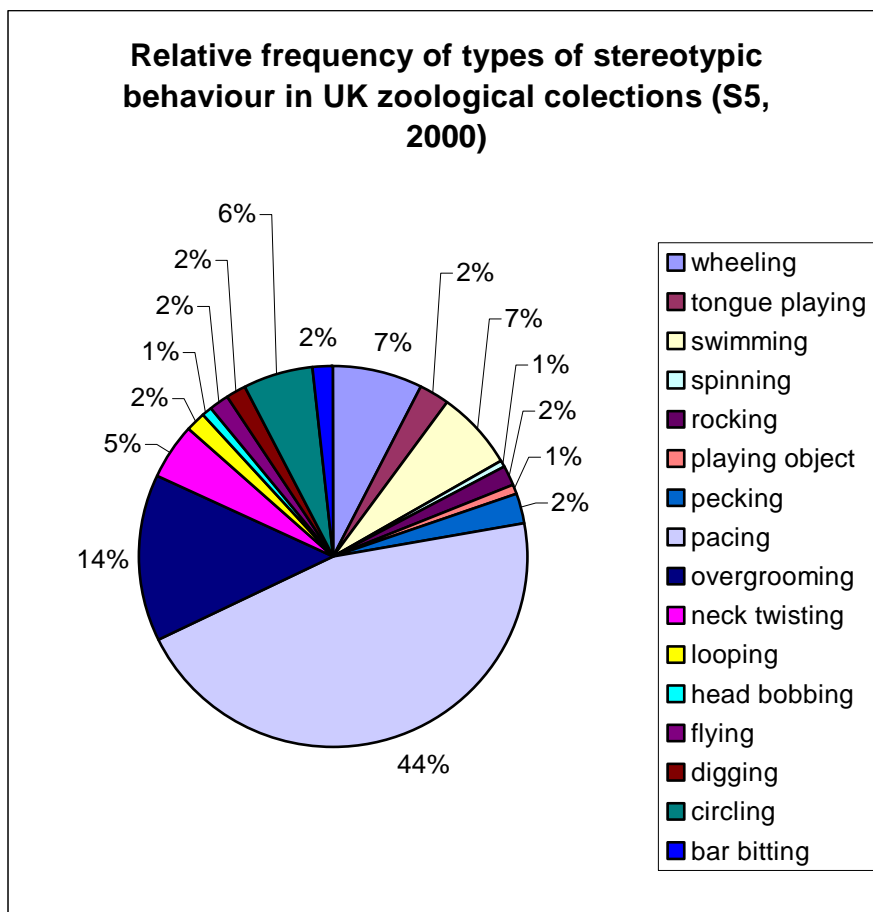


Figure 88. Relative percentage of types of stereotypic behaviour in UK zoological collections (S5, 2000), (see text for definitions)

DISCUSSION

General

As suggested by Mason (1991), stereotypies are heterogeneous in their source of origin, proximate causation and physical characteristics. Mason also states that stereotypies change over time in important aspects and therefore, it is sensible to use a definition that embraces all this heterogeneity. One such definition is that of Odberg (1978), which is used in this study.

The only common quantifiable behavioural aspect for all stereotypes using Odberg definition is the concept of repetition. Authors differ as to just how rigid or repetitive a behaviour pattern has to be before they will call it a stereotypy. Forrester (1980) stated that stereotypies are not completely inflexible, and Fraser & Broom (Broom 1983; Fraser and Broom 1990) define a stereotypy as being only 'relatively' invariant. The key element seems to be how many times a behavioural pattern should be repeated to fall into the definition.

One way around the problem, is to use informational redundancy to quantify the repetition within behavioural sequences (Stolba et al. 1983). Studies with stalled sows (pigs) using this method, concluded that repetitions of three or more times in the 30 seconds assessment period agreed with the results of information-redundancy analysis (Stolba et al. 1983). Other work in stereotypia in mink, also used three successive repetitions of a movement or sequence of movements as a criteria to identify stereotypies (Mason, 1994).

Following these criteria, this study used three successive repetitions as a discriminator, although no limit of time was used due to the fact that a wider heterogeneous source of stereotypia had been observed, more varied than any specific research done in a particular species. To prevent to consider 'repetitions' behavioural sequences that were too separated in time to be part of the same 'bout', the general rule of considering pauses longer than twice the average duration of the behavioural element repeated as a discriminator was used as a criteria.

The criterion of three repetitions was only restricted to the number of sequence of movements (*cycles*), not individual movements (*steps*). The reason for this is that this study mainly focuses on the individual animal performing stereotypia (using the concept, 'possible-stereotypic-animal'), rather than the stereotypic behaviour itself. Since this concept implies that there is a high probability that the animal performs the stereotypia often, an extra criteria was added to avoid the cases where the stereotypia was very incidental. This criterium was to consider only *cycles* with at least five *steps*, assuming that three would probably be enough for consideration, but five allows better certainty.

Despite having restricted the definition, the limited number of observations in a single visit made it difficult to be certain how established the witnessed stereotypia was in that particular individual over time, and for this reason the word 'possible' was added to the concept.

This certainty could also be classified according to how much data was available for each individual case. Figure 87 shows that in the majority of the cases, the amount of data was sufficient to consider the cases established, but since the criteria to discriminate types of certainty is arbitrary, the term 'possible' cannot be removed. As can be seen in table 6, the data nevertheless shows, that in the majority of the cases there was a much higher degree of repetitiveness than the minimum accepted by the definition used. Therefore, any general conclusion that ventures to link the filming of stereotypia with the characterisation of the individual that performed it, is sound.

The cases of possible overgrooming were considered of 'lower certainty' since assumption was taken on the presence of bald patches or hair/feather loss rather than witnessing the actual behaviour. Since the general objective of this study is not to quantify the degree of stereotypia or their direct connection with welfare, it was concluded that the presence of bald patches was enough for not discarding the possibility that a stereotypic overgrooming produced them. However, it must be made clear that the presence of patches does not necessarily mean that overgrooming caused it, and therefore considering an animal with such patches as possibly stereotypic is an assumption that was taken with low certainty.

Occurrence of possible stereotypic animals in UK zoological collections

Table 6 and figures 82 and 83 show that stereotypic behaviour is not absent in modern UK zoological collections. Almost half of the collections showed at least one case of possible stereotypic animal by observing the animals an average of 2.5 minutes, and a fifth showed at least three cases. In some occasions there were 10 or more cases found. All these values only represent the minimum occurrence, since the method used could easily miss cases not detected because the animal was not performing stereotypia when filmed. Having in consideration that the average time zoo checkers observed an enclosure with visible animals was 3.6 minutes, it is very possible that many more cases are present in UK zoological collections that were undetected.

Broom (1983) has suggested that stereotypies should be viewed with alarm if the behaviour takes up to more than 10% of the animal's time. Using this value, the probability of having missed during the zoo scan a stereotypic behaviour of a stereotypic animal with the minimum stereotypia to be viewed with alarm is 0.90. Nevertheless, 121 cases were found, which means that assuming the Broom percentage and that all animals showed the minimum stereotypia, it is possible that the total occurrence of possible stereotypic animals in the UK collections sampled is as high as 1210. This would represent 30% (n= 4087) of the animals.

If, alternatively, we consider any possible stereotypic animal, not only the ones that spend 10% of their time stereotyping, the percentage could be much higher.

Wiepkema (1983) has stated that if stereotypies occur in more than 5% of the population, its welfare is 'unacceptable'. The results in this study do not contradict the hypothesis that the UK zoological collection population does not have a percentage of stereotypia higher than 5%, but it is also possible that is lower. Our data shows however, the percentage is at least 2% with an average observation time of 2.5 minutes per individual. It is very likely than the real number is higher than 5%, and therefore according to Wiepkema the welfare in UK zoological collections as a whole is 'unacceptable'.

Unfortunately, since not all the animals will have a set percentage of stereotypia in relation to time, and that we do not have bases to consider any percentage as a cut-off value, the only conclusion that can be deduced with absolute certainty about this, is that the occurrence of stereotypia in UK zoological collections is not negligible, and it could be very high.

Possible stereotypic animals per type of zoological collection

Figure 84 shows that 'possible stereotypic animals' are not restricted to a particular 'type' of zoological collections. Figure 84 and 85 shows that large zoos and wildlife/safari parks have the highest relative frequency of possible stereotypic animals. However, this may also be caused by the fact that these zoo 'types' have the highest number of individuals displayed.

If we eliminate the number of animals displayed by calculating the number of possible stereotypic animals per number of animals displayed then the zoo 'type' with the largest number of stereotypia changes. In this case, Farms appear to have double or more cases of animals with stereotypia than the other 'types' of zoological collections (Figure 86). Farms are followed by Large zoos, Wildlife/Safari parks, and Small zoos, all with similar values of numbers of stereotypia cases.

Although the different sample size might have had an effect in these comparisons, other data supports these results. As seen in table 6 and figure 86, the collections with the highest number of possible stereotypic animals were a farm and a large zoo.

This data does show that, in a random visit to a randomly selected large zoo or wildlife/safari park in the UK, it is highly likely that at least an animal performing stereotypic behaviour is witnessed. It would also be relatively certain to see stereotypic behaviour by a visit to a Small zoo, Farm Park, or Amusement Park, and less likely to observe it in a Sanctuary, Aquaria or Specialised collection.

Types of stereotypic behaviour in UK zoological collections

The data of table 6 shows that there is a variety of stereotypic behaviours that can be seen in UK zoological collections. The types described only correspond to the types witnessed during the zoo scans of the selected collections, and therefore it is likely that more types are present in more individuals of all collections.

Although definitions of types of stereotypic behaviour vary from author to author, some attempts have been made to group several behaviours into main types.

When the stereotypia occurs because of physical limitations of the captive environment, they have been classed as 'cage stereotypes' (Draper & Bernstein. 1963; Berkson 1967, Ridley & Baker, 1982). They tend to be locomotory, and are typical of small or barren cages, but can be altered by changes in the environment enrichment.

Figure 104 agrees with this definition, since most stereotypies filmed were indeed locomotory, but it also shows that not all are, agreeing with Mason (1991) who thinks this classification is a little simplistic.

Nevertheless, some generalisations are normally accepted. For example, the pre-feeding stereotypy of one carnivore species is probably homologous with that of another (Mason 1991). This is consistent with the results shown in table 38.

Other classifications of stereotypic behaviour depend on factors like their relation with feeding times, or their state of development, but the data gathered in this study does not allow us to distinct these.

DO UK ZOOLOGICAL COLLECTIONS PUT VISITORS AND ANIMALS AT RISK?

Risk of zoonoses in UK zoological collections

INTRODUCTION

Zoonoses are defined as diseases the agents of which are transmitted between vertebrate animals and humans (Hubbert et al. 1975; Schwabe, 1984). There are more than 230 known species of organism that are zoonotic agents, but it is probable that this represents a very small proportion of the agents that really can infect both human and other vertebrates.

Zoonoses can be transmitted by faeces, urine, saliva, blood or milk, via aerosol, oral, contact with bedding or animals, direct blood to blood contact, or animal vectors. The transmission can happen from humans to animals or animals to humans.

Some diseases caused by infection with zoonotic agents have been recognised clinically since early history whereas others, are only now being recognised for the first time (Huge-Johnes et al. 1995)

Any place where humans and vertebrate animals are in direct or indirect contact with one another is susceptible in having a zoonoses risk, and zoological collections are not an exception. Large, dense populations of susceptible species have the potential of acting as sources of novel or previously unnoticed infections, especially if the multiplying host is relatively unaffected (Hugh-Jones et al., 1995).

All types of zoological collections, from safari parks to aviaries, can be at risk of zoonoses.

Tuberculosis is a global problem in deer. It has already emerged as a threat to North America's aging Asian elephants. 3.3% of the captive Asian elephant population tested positive for the human strain of tuberculosis (S. Mikota, quoted by Pellegrini, 2001). Avian tuberculosis in North American exotic species is also a problem (Hugh-Jones et al., 1995)

Birds, reptiles, and turtles are especially dangerous sources of *Salmonellosis*. In the UK in December 1999, a three-week-old baby died after apparently contracting *Salmonellosis* as a result of 'contact' with a pet reptile in the last six months. In the last two years, 13 people in the UK have contracted salmonella from pet reptiles.

A study of *Vero cytotoxin* producing *Escherichia coli* (VTEC) O157 infections in Cornwall and West Devon was conducted to identify associations between human infection and contact with farm animals. Three children, one who lived on an open farm and the other two who visited the farm in school parties, developed *Vero cytotoxin* producing *Escherichia coli* (VTEC) O157 infection in 1997. Emus and ostriches, often seen today in farms, are found to be excellent sentinels for eastern *Equine encephalitis* (Hugh-Jones et al., 1995).

Zoo practices have changed over the years but it may be a fact that the new zoo practices have actually increased the risks of zoonoses. Many zoological collections have introduced 'hands on' activities, or 'animal encounter' exhibits, also there is an increased in the exchange of animals between collections. All these practices could increase the zoonoses risk, rather than reducing it.

To assess the risk of zoonoses, the frequency of human to animal contact in zoological collections could be investigated to answer the following questions. Do today's UK zoological collections permit and encourage "hands on" activities between animals and the public? Is there a high occurrence of animal/human physical interactions in today's UK zoological collections? Do keepers in today's zoological collections take the necessary precautions to prevent the transmission and spread of zoonoses?

METHODS

Randomly selected zoological collections were visited following the zoo scan method explained in the ‘sampling’ section above, filming all the events that could contribute to the risk of cross contamination of zoonoses. The following criteria was used to detect possible cases:

- Primarily the events sought were cases of physical contact or interaction between the animals and humans. This covered both animal contact with the keepers and the visitors. For the purpose of this study, ‘Contact’ describes any direct physical interaction between an animal and a human...
 - through parts of their bodies
 - through objects directly manipulated by either (i.e. food) immediately prior the interaction
 - through humans touching the water where aquatic animals swim
- For the purpose of this study, ‘contact attempt’ describes any action performed by a visitor directly aimed to achieve a physical interaction between himself/herself and an animal but fails to do so for reasons other than the apparent unwillingness of the visitor (i.e. visitor cannot reach the animal, food thrown falls outside the enclosure, etc.).
- For the purpose of this study, a ‘visitor’ describes any person within the public area of a zoological collection that was:
 - not dressed in working gear (i.e. keeper’s uniform, overalls, Wellington boots, walkie-talkie, etc.)
 - and not taking notes or using measuring equipment
 - and not going in and out of restricted areas
 - and not wearing an identification badge
 - and not doing any maintenance work
 - and behaving in a way consistent with visitor behavior (i.e. walking watching the animals, taking pictures of the animals, etc.).
- For the purpose of this study, a ‘keeper’ describes any person in a zoological collection that was:
 - dressed in working gear (i.e. keeper’s uniform, overalls, Wellington boots, walkie-talkie, etc.)
 - and was going in and out of restricted areas, specially enclosures
- For the purpose of this study, ‘unauthorized contact’ describes ...
 - any visitor’s contact with an animal from that collection in an area where a sign prohibits the action.
 - or, any visitor’s contact with an animal from that collection in an enclosure, when there was no keeper directly encouraging and supervising the interaction.
- When keepers were seen working in enclosures, it was noted whether the keeper was wearing gloves or not.

RESULTS

Contact between visitors and animals

At least in 60% of the UK zoological collections there was physical contact between visitors and animals (n=104).

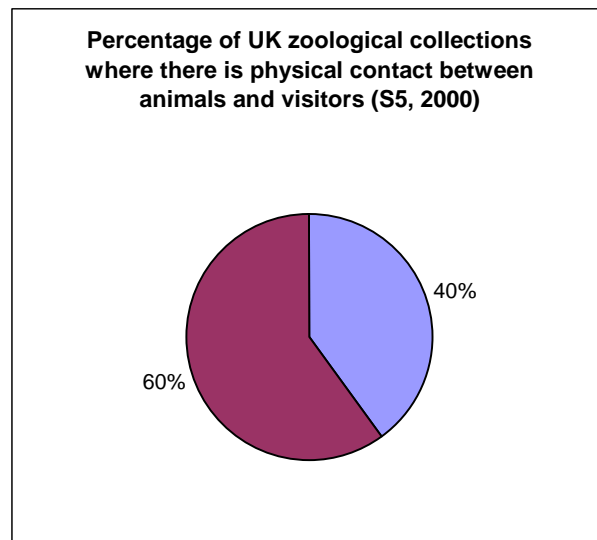


Figure 89. In red, percentage of UK zoological collections where there is physical contact between animals and visitors (S5, 2000)

Authorized contact human/animal

At least in 38% of the UK zoological collections have shows/talks in which a keeper interacts physically with animals (n=104).

At least in 25% of the UK zoological collections have show/talks where visitors interact physically with the animals (n=104).

At least in 36% of the UK zoological collections authorize visitors physical interaction with particular animals (n=104).

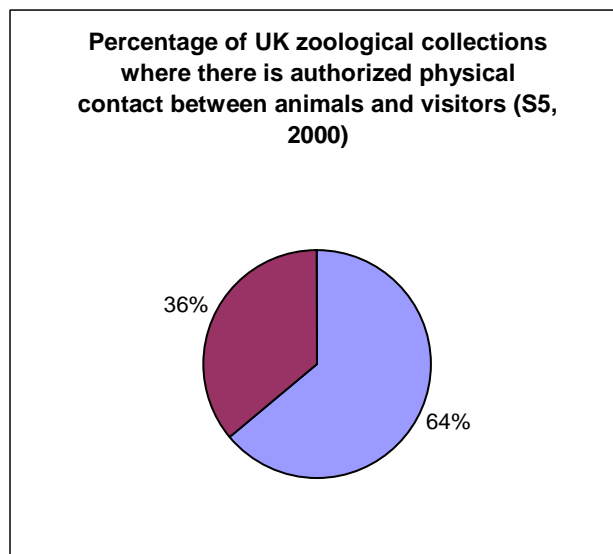


Figure 90. In red, percentage of UK zoological collections where there is authorised physical contact between animals and visitors (S5, 2000)

In all 'types' of UK zoological collections there are collections with authorized animal/visitor contact.

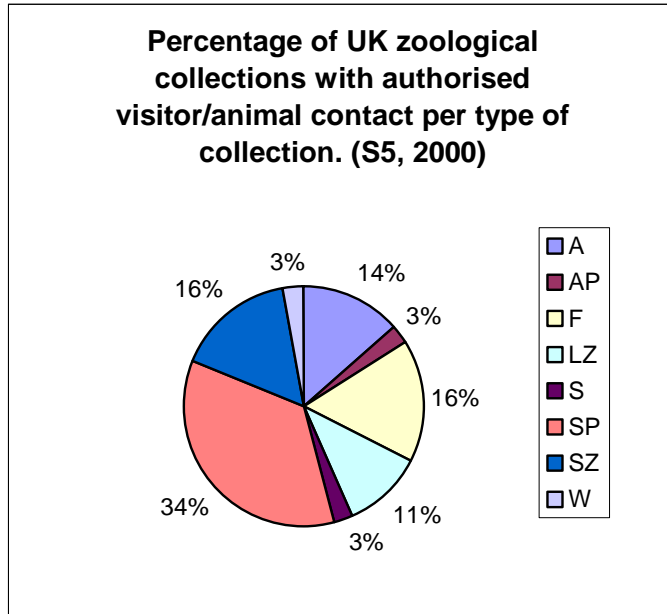


Figure 91. Percentage of UK zoological collections with authorised visitor/animal contact per type of collection. (S5, 2000) A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

Unauthorised contact visitor/animal

In 44% of the UK zoological collections at least one case of animal/visitor unauthorized contact was filmed (n=104).

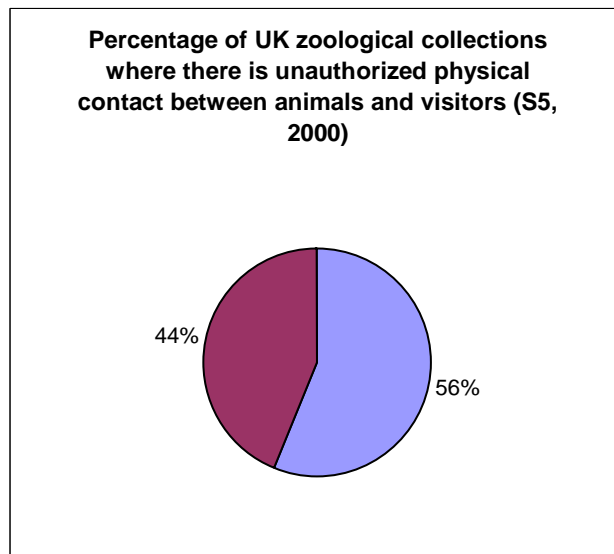


Figure 92. In red, percentage of UK zoological collections where there is unauthorised physical contact between animals and visitors (S5, 2000)

At least in 6% of the UK zoological collections 10 or more cases of unauthorized contact were filmed (n=104), which represents 14% of the collections where at least one case was filmed (n=43).

In two aquaria that were filmed the number of unauthorized contact was as high as 50 and 44 cases, and in one Farm as high as 26 cases.

Over 300 cases of unauthorized contact or contact attempt were filmed during this study, which represents almost 3 cases per zoological collection. From those, only 3% are contact attempts, and 97% are actual contacts.

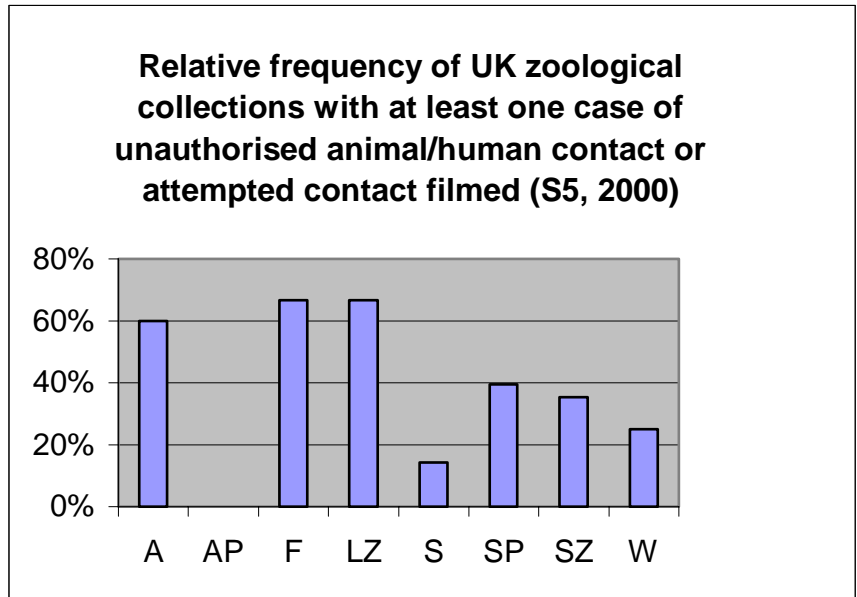


Figure 93. Relative frequency of UK zoological collections with at least one case of unauthorised animal/human contact or attempted contact filmed (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

Precautions against zoonoses

Only in 10% of the UK zoological collections were keepers seen either cleaning an enclosure, feeding an animal or physically interacting with animals, only one keeper was using gloves.

In less than 3% of the UK zoological collections at least one keeper was seen working in enclosures or with animals with gloves.

In less than 2% of the UK zoological collections a keeper was seen advising visitors not to touch the animals.

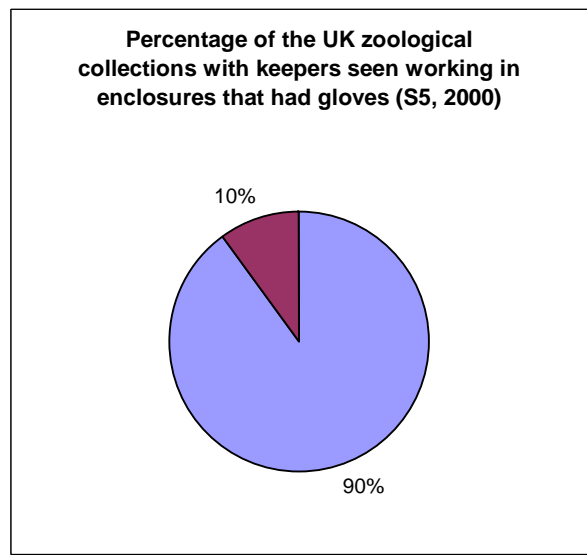


Figure 94. In red, Percentage of the UK zoological collections with keepers seen working in enclosures that had no gloves (S5, 2000)

Collections filmed with keepers....	Absol.freq.	Rel.freq
cleaning enclosures	14	13%
feeding animals	13	13%
touching animals	16	15%
being attacked by animal	2	2%
using gloves	3	3%
sneezing when feeding	2	2%
advising visitors not to touch animals	2	2%
N	104	

Table 7. Frequency of some events filmed during zoo scans (S5, 2000) featuring keepers.
Absol.freq.= absolute frequency. Rel.Freq.= Relative frequency

Cases of zoonosis risk witnessed

During the 'zoo scans' the following cases were filmed:

- Penguin biting keeper's foot repeatedly and then Meerkat sniffing the keeper's foot area where the penguin had bitten
- Keeper blowing her nose and immediately feeding a sea lion without washing her hands
- Keeper blowing her nose and immediately feeding a raccoon without washing her hands
- Polecat biting keeper and struggling to get free
- Polecat biting visitor
- Several deer eating tissue paper immediately after been thrown by a visitor

DISCUSSION

Occurrence of human/animal contact

From the results in Figure 89, in the majority of the UK zoological collections animal/visitor contact does occur. Authorized contact occurred in 38% of the UK zoological collections, but unauthorized contact occurred in 44% of the zoological collections (Figure 90 and 92). It is interesting to note, that the percentage of collections with unauthorized contact was higher than authorized contact. The zoonotic risk involved in a physical interaction is likely to be higher in an unauthorized contact when there may be fewer precautions taken.

Figure 93 shows that unauthorized contact occurs in all 'types' of collections. The only exceptions to this are the Amusement Parks but, with such a small sample size of this 'type', it is not possible to come to such an assumption. Unauthorized contact however is shown to occur more in Aquaria, Farms and Large zoos. In some collections, the number of unauthorized contacts witnessed was as high as 50 cases, but as an average, there were at least 7 cases per collection observed. During the visit, the zoo checker could only observe one area of the collection at a time that is likely to visually cover less than 10% of the view of the visiting public actions. Therefore, the 300 cases of unauthorized contact witnessed during the zoo scans are likely to be just 10% of the cases occurred, and therefore the actual number could be in thousands. Furthermore, the zoo scans took place with only one day visit to each selected zoological collections, but if we consider all collections in the UK during six months opening season, the annual cases of unauthorized contact could run into millions.

One explanation for the high occurrence of unauthorized contact is that authorized physical interaction with animals is very much part of the modern zoo culture where many zoological collections encourage 'animal encounters'. In many cases, measures to prevent contact are not taken seriously by zoo operators and the public does not seem to differentiate between unauthorized and authorized contact.

As mentioned, in more than a third of the collections visited, the keepers themselves physically interact with the animals in front of the public in their talks or shows and in the majority of these, visitors are allowed to physically interact with the animals as well. This authorized contact was observed in all 'types' of collection (Figure 91), and in many cases, specifically designed areas, are available for this physical interaction with animals to take place (i.e. 'petting areas' or 'touch pools'). Table 7 shows that in only 2% of the collections a keeper was seen advising or preventing visitors not to touch the animals.

Staff supervision and attitude does not seem to be the only problem. Often it is the way that the enclosure or the viewing area is designed, allowing contact to occur. The results show that there appears to be a lack of stand off barriers and other apparatus to prohibit actual contact. Comparing the cases of actual contact with 'attempted contact', actual contact outnumbers attempted by 32:1, suggesting that more physical barriers are required to prevent such animal/visitor interactions.

Prevention of zoonoses

Despite the abundance of human/animal interactions, it could be argued that the risk of zoonoses in UK zoological collection is very low because enough precautions are taken to prevent cross contamination. Although this study did not cover all possible cross contamination routes that could occur in a zoological collection, it did focus on one of the most basic preventive methods of preventing contamination: the use of disposable gloves. From hospitals to bakeries, disposable gloves are widely used for such purposes.

During the zoo scans, in less than 3% of the collections keepers were seen working in enclosures using gloves, and only in 10% of the collections where keepers were seen in the enclosures they used gloves (Figure 94). This low percentage indicates that there are no grounds to believe that in the UK zoological collections the high occurrence of human/animal contact is compensated by thorough precautions to prevent zoonoses.

In addition to the lack of glove use, there are other signs of lack of precautions taken by the zoological collections. Table 7 and the section about cases witnessed, also indicates that in some cases of animal contact where the likelihood of possible transmission of a disease is much higher, potential disease transmission is ignored and precautions are not taken. Examples include cases where keepers sneeze and do not wash their hands while working with the animals, or situations of potential saliva to blood transmission through bites. This study shows that these cases do exist in UK zoological collections.

Visitors misconduct in UK zoological collections

INTRODUCTION

Most zoological collections have signs indicating how visitors should behave. Advice includes ‘not to touch’, ‘do not feed’, ‘wash your hands’ or ‘do not disrupt’ the animals as well as showing people where to go and where not to go. The signs exist to protect both the animals and visitors and is a requirement laid down by the Secretary of State’s Standards of Modern Zoo Practice (2000). The Standards also enforce the use of barriers and fences.

Despite all the signs, their design and regulation, whether they receive the necessary attention by the visitors, or whether the signs are properly implemented, is questionable. Visitor’s behaviour may therefore become a threat to the animals as well as dangerous to the person(s) concerned. How often does this happen in the UK zoological collections? Does the zoo staff challenge visitors that misbehave? This study will try to answer these questions by analysing the film taken during the ‘zoo scans’.

Zoological collections are responsible of the welfare of their animals and the safety of their visitors, and if their methods to protect animals from visitors and visitors from injury or diseases are inefficient, it is important to highlight this fact improvement can be made.

METHODS

Randomly selected zoological collections were visited following the zoo scan method explained in the ‘sampling’ section by filming all the actions performed by visitors that could be classified as disruptive to the animals or as misconduct. The method used to detect possible cases was as follows:

- Two main types of visitor misconduct were sought in this study: actions that might disrupt the animals and actions that are prohibited during a visit to a zoological collection. In the purpose of this study, ‘misconduct’ is any unauthorized behaviour that ...
 - directly disrupts the peace of the animals
 - or might have a negative effect in the welfare of the animals
 - or might put the visitor at risk of injury or disease.
- The types of misconduct observed were:
 - **Feeding animals**
Giving food items (or throwing them into the enclosure) to animals by the visitors is explicitly not allowed by keepers, or giving/throwing unauthorized food items to any animal unless under guidance.
 - **Touching animals**
Physical interaction with animals when prohibited to do so, or when no direct keeper supervision is present.
 - **Touching water**
Put fingers or hands in water where animals swim when prohibited doing so, or when no direct keeper supervision is present.
 - **Standing or sitting on fence/barrier**
Actively reducing the effective height of a fence or barrier by having both feet on any part of a fence/barrier, by sitting on it, or by leaning over it.
 - **Tapping on glass**
Hitting the glass of an enclosure in order to draw the attention of the animal(s) inside
 - **Disrupting animals**
Calling, shouting or making noise to draw the attention of the animals, using flash photography when prohibited not to do so, chasing free range animals, or otherwise actively interacting with animals in a way other than touching, feeding or tapping on the glass when not explicitly authorized by keepers.
 - **Fingers/arms through wire**
Put body parts through the wire into an enclosure.
 - **Objects into enclosures**
Put objects through the wire, or throwing them into the enclosure.

RESULTS

Occurrence of visitor misconduct

556 cases of visitor misconduct were filmed, which represents over 5 cases per collection.

In 14 occasions (2%, n=565) the behaviour was performed at full view of a keeper, who made no attempt to stop it.

62% of the UK zoological collections showed at least one case of visitor misconduct (n=104)

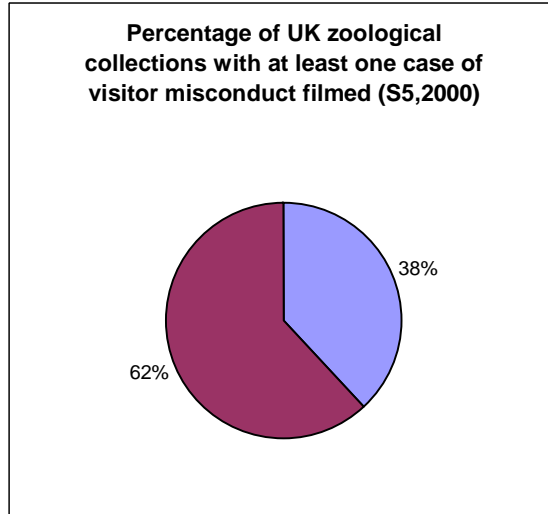


Figure 95. In red, percentage of the UK zoological collections with at least one case of visitor misconduct (S5, 2000).

17% of the UK zoological collections showed 10 or more cases of visitor misconduct during this study (n=104). The number of cases of misconduct filmed in a particular collection was as high as 53.

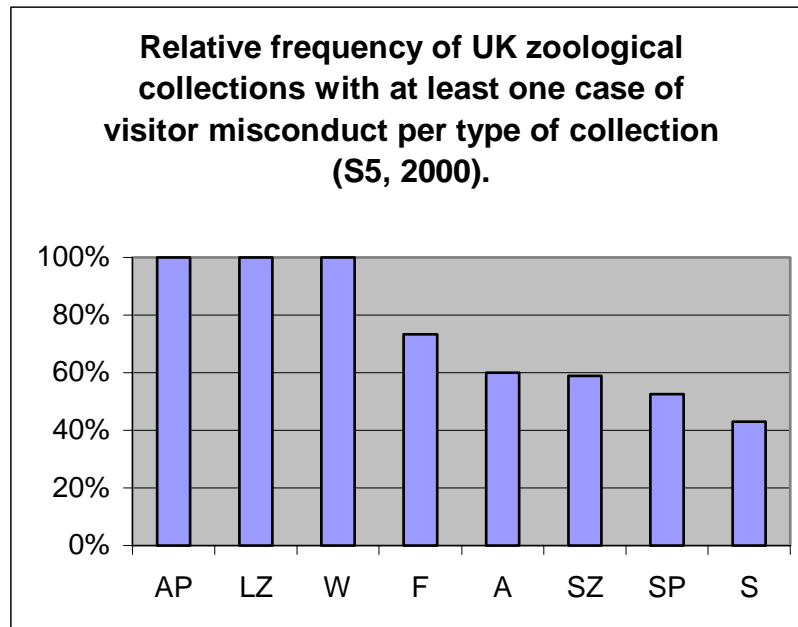


Figure 96. Relative frequency of UK zoological collections with at least on case of visitor misconduct per type of collection (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

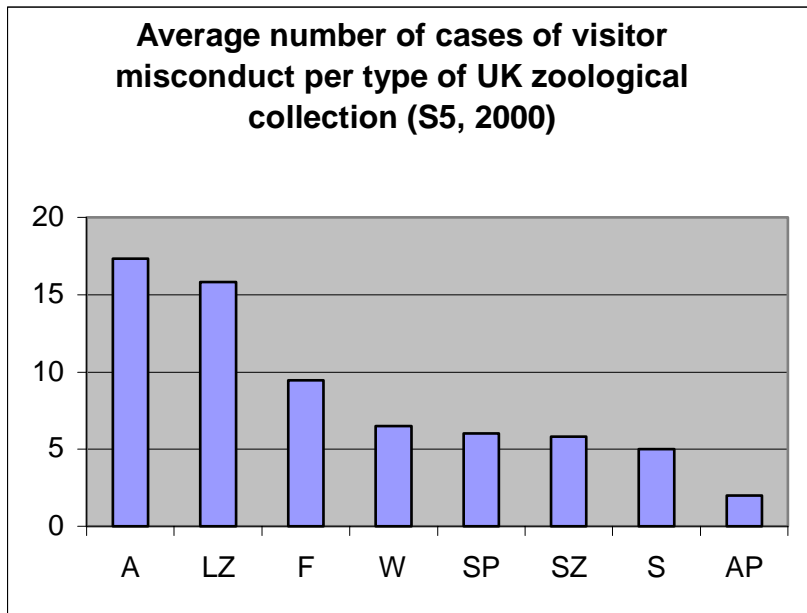


Figure 97. Average number of cases of visitor misconduct per type of zoological collection (S5, 2000). A= Aquaria, AP= Amusement Parks, F= Farm, LZ= Large Zoo, S= Small zoo, S= Sanctuary, SP= Specialised Collection, SZ= Small Zoo, W= Wildlife/Safari Park

Types of visitor misconduct

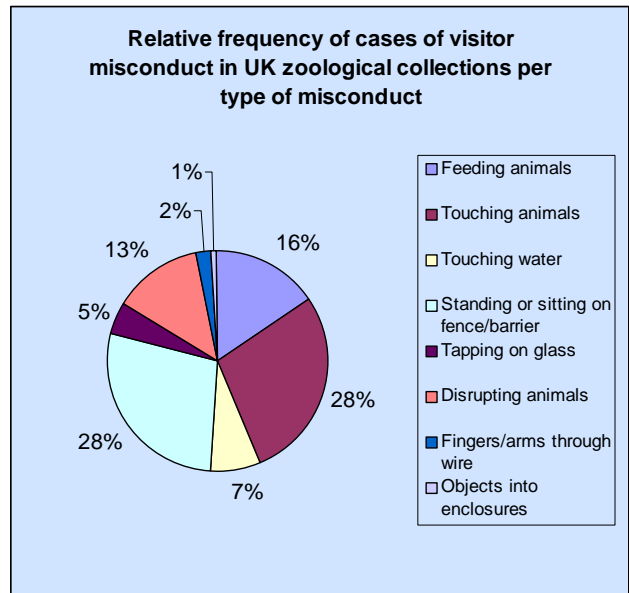


Figure 98. Relative frequency of cases of visitor misconduct in UK zoological collections per type of misconduct (S5, 2000). See text for definitions

DISCUSSION

Figure 95 shows that the majority of the UK zoological collections showed cases of visitors misconduct. During the visit, the zoo checker could only observe one area of the collection at a time and therefore the zoo scan is likely to visually cover less than 10% of the actions of the visiting public. Therefore, the 500 cases of visitor misconduct witnessed could be a much greater number running into thousands of actual cases. Furthermore, the zoo scans took place only on one day visit per selected collection, and therefore considering all the zoological collections and an opening season of six months, the annual cases of visitor misconduct in UK zoological collections could run into millions.

Visitor misconduct was witnessed in all 'types' of zoological collections (figure 96). In particular most of the Large zoos, Wildlife/safari parks and Amusement parks had cases of misconduct, but as seen in figure 97 Aquaria, Large Zoos and Farms had the highest frequency of cases.

All the types of misconduct witnessed had the potential to effect the animal's welfare. As seen in the chapter about 'zoonoses', feeding, touching, throwing objects into enclosures or touching the water of a swimming animal may well be a potential route of transmission of a zoonotic disease from a visitor to an animal (or visa versa). In addition, feeding might also cause the animal to become overfed or feeding the animal potential damaging food items. Touching the water has often the effect of releasing soap particles or other chemicals that might have the accumulative effect of upsetting the water's chemical balance, which in turn might produce diseases to the aquatic animals. Objects thrown into the water may also damage the animal; throwing coins into water for example.

The misuse of barriers and fencing by standing on barriers, putting fingers through the wire, tapping the glass of an enclosure, disrupting the animals using flash photography or shouting to them, all might effect the animal's well being. The animals are often startled, scared, awoken, or intimidated often enough to compromise their psychological welfare. As seen in the chapter about animal welfare, there is evidence that psychological animal welfare problems do occur in today's UK zoological collections and some of these causes might be caused by the constant disruption of the visiting public.

Visitor misconduct witnessed during the zoo visits often puts the visitor at risk. The zoonotic risk expressed (see relevant chapter) can put both human and animal at risk from the transmission of diseases. Standing or sitting on fences, as well as putting fingers through wire might also potentially put the visitor at a risk of falling into the enclosure or being attacked by the animal interpreting the intrusion as a threat.

All these concerns are clearly expressed in the regulations that govern the UK zoo licensing system. The Secretary of State's Standards of Modern Zoo Practice state in the Provision of 'protection from fear and distress' that, "any direct physical contact between animals and the visiting public must only be for restricted periods of time and under conditions consistent with animal's welfare" and "animals must not be provoked for the benefit of the public". The Standards go on to say in the Provision of 'food and water' that, "uncontrolled feeding of animals by visitors should not be permitted".

From the results, the two most common types of misconduct observed in this study were standing/sitting on fences or barriers, and touching the animals (together covering over 50% of the cases, as seen in figure 98). The feeding of animals were also observed a great deal. Animals and visitors are put at risk by visit misconduct.

There are several possible explanations for the high occurrence of visitor misconduct. A lack of information from signs and zoo staff may mean that visitors might not be aware of the risk they are putting to themselves or the animals. Some zoological collections were seen to have information available but the high frequency of misconduct found perhaps shows that this information was not complete and, some collections lacked this sort of information all together.

The lack of zoo staff presence is possibly another reason for the lack of enforcement and conveying of information. Rarely were persons carrying out actions of risk to themselves or the animals challenged by zoo staff or even, another member of the public. As can be seen in table 7 in the chapter about zoonoses, only in two occasions, representing 2% of the zoological collections, a keeper was seen to challenge a visitor's behaviour. The ratio of misconduct versus challenging misconduct was 283:1, indicating that most visitor misconduct goes unchallenged. This hypothesis is confirmed by the fact that in 14 occasions the misconduct filmed was in the presence of a zookeeper who made no attempt to challenge the visitor. In many other occasions, like in a case of an Aquarium, over 50 misconduct cases were filmed, all of them went unchallenged. Perhaps this lack of enforcement of visitor conduct has lead the visiting public to believe that such behaviour, despite the signs, is acceptable.

PUBLICITY AND PR IN UK ZOOLOGICAL COLLECTIONS

INTRODUCTION

Any institution that has a product for sale can benefit of proper marketing techniques. When the product to sell is a concept or idea, the institution can benefit from having a PR strategy.

Zoological collections, as any institution, can benefit from both a PR strategy and Marketing techniques. The product in this case is to sell tickets to the public to go to the attraction and the idea that zoos are a legitimate and justifiable activity.

Do today's UK zoos use PR exercises and marketing techniques? Which concept are they selling? How well do they manage to 'seduce' their markets? How far are their messages from their reality?

To answer these questions, published material produced by the UK randomly selected zoos was analysed. Specific concepts like 'conservation', 'education', 'research' or 'animal welfare' were sought in such material, and their occurrence was compared to results on the zoo's performance on such issues unearthed during this study, and expressed in other chapters.

METHODS

- All the randomly selected UK zoological collections were visited and scanned and all printed material available to the visitor was taken or purchased.
- Printed information (leaflets, tourist guides, etc.) on the zoological collections visited was collected from local tourist information centres, libraries or tourist information points situated in other zoological collections.
- After a collection was visited, within a three month period, the official web pages of the zoological collection were found using traditional Internet searching methods or from the web address from the collected leaflets. For the zoological collections where a web page was found, all its contents (all pages and links) were saved for future analyses. Due to the fact that the last visit was made at the beginning of October 2000, all the content of the web pages analysed was relative to the year 2000 only.
- A computerised search was carried out for the presence of particular selected words (*conservation, endangered, education, research, rescue and rehabilitation*) within all the web pages saved. All the collected printed material was red looking for the same words.
- The following criteria was use to determine if a particular publication featured 'prominently' any of the above selected words.
 - If the words were part of their mission statement, and if such a statement was published in the main pages of the document.
 - If a whole chapter conveyed the concepts directly linked to the words, and the relative size of the chapter was not small.
 - If statements using the words were significantly and relatively highlighted in the main pages of the publication in terms of position, size or colour.
 - If the words were part of main titles in the initial home page, or the front cover of the printed material.
- Any publication system used to deliver a PR message was considered a 'PR platform'. When no printed material or web pages were found for a collection, it was considered to be lacking a PR platform.

RESULTS

PR platforms

More than 70% of the UK zoological collections have PR platforms widely available to the general public that allows them to sell their image outside the actual centre.

About 90% of the UK zoological collections with a PR platform used leaflets in the year 2000.

About 40% of the UK zoological collections with a PR platform use books or guides in the year 2000.

About 40% of the UK zoological collections with a PR platform use web pages in the year 2000.

At least 10% of the UK zoological collections with a PR platform use printed material other than leaflets and books in the year 2000.

At least 10% of the UK zoological collections with a PR platform use printed adverts in the year 2000.

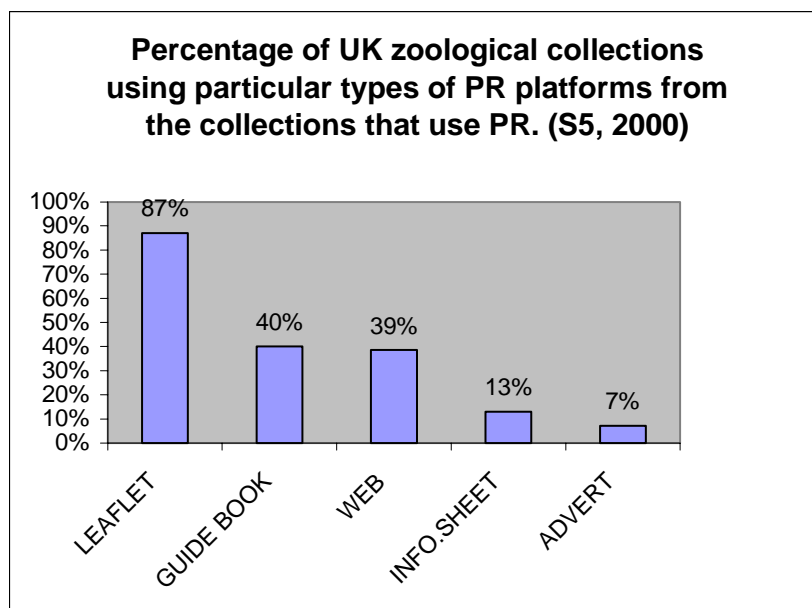


Figure 99. Percentage of UK zoological collections using particular types of PR platforms from the collections that use PR (S5, 2000).

Use of concepts

Over 80% of the UK zoological collections that publish web pages in the year 2000 had the term '**conservation**' in them at least once (n=70)

Over 65% of the UK zoological collections that publish web pages in the year 2000 had the term '**endangered**' in them at least once (n=70).

Over 90% of the UK zoological collections that publish web pages in the year 2000 had the term '**education**' in them at least once (n=70).

About 60% of the UK zoological collections that published web pages in the year 2000 had the term '**research**' in them at least once (n=70).

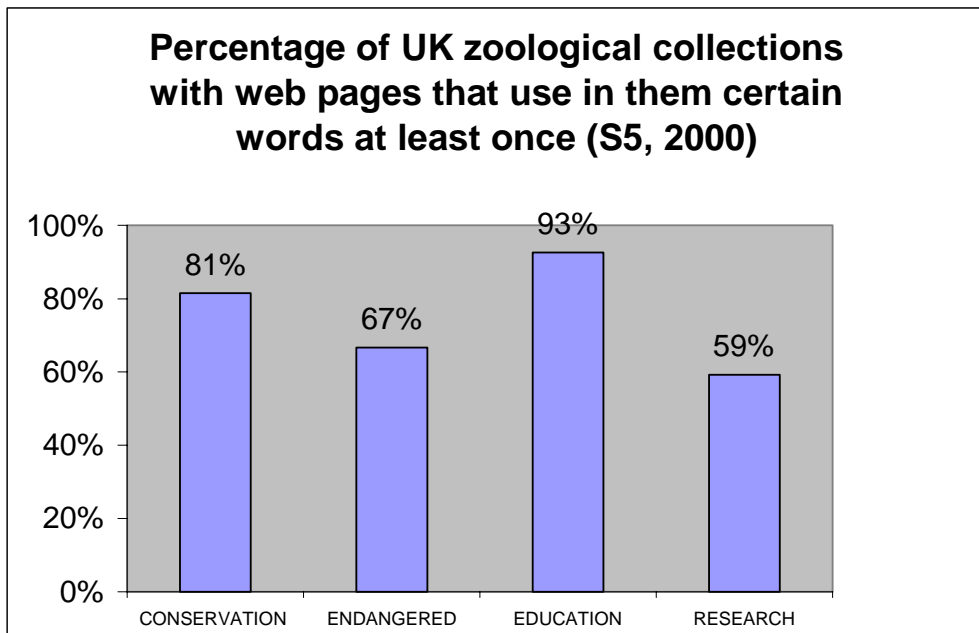


Figure 100. Percentage of UK zoological collections with web pages that use in them certain words (the ones written in the X axis) at least once (S5, 2000)

Over 60% of the UK zoological collections with a PR platform use the concept of ‘**conservation**’ or ‘**endangered species**’ in their PR exercises (n=70), and in about 50% of those the concepts are used predominately.

Over 40% of the UK zoological collections with a PR platform use the concept of ‘**education**’ in their PR exercises (n=70), and in over 30% of those the concept is used predominately.

Less than 10% of the UK zoological collections with a PR platform use the concept of ‘**research**’ in their PR exercises (n=70), and none of those use the concept predominately.

About 15% of the UK zoological collections with a PR platform use the concept of ‘**rescuing**’ or ‘**rehabilitating**’ in their PR exercises (n=70), and in over 90% of those the concept is used predominately.

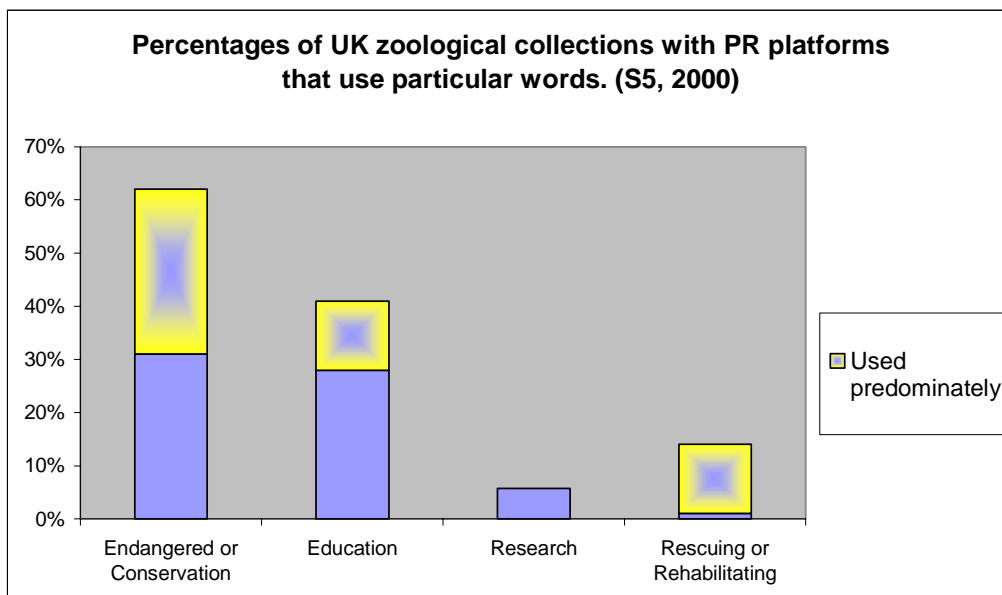


Figure 101. Percentage of UK zoological collections with PR platforms that use in them certain words (the ones written in the X axis) at least once (S5, 2000). In yellow the relative frequency of collections where the words are used predominately.

Some of the sentences used in the PR platforms of the zoological collections studied (each from a different centre) referring 'conservation' and 'endangered species':

"conservation is one of the park's primary concerns"

"we're big on conservation too"

"the zoo is home to many endangered species"

"many of our animals are close to extinction"

"many of the animals you will see in our zoo are endangered"

"many are part of breeding programmes to help the conservation of animals facing extinction"

"see how rare breeds close to extinction are now surviving"

"international breeding centre for rare and endangered species"

"protection and breeding of rare and endangered animals is a prime role"

"conservation has taken the foremost position"

Discrepancy between PR messages and performance

*Conservation

The average percentage of non-threatened species kept by the UK zoological collections that use 'conservation' or 'endangered species' concepts in their PR exercises is 87%.

Over 88% of the UK zoological collections that use 'conservation' or 'endangered species' concepts in their PR exercises have less than 25% of their species they keep included in the IUCN 2000 Red List, and therefore considered threatened (n=44).

Less than 13% of the UK zoological collections that use 'conservation' or 'endangered species' concepts in their PR exercises have more than 5% of their species they keep included in the IUCN 2000 red list, and therefore considered threatened (n=44).

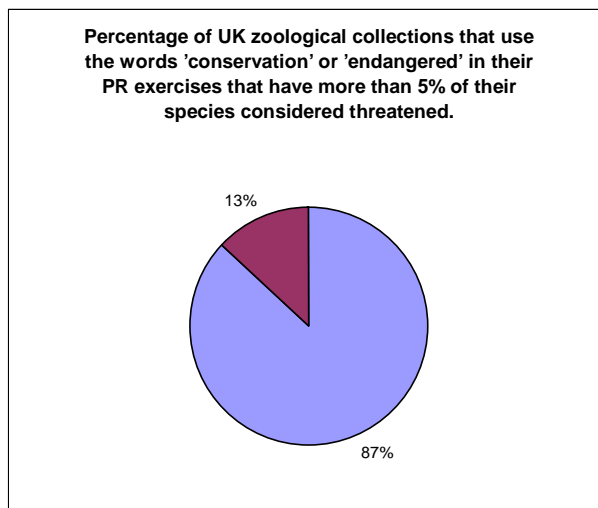


Figure 102. In red, percentage of UK zoological collections that use the words 'conservation' or 'endangered' in their PR exercises that have more than 5% of their species considered threatened by IUCN.

Less than 3% of the UK zoological collections that use 'conservation' or 'endangered species' concepts in their PR exercises have more than 50% of their species they keep included in the IUCN 2000 Red List, and therefore considered with some threat (n=44).

The average percentage of non-threatened species kept by the UK zoological collections that use ‘conservation’ or ‘endangered species’ concepts **predominately** in their PR exercises is 85%.

Over 80% of the UK zoological collections that use ‘conservation’ or ‘endangered species’ concepts **predominately** in their PR exercises have less than 25% of their species they keep included in the IUCN 2000 Red List, and therefore considered threatened (n=44).

About 35% of the UK zoological collections that use ‘conservation’ or ‘endangered species’ concepts **predominately** in their PR exercises have less than 10% of their species they keep included in the IUCN 2000 Red List, and therefore considered threatened (n=44).

More than 15% of the UK zoological collections that use ‘conservation’ or ‘endangered species’ concepts **predominately** in their PR exercises have less than 5% of their species they keep included in the IUCN 2000 Red List, and therefore considered threatened (n=44).

Less than 5% of the UK zoological collections that use ‘conservation’ or ‘endangered species’ concepts **predominately** in their PR exercises have more than 50% of their species they keep included in the IUCN 2000 Red List, and therefore considered with some threat (n=44).

*Research

All the zoological collections that use the words ‘research’ in their PR exercises only published 6 scientific papers in the year 1999-2000, which represents 0.4 papers per collection (n=16).

All the zoological collections that use the words ‘research’ in their year 2000 PR exercises only published an average of 0.24 papers per year and collection during the period from 1977 to 2000, which represent an average of one paper every five years per collection.

38% of the zoological collections that use the words ‘research’ in their year 2000 PR exercises had not published any scientific paper mentioned in the Zoological Record in the last 24 years (n=16).

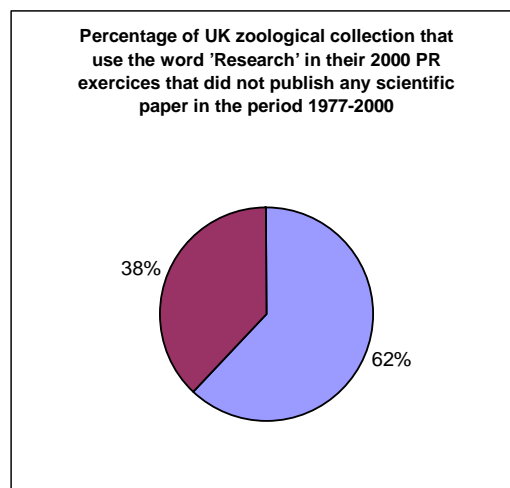


Figure 103 In red, percentage of UK zoological collections that did not published any scientific paper in the period 1977-2000, from the ones that use the words ‘research’ in their PR exercises (S5, 2000).

DISCUSSION

Use of PR and Marketing platforms

Many of the zoological collections visited, do use Marketing techniques and PR exercises (figure 99), and both target potential and actual 'clients' like zoo visitors and tourists. The most common platform used is the leaflet, and almost half of the collections already have a web page. Since the study was conducted in the year 2000, it is possible that with an increase in Internet awareness, the amount of zoological collections advertising on the Internet is now much greater.

Marketing the zoo and the techniques used seems to be regarded as very important to the zoo community. For the last four years, the World Zoo Organisation (WZO) has been organising the International Zoo Marketing Conference, which brings together marketing departments of zoological collections from all over the world. Open only to the zoo community, the most recent meeting was in May 2001 in Tenerife.

Concepts used in Zoological collections' PR

It is obvious that the main aim of the PR platform is to promote the zoo as a "fun day out" and to encourage people to visit but, the occurrence of words 'conservation', 'endangered', 'education' and 'research' is also very much a part of the message (figure 100). Most zoological collections use these words at least once, and as can be seen in figure 101, often the words feature predominately in their publications. This fact does not come as a surprise, even the WZO Conference in 2001 has focused on advertising the conservation message. In 2002, with the implementation of the European Zoo Directive, it will be a legal requirement for all zoological collections in Europe to actively participate in conservation. The Council Directive 1999/22/EC relating to the keeping of wild animals in zoos entered into force on 29 March 1999 and requires all Member States to follow the legislation. The Directive provides for the licensing and inspection of zoos and for standards of animal care, and sets the framework for the participation of zoos in conservation, research and education.

From reviewing all the available literature, the word 'conservation' seems to have the highest occurrence. Especially when expressed in terms of helping/saving endangered species, many of the zoos use conservation statements in their publicity. Figure 102 shows that more collections use the concept 'conservation' than the other concepts (the other selected words) investigated, and half of the zoological collections that use it do it predominately.

The use of the concept of 'conservation' in the Marketing and PR exercises by the zoo community, is conveyed in a quote taken from the opening lecture of the First International Zoo Marketing Conference in 1997 at Aalborg, Denmark. Prof. Roger J. Wheeler, Director of the Royal Zoological Society of Scotland, stated..."we have to get our local communities convinced that the zoo is not only great fun to visit - and we lose that element of our activities at our peril - but that it is contributing to, and indeed part of a wider conservation world. To achieve this understanding is what this meeting is mainly concerned with".

In fact, the use of conservation in marketing and PR of zoos it is not only to explore new markets, but also to improve an image, which has received bad press in the past. This hypothesis is supported by the fourth goal of The World Zoo Organisation (IUDZG) Action Plan, which states "communicating the mission of zoos to press and public, improving public perception and enhancing community support for zoos of the world".

Discrepancy between PR messages and performance

Most PR and Marketing exercises tend to exaggerate the product they are 'selling', and there is no reason to assume that the zoo industry would be any different. How far this exaggeration goes, however, would have an influence on the market to which the campaign is addressed.

Figures 102 and 103 show that in the case of the conservation message in the keeping of endangered species and the amount of research carried out, there is a discrepancy between PR messages and their actual performance.

Although the presence of the words 'conservation' or 'endangered' does not necessary reveal the context in which the words have been used, it is reasonable to believe that in most cases the publicity is promoting the work carried out by the zoo in preserving endangered species. The examples of sentences used in the printed material in the results section confirm this. By contrast, though, data on figure 24 and the chapter on the percentage of endangered species in zoological collections show their actual occurrence is very small. Even the Large Federation zoos exhibit a small percentage of endangered species. According to the results of this investigation on the performance of UK zoological collections, Large Zoos exhibit a majority of non-threatened species, and yet their publicity only focuses on the endangered species, giving the impression that that the zoo's work is predominantly conservation based.

As far as research is concerned, according to the results, 38% of the zoological collections that used the word 'research' in their publicity have never completed any scientific research in the last 24 years (figure 103, and chapter on research).

ZOOLOGICAL COLLECTIONS OPERATING WITHOUT A ZOO LICENCE IN THE UK

INTRODUCTION

Since 1981 there has been legislation in the UK that regulates zoological collections. The main aspect of this regulation is the establishment of a licensing system in which local authorities inspect and licence any zoological collection that opens to the public.

The Zoo Licensing Act 1981 states under Section 21, that a “Zoo” is an establishment “where wild animals are kept for exhibition” and “to which members of the public have access, with or without charge for admission, on more than seven days in any period of 12 consecutive months”. A ‘wild animal’ is defined as “any animal not normally domesticated in Great Britain”.

Are all zoological collections in the UK licensed? Are there collections that might be illegally opened to the public in the UK? This study will address these questions by using the definitions of the Zoo Licensing Act 1981, and asking both local authorities and zoological collection operators.

METHODS

Data collection relied on the co-operation of both the Local Authorities and many of the zoological collections listed on the Zoo Check, zoo records.

- Using Shaw’s, Local Government Directory 2000/2001, all 411 councils (District, Borough, Metropolitan and Unitary) of England, Scotland and Wales, were contact by telephone and asked a series of set questions.
- In England, Scotland and Wales, the Local councils issue zoo licences. Each council was individually contacted and asked if they issue any zoo licences in their constituency. Those councils that did have establishments requiring a zoo licence were ask to provide the establishment’s name, the renewal date of the licence and whether the establishment had a ‘Dispensation’ or ‘Exemption’ under Section 14 of the Zoo Licensing Act 1981.
- In Northern Ireland, individual councils do not licence zoological collections but instead licences are issued through the Department of Agriculture. An up-to-date list was acquired from the Department of the names and addresses of all the ‘zoos’ with a licence.
- The names of zoological collections acquired from the Local Authority survey were compared with the Zoo Check zoo records database, listing all zoological collections known to the organisation.
- Those collections which appeared on the Zoo Check database as ‘zoos’ but were not recorded as being licensed under any Local Authority were individually telephoned and asked to provide details on opening times to the public, the variety of animals exhibited, visitor numbers and whether the collection operates under a zoo licence. If the zoological collection claimed to have a licence but there was no record of it from the LA survey then the Local Authority was telephoned a second time and asked specifically if that collection was licensed.
- Those collections that only exhibited ‘domestic’ animals and did not have ‘non-domestic’ animals were removed from the zoo list (see below for the definitions).
- Those collections however, that had ‘non-domesticated’ animals (even if they also exhibited ‘domesticated’ animals) and were not listed as licensed by any Local Authority, were classed as a ‘zoological collection operating without a zoo licence’.
- In order to stipulate the animals as being ‘domesticated’ or ‘non-domesticated’ the following criteria was used:
 - **‘Domesticated’** animals, according to the Encyclopaedia Britannica are defined as animals that “are created by human labour to meet specific requirements or whims and are adapted to the conditions of continuous care and solicitude people maintain for them.” This includes animals like sheep or cattle selectively bred to enhance wool production or milk yield or dogs, which have been artificially bred into a variety of shapes and sizes.

- **'Non-domesticated'** animals are those animals that have not undergone hereditary reorganisation in the interests of people and are not genetically different to their wild counterparts. This includes animals kept as pets that have not been genetically reorganised by humans, animals taken from wild populations and feral animals that have escaped from captivity in the past, which didn't imply artificial genetic modification (i.e. wallaby).

These definitions stand regardless of whether the animal is tame or not.

RESULTS

General

5 Local Authorities consulted refused to provide any information (1.2%, n= 411).

9 Local Authorities consulted failed to provide a complete list of zoological collections licensed under their constituency when approached first time (2.2%, n= 411). A complete list was acquired on approaching the Authority for a second time after the individual zoological collections were telephoned and found they stated not to have licences.

Occurrence of UK zoological collections without a zoo licence.

Comparison of Zoo Check records and those of Local Authorities, the body that issues the zoo licence, revealed that 18% of the UK zoological collections visited during the year 2000 (S5, 2000) were suspected of operating without a zoo licence.

The following table lists all the selected zoological collections (S5, 2000). Those that were found to possibly be operating without a zoo licence are highlighted in **bold**.

Table 8. List of all the selected zoological collections (S5, 2000) indicating those that were found to possibly be operating without a zoo licence (highlighted in **bold**).

* indicates that following the method above, it is suspected the zoological collection operates without a zoo licence.

*A indicates that following the method above, it is suspected the zoological collection operates without a zoo licence but, the Local Authority is aware that the collection needs to be licensed.

*E indicates that following the method above, it is suspected the zoological collection operates without a zoo licence but, the zoological collection claims that it is exempt from licensing.

<u>Code</u>	<u>Zoo Type</u>	<u>Name of Zoological Collection</u>	<u>no licence</u>
ABE002	A	Aberaeron Sea Aquarium	
ALS006	F	Alstone Wildlife Park	
ANG010	SP	Anglesey Bird World	
ANG011	A	Anglesey Sea Zoo	
ANI013	SZ	Seal Sanctuary (from Easter 2001)	
AQU016	A	Aquarium of the Lakes	
BAT030	SZ	Battersea Park Children's Zoo	
BEN034	SP	Bentley Wildfowl	
BIR042	SP	Birdworld	
BOD051	SP	Bodelwyddan Castle Hotel	
BOR054	SZ	Borth Animalarium	
BRI067	A	Brixham Aquarium	
BUC071	S	Buckfast Butterfly Farm & Dartmoor Otter Sanctuary	
BUT074	SP	MacFarlanes Butterfly Centre	
CHE095	AP	Chessington World of Adventures	
CHI098	SP	Child Beale Wildlife Gardens	
COL104	LZ	Colchester Zoo	
CON106	SP	Conwy Butterfly jungle	*
COR107	S	National Seal Sanctuary	
COT110	LZ	Cotswold Wildlife Park	
CRA112	F	Tannaghmore Animal Farm	
DAR118	SZ	Dartmoor Wildlife Park	

DRU126	SZ	Drusillas Park	
DUD127	LZ	Dudley and West Midlands Zoological Society	
DUT129	SP	Ama Zone	
EAM131	A	Eamley Gardens	
EDI504	SP	Edinburgh Butterfly and Insect world	
ELS136	F	Elsham Hall Country and Wildlife Park	
ESC137	SZ	Escot Country Park and Gardens	
FLA147	AP	Flamingo Land Theme Park and Zoo	
FOL149	F	Folly Farm	
FOW151	A	Fowey Town Aquarium	*
GLA156	LZ	Glasgow Zoo	
GRE159	F	Green Acres Farm	
HAM164	SZ	Hamerton Wildlife Park	
HAR166	SP	Harewood Bird Garden	
HAW167	SP	Hawk Conservancy	
HER169	S	Heronfield Animal Rescue Centre	
HES171	SP	Churchtown Botanical Gardens	*
HOR175	A	Horniman Museum/Gardens	
HOR176	SP	Hornsea Pottery	*A
ISL180	SP	Butterfly World & Fountain World	
ISL181	SP	Isle of Wight Rare Breeds and Waterfowl Park	
KNO194	W	Knowsley Safari Park	
LLO202	SP	LLoyd Park Aviary	*
LON203	A	London Aquarium	
LON206	SZ	Long Sutton Butterfly Park	
LON207	W	Longleat Safari Park	
LOW210	F	Monreith Animal World	
MAC212	A	MacDuff Marine Aquarium	*
MAR222	SZ	Maryon Wilson Animal Park	*
MIN230	F	Minster Agricultural and Rural Museum	
MOF231	SZ	Fife Animal Park	
MON234	SP	Monkey World	
NAT239	SP	National Birds of Prey Centre	
NAT241	SP	Natural History Centre	
NAT243	S	Natureland Seal Sanctuary	
NEW246	F	The Secred World. The budger and wildlife rescue centre.	
NEW248	A	Blue Reef Aqaurium	
OTT258	S	Tamar Otter Park	
OWL259	SP	Owl Centre	
PAL263	F	Palacerigg Country Park	*
PEN273	SP	Pensthorpe Waterfowl Park	
PLY281	A	National Marine Aquarium	
POR284	W	Port Lympne Zoo	
PRI286	SP	Prinknash Bird Park	
RIB292	SZ	Riber Castle Wildlife Park	
RHY291	A	Rhyl Sea Life Centre	
SAN298	LZ	Jack Corney's Tiger and Big Cat Sanctuary	
SCR301	SP	Screech Owl Sanctuary	
SEA309	A	Scarborough Sea Life & Marine Sanctuary	
SEA314	A	Sea Life Centre	
SEA315	SP	Seaforde Butterfly House	
SHA316	SZ	Shaldon Wildlife Trust Ltd.	

SHE319	SP	Sherwood Farm Park	*
SHI320	SP	West Lodge Rural Centre	*
SOU329	A	Southend Sea Life Aquarium	
STE337	SZ	Stewart Park	*
SUF341	LZ	Suffolk Wildlife Park	
THE358	S	Ramsey Raptor Rescue Centre	
TRO364	SP	Tropic House	
TRO365	SP	Tropical Bird Garden	
TRO366	SP	Tropical Rainforest	*
WAL382	F	Walton Hall Gardens Childrens Zoo	
WEL388	SP	Welsh Hawking Centre & Wildlife park	
WET392	SP	Wetlands Waterfowl Reserve	
WHI394	W	Whipsnade Wild Animal Park	
WIC395	SP	Wicksteed Poole Aviary	
WIL402	SP	Wildfowl & Wetlands Trust	
WIL406	SP	Waterfowl World & Gardens	
WOO410	S	Wood Green Animal Shelter	*
WOR414	SP	Worldwide Butterflies, Sherborne	*E
AMA431	SZ	Amazon World	
ODD459	F	Odds Farm Park	*
PIL463	SZ	Pilis Palas	
CON464	A	Conwy Harbour Aquarium	*
HIL474	SP	Hillside Bird Oasis	
AMA495	SZ	Amazonia Live Tropical Zoo	
THE500	SP	The Scottish Deer Centre	
HAZ501	SZ	Hazelhead Park Pets Corner and Walk-in Aviary	*
BEV507	F	Beveridge Park	*
LET509	F	Letham Glen	*
WHI528	F	White Post Modern Farm Centre	
TRO587	SP	Tropical Butterfly Gardens & Falconry Centre	

Using only the data of 104 zoological collections visited in the year 2000, 19 collections (18%) were suspected found to exhibit 'non-domesticated' animals but did NOT have a zoo licence.

Figure 104 shows the percentage of total number of zoological collections operating without a zoo licence from the 104, S5, 2000 selected zoos:

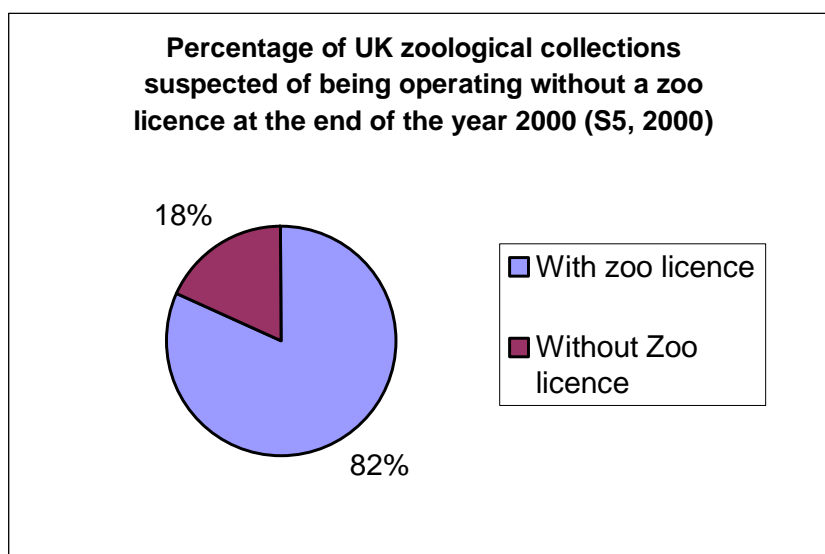
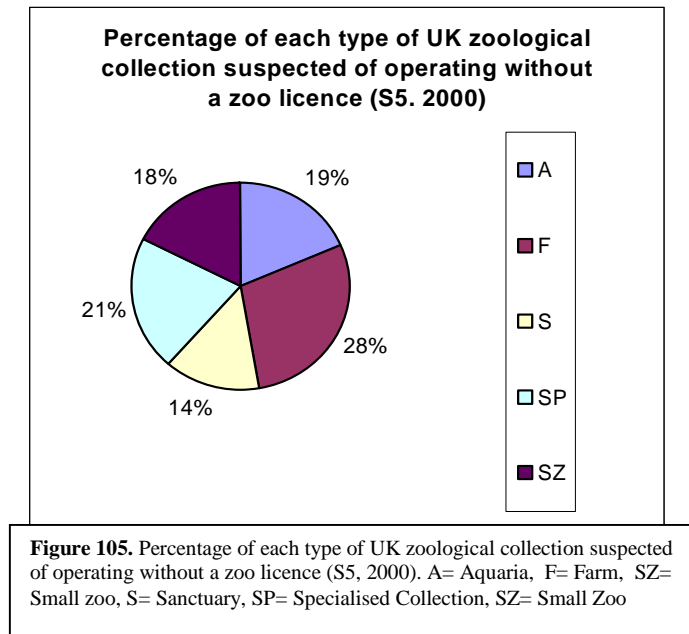


Figure 104. In red, percentage of UK zoological collections suspected of being operating without a zoo licence at the end of the year 2000 (S5, 2000)

Type of zoological collections suspected of being operating without a zoo licence



DISCUSSION

It has become apparent from the results that the Local Authorities, who issue the zoo licences and inspect the zoological collections, interpret the terms ‘wild animal’, ‘domesticated’ animals and ‘non-domesticated’ animals differently to the definitions given above (see methods). However, no official definition is available and it would appear that licensing authorities differ in their interpretation of the criteria in the issuing of zoo licences. For example, park aviaries contain a variety of ‘exotic’ birds yet, some Authorities do not recognise that such a collection needs a zoo licence. Other Authorities however, have licensed park aviaries that are found under their constituency.

A ‘wild animal’ according to the Zoo Licensing Act 1981, is defined as “any animal not normally domesticated in Great Britain” but even this definition allows a degree of differing interpretation. The llama originally from Peru is normally domesticated in South America, but not in Europe, despite been relatively common in farm parks. There are numerous parks that exhibit Indian peafowl, although this does not mean that they are farmed. Should these animals be classed as ‘normally domesticated in Great Britain’ or ‘not normally domesticated in Great Britain’? And what about introduced species like the grey squirrel, which is from North America, although has become feral?

Differing interpretation is apparent across the broad spectrum of ‘zoo types’ (figure 105), but particularly in the case of aquaria, farm parks, sanctuaries, specialised zoos and small zoos. Many Farm Parks, which traditionally exhibit a working-farm environment, are now exhibiting other animals like llama, bison and reptiles. However, such establishments seem to be overlooked and continue to operate without the necessary zoo licence. Sanctuaries, which may take in unwanted pets or excess animals from larger zoos, too require a zoo licence if these animals are displayed to the public for 7 days or more in a year. Authorities, but also the owners of the zoological collections, appear to perceive ‘zoos’ as large collections exhibiting animals like tigers and monkeys. In reality, even a zoological collection exhibiting only national species to the public would still be classed as a ‘zoo’.

Many of the taxa exhibited in the zoological collections suspected of been operating without a zoo licence are listed overleaf. The list only shows the taxa that might be classified differently as far as their domestic status is concerned according to the source consulted, and the classification used in this survey is shown. Such a list would be a useful tool for a future clarification of the subject if sent to the proper authorities for consultation.

Table 9 - indicates which category the following taxa, commonly exhibited in Farm Parks, Sanctuaries, Aquaria and other zoological collections, have been classified in this study.

Table 9. List of some taxa commonly exhibited in UK Farm Parks, Sanctuaries, Aquaria and other zoological collections, with their classification in relation of being normally domesticated in the UK used in this study.

Domestic	Non - Domestic	Common name (species)	Domestic	Non – Domestic	Common name (species)
	◆	Llama (<i>Llama glama</i>)		◆	Rhea (<i>Rhea americana</i>)
	◆	Bison (<i>Bison spp.</i>)		◆	Ostrich (<i>Struthio camelus</i>)
	◆	Sika deer (<i>Cervus nippon</i>)		◆	European eagle owl (<i>Bubo bubo</i>)
	◆	Wild Boar (<i>Sus scrofa</i>)		◆	Barn owl (<i>Tyto alba</i>)
	◆	Pygmy goat (<i>Capra hircus</i>)		◆	Guinea fowl (<i>Guttera spp.</i>)
	◆	Wallaby (<i>Macropus spp.</i>)		◆	African grey parrot (<i>Psittacus erithacus</i>)
◆		Highland cattle (<i>Bos taurus taurus</i>)		◆	Flamingo (<i>Phoenicopterus spp.</i>)
◆		Wolf dog hybrid		◆	Golden pheasant (<i>Chrysolophus pictus</i>)
	◆	Sealion (<i>Zalophus californianus</i>)		◆	Cockatiel (<i>Nymphicus hollandicus</i>)
	◆	Vietnamese pot-bellied pig (<i>Sus scrofa</i>)		◆	Budgerigar (<i>Melopsittacus undulatus</i>)
	◆	Buffalo (<i>Syncerus spp</i>)		◆	Lovebird (<i>Agapornis spp.</i>)
	◆	Polecat (<i>Mustela putorius</i>)		◆	Zebra finch (<i>Poephila guttata</i>)
	◆	Chinchilla (<i>Chinchilla lanigera</i>)		◆	Green iguana (<i>Iguana spp</i>)
	◆	Ferret (<i>Mustela nigripes</i>)		◆	King Snake (<i>Lampropeltis spp.</i>)
	◆	Siberian chipmunk (<i>Tamias spp</i>)		◆	Burmese python (<i>Python molurus</i>)
	◆	Alpaca (<i>Llama pacos</i>)		◆	Tortoise (<i>Testudo spp.</i>)
	◆	Guinea pig (<i>Cavia porcellus</i>)		◆	Red-eared turtle (<i>Chrysemys scripta</i>)
	◆	Angora rabbit (<i>Oryctolagus cuniculus</i>)		◆	Red-kneed tarantula (<i>Brachypelma spp</i>)
◆		Shetland pony (<i>Equus caballus caballus</i>)		◆	Indian stick insect (Phasmidae)
	◆	Mara (<i>Dolichotis patagonum</i>)		◆	Tropical butterflies
	◆	Red squirrel (<i>Sciurus vulgaris</i>)	◆		Honey bee (<i>Apis mellifera</i>)
	◆	Grey squirrel (<i>S. carolinensis</i>)		◆	Cockroach (Blatidae)
	◆	Degu (<i>Octodon degus</i>)		◆	African giant land snail
	◆	Meerkat (<i>Suricata suricata</i>)		◆	Goldfish
	◆	African gerbil (<i>Gerbillus spp.</i>)		◆	Koi carp
	◆	Peafowl (<i>Pavo spp.</i>)		◆	Dogfish
	◆	Canada goose (<i>Branta canadensis</i>)		◆	Piranha (<i>Piranha spp.</i>)
	◆	Bar-headed goose (<i>Anser indicus</i>)			

GENERAL CONCLUSIONS

This study was designed to investigate and assess the current status of the UK zoological collections and whether their standards have improved since 'The Zoo Inquiry' and the implementation of the new legislation. Do the reasons that once fuelled the 'zoo debate' still exist?

The overall conclusion from this investigation is that despite claims of improvement since the enforcement of the new legislation, there still appears to be the occurrence of problems similar to those highlighted in the 1994 'Zoo Inquiry' and therefore, this gives justification that the 'zoo debate' is clearly not over.

The anti-captivity side of the debate defends the idea that the existence of zoos is not justifiable in the 21st century since zoos do more harm than good.

The pro-captivity side of the debate defends the idea that zoos do have a justifiable role in society having improved their commitment to positive work since they do not harm anymore (although it is accepted that harm was caused in the past, or may occur currently abroad), and that they do provide a great deal of good work, such as conservation, education or research.

The findings of the 'UK Zoo Review' supports more the claims of the anti-captivity side than the pro-captivity side, based on the following conclusions:

Do zoological collections in the UK cause harm?

Poor animal welfare

- The occurrence of indications of potential poor animal welfare in UK zoological collections is not negligible.
- Events occur in all 'types' of UK zoological collections that might affect the individual animals in an aversive way.
- Both abnormal behaviour and signs of frustration in animals were seen to occur in UK zoological collections with such a frequency and intensity that the chances of witnessing a case of either of these in a randomly selected visit to a randomly selected collection, is high.
- Stereotypic behaviour, often considered a good sign of poor welfare, is not absent in modern UK zoological collections. The occurrence of stereotypia in UK zoological collections is not negligible, and it is possible that the number of animals with established abnormal behaviour could be counted in thousands.

Zoonoses

- In the majority of UK zoological collections animal/visitor contact occurs, which can constitute a risk of zoonoses for both the animals and the visitors. Annual unauthorised visitor/animal contacts in the UK zoological collections might well be counted in millions.
- There are not grounds to believe that in the UK zoological collections the high occurrence of human/animal contact is compensated by thoroughness in the prevention of zoonoses.

Lack of protection

- The majority of the UK zoological collections have cases of visitor misconduct that might cause a negative effect to the animal's welfare. In a year it might be justified to say that such cases might be counted in millions. The high occurrence of cases might be due to the lack of interest by the zoo staff in challenging visitor misconduct.

Misleading

- The UK zoological collections PR exercises can be responsible for misleading the general public to believe that zoos perform more conservation and research than they actually do.

Illegal

- The percentage of UK zoological collections that might be operating without a zoo licence, and therefore that do not have the proper inspections that guarantee a standard of welfare for the animals and safety for the public, is not negligible.

Do zoological collections in the UK compensate any harm by producing a great deal of good work?Conservation work?

- Every 'type' of zoological collection in the UK has a very low percentage of threatened taxa, regardless of size, or if it is a member of the Federation of Zoos.
- The percentage of critically endangered taxa in UK zoological collections is negligible.
- The immense majority of the breeding taxa in UK zoological collections do not belong to a co-ordinated captive-breeding programme.
- Reintroduction into the wild of endangered animals from the UK zoological collections is extremely rare.
- Describing UK zoological collections as institutions that regularly 'save' threatened species is extremely inaccurate.

Research work?

- The relative contribution to published scientific work from the UK zoological collections is very small. The majority of the collections have not produced any published research in the last 24 years.
- The average UK zoological collection produces a single scientific paper every 15 years.

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