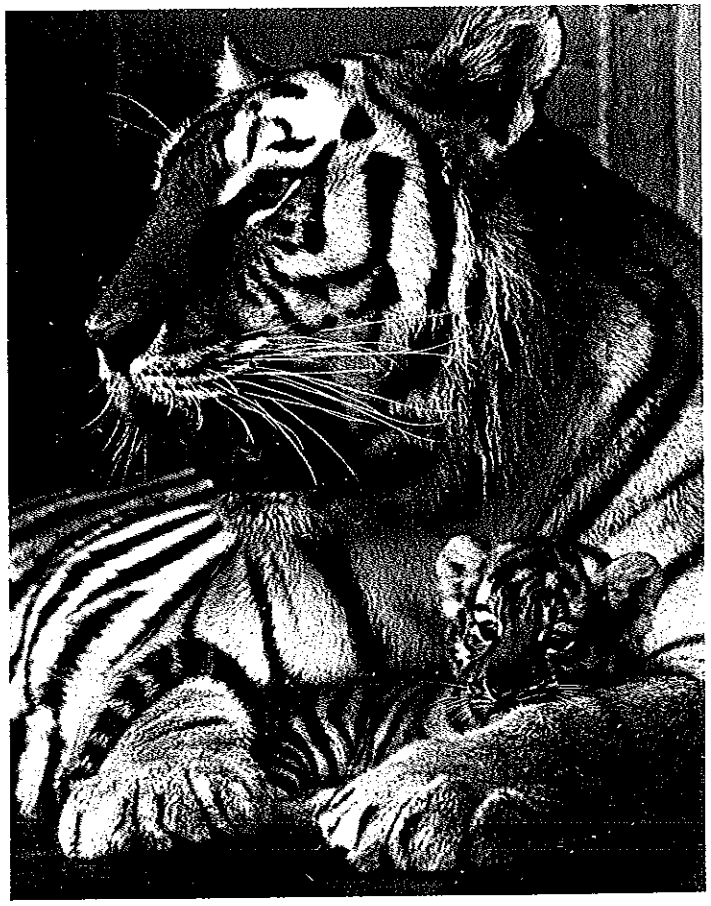
CITES Appendix I Species in Captivity 1977–1981

A survey of the maintenance and breeding of captive mammals, birds, reptiles, and amphibians from three data sources

by

Lynn Gray-Schofield



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COVER

The tiger (*Panthera tigris*) is an example of an Appendix I species that is breeding well in captivity. All tiger subspecies (with the exception of *P. t. altaica*) are listed on CITES Appendix I. Photo by Bill Meng, New York Zoological Society.

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Lynn Gray-Schofield
Staff Biologist

Foreword

This report, entitled "CITES Appendix I Species in Captivity, 1977 through 1981: A survey of the maintenance and breeding of captive mammals, birds, reptiles, and amphibians from three data sources," contains information that will be invaluable to all those concerned with endangered species. It provides very important information in regard to the work of zoological parks and aquariums in providing sanctuary for critically endangered wildlife and helps in the selection process for those species to be included in the American Association of Zoological Parks and Aquariums' Species Survival Plan. The publisher, TRAFFIC(U.S.A.), is to be commended for this compilation of data. The staff biologist, Lynn Gray-Schofield, compiled the data in a most useful and readable format.

In addition to being an important source of information for zoological park and aquarium staff members, this report will be of equal importance to CITES Scientific Authorities throughout the world in considering the appropriateness of issuing both export and import permits for CITES Appendix I species.

TRAFFIC(U.S.A.) has long been highly regarded for its efforts in monitoring the trade in endangered and other protected species of wildlife. This paper is yet another indication of its most noteworthy efforts to provide important information on which species are being trafficked in, by whom, and for what purposes.

Robert O. Wagner
Executive Director
American Association of Zoological Parks
and Aquariums

Acknowledgments

I am indebted to Nicole Duplaix, David Mack, and Linda McMahan for helping to make this report a reality. I owe particular thanks to Lynne Hardie Lehman for suffering through all the necessary changes and revisions. I especially want to thank Judith Block for all of her invaluable help and comments, and Laura Grady, who in addition to providing useful comments, initiated data compilation several years ago. I also appreciated all the helpful comments of Devra Kleiman, Nate Flesness, Ginette Hemley, Nancy Roeper, and especially, Jon Barzdo.

Abstract

As wild animal populations decrease, the need for captive-breeding programs in zoos and other private breeding centers becomes more critical.

TRAFFIC(U.S.A.) compiled data for mammals, birds, reptiles, and amphibians listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) that were maintained and bred in captivity using as resources the International Zoo Yearbook, the International Species Inventory System, and the Inventory of Live Reptiles and Amphibians in North American Collections for the years 1977 through 1981.

Of the 357 animal species (excluding fish and molluscs) listed on CITES Appendix I, 215 were recorded as maintained in captivity, of which 150 species were recorded as producing at least first-generation young. Over half of the species maintained (215) and half of those that produced young (150) were mammals. Nearly one-third of the 215 Appendix I species reported to be maintained in captivity produced successful second-generation, captive-born young. Over 50 percent each of mammals, birds, and reptiles listed on Appendix I were recorded as maintained in captivity. Amphibians, however, were more poorly represented, with only two out of the twelve Appendix I species reported to be maintained in captive populations; neither of the two species were recorded as producing young.

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I. Introduction

Habitat destruction and wildlife trade are diminishing population levels of many animals worldwide. Captive-breeding programs to preserve species threatened with extinction are becoming increasingly important, with zoos and other private breeding centers playing a vital role in species conservation. Captive propagation may be the last resort for some species (Frankel and Soulé, 1981). Przewalski's horse (Equus przewalskii, Fig. 1), for example, probably is extinct in the wild and therefore is dependent on captive populations for its continued existence (Olney, 1979).

In addition to their role in wildlife conservation, zoos are an important source of public education. In the U.S., more than 100 million people visit zoos each year (Bendiner, 1981), representing nearly half of the total U.S. population. For many visitors, zoos provide a special opportunity to observe and learn about wild animals. Zoos, therefore can awaken in people the interest and concern for endangered species that are vital to the long-term survival of many animal species threatened with extinction in the wild.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was implemented in 1975. It has helped ease pressure on certain rare and endangered species by placing restrictions on the international trade of those animals and plants listed on the CITES appendices. CITES requires zoos or private collectors to meet exacting standards when importing rare animals or plants taken from the wild. Permits are issued only when both the exporting and importing countries determine that the taking is "not detrimental" to the wild population. These regulations and others make specimens from the wild less readily available, thereby increasing the importance of those already in captivity for breeding programs.

I have compiled maintenance and breeding data from 1977 through 1981 for captive populations of mammal, bird, reptile, and amphibian species listed on Appendix I of CITES[1]. The data presented in this paper are limited in nature due to the vastness and complexity of the topic. It is difficult to ascertain precise numbers of species in captivity, particularly where private collectors are involved. The purpose of this paper is to provide a general view, albeit a minimal one, of how Appendix I species are

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[1] CITES defines Appendix I animals and plants as "all species threatened with extinction which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances" (CITES Art. II, Sec. 2, 1973).

faring in captivity. This information may be useful to institutions or individuals wishing to identify species that are successful or difficult breeders in captivity. An example of possible use is as an aid in determining which species should be selected for the American Association of Zoological Parks and Aquariums' (AAZPA) Species Survival Plan (SSP). Existing criteria for SSP programs include rarity, founding stock of sufficient size, status of original habitat, research potential, educational value, and estimated cost (Muckenhirn, 1980). The previous captive-breeding history of a species might also be of value in determining which species would benefit most from an SSP program.

This paper also may aid CITES Scientific Authority officials (particularly those who do not have access to other captive-breeding data) in their determination of whether to grant import or export permits for Appendix I species. The CITES annual reports filed by member countries show that many Appendix I animals are presently in trade to zoos, involving species with large numbers already in captivity. TRAFFIC(U.S.A.) staff hopes this paper can be used to help evaluate the need for taking additional wild specimens to include in captive-breeding programs.

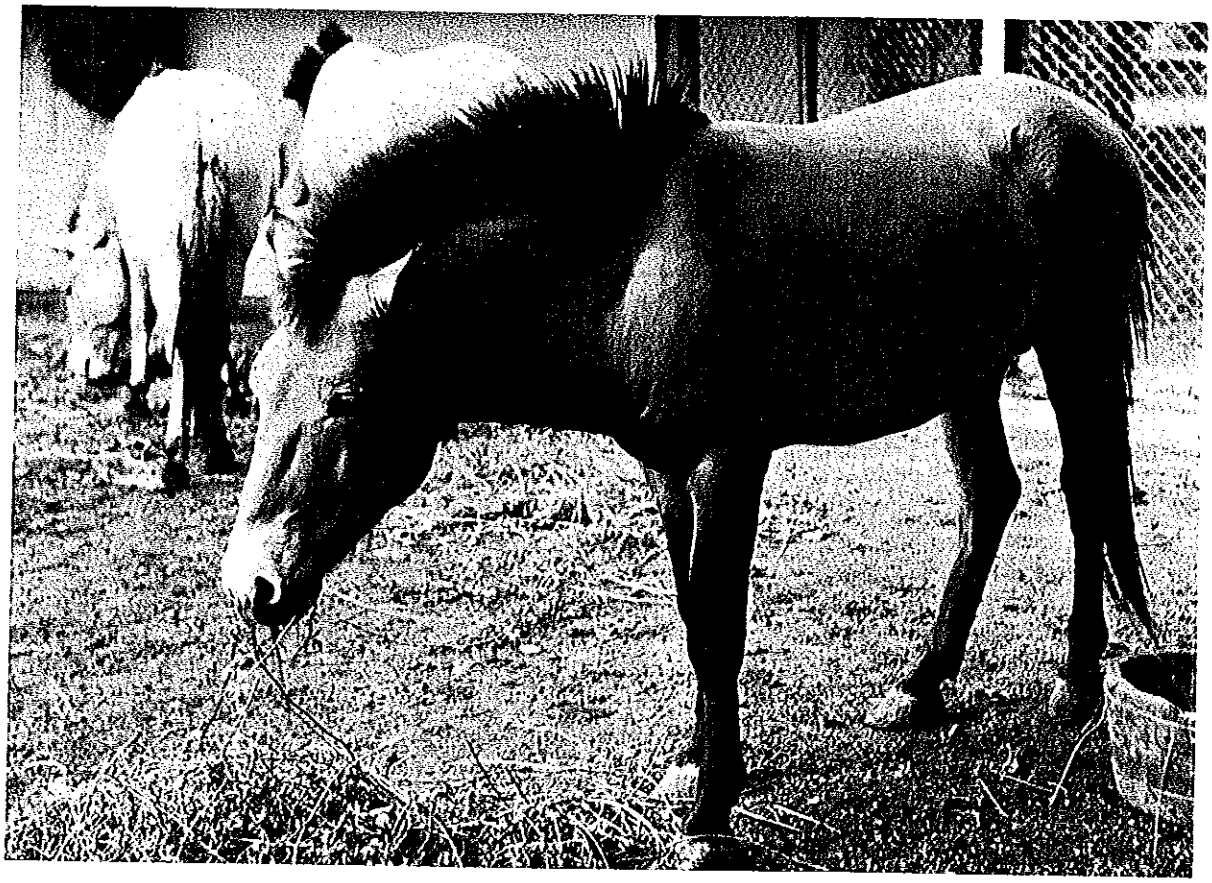

Fig. 1. Przewalski's horse (Equus przewalskii) shows the importance of maintaining species in captivity. Although extinct in the wild for several decades, this species is doing well in captivity, with over 376 animals reported in zoos in 1981. Photo by F. Vollmar, World Wildlife Fund.

II. Methods

This report includes data on maintenance and breeding in captivity for all mammals, birds, reptiles, and amphibians listed on CITES Appendix I. The scientific names and annotations are based on Appendices I and II as of 6 June 1981 which are listed in the Proceedings of the Third Meeting of the Conference of the Parties (CITES Secretariat, 1982).

A. Data Sources.

Maintenance and breeding data for mammals, birds, reptiles, and amphibians for the years 1977 through 1979 were compiled from the International Zoo Yearbook (IZY), Volumes 19 and 20 (Olney, 1979, 1980). The International Species Inventory System (ISIS) provided mammalian and avian data for the years 1979 through 1981. Reptile and amphibian data for the same period were compiled from Inventory of Live Reptiles and Amphibians in North American Collections (hereafter referred to as Inventory) by Frank Slavens (1980, 1981).

The data presented in this paper represent the annual maintenance and breeding totals for Appendix I species. The reader should refer to the three data sources listed above for detailed information on the number and names of institutions and/or private collectors involved in maintaining and breeding these species.

It should be noted that each of the three data sources is limited in scope to a certain extent. Each source is selective and not truly representative of all Appendix I animal species in captivity. The sources are, however, the best generally available and provide an overall view of the status of many rare species in captivity.

1. International Zoo Yearbook (IZY) is published annually by the Zoological Society of London and supplies invaluable information regarding captive wild animal species. Its two sections entitled "Census of Rare Animals in Captivity" and "Species of Wild Animals Bred in Captivity and Multiple Generation Births" provide the model and format basis for the "rare" and "bred" columns in the appendices in this report. As its title suggests, IZY contains the best summary data relating to species maintained in captivity worldwide.

In 1979, 194 institutions responded to the section of the IZY survey pertaining to captive-breeding data programs. This number represents about 41% of the total number of institutions that supplied IZY with general breeding information.

Please note the following points in reference to IZY data:

- For certain species, IZY contains no information on the total number of individuals maintained in captivity ("rare" column), although breeding data is available for those species ("bred" column). Generally this is the case when large populations of a species occur in captivity. One example is the chimpanzee (Pan troglodytes). Although rare in the wild, this species is relatively common in zoos. Other examples are footnoted in the appendices with the symbol " ◇ ". The census IZY sends to zoos is based on species listed in the International Union for Conservation of Nature and Natural Resources' (IUCN) Red Data Books plus "certain taxa which, although not necessarily rare and endangered in the wild, are rare in zoos and of great interest to zoos" (Olney, 1980:449). Some mammals, birds, and reptiles, although listed on CITES Appendix I and endangered in their natural habitats, are relatively common in captivity and breed regularly. These animals have been omitted from the IZY census. IZY maintains that these species' exclusion from the census "in no way invalidates the urgency of instituting captive-breeding programs for their survival" (Olney, 1980:449).

- IZY compilers note those species that have successfully bred to the second-generation in captivity (F_2 generation). These examples are given an asterisk (*) in the appendices. This information was checked for the year 1978 only.

- Although IZY contains information on multiple-generation births, the data underestimate the number in captivity, particularly in cases where the status of the parents is unknown.

2. International Species Inventory System (ISIS) is a computer-based information system that contains records on the status of animals in most American Association of Zoological Parks and Aquariums (AAZPA) institutions plus a small but growing number of other zoos (Foose, 1981). The ISIS system is housed at the Minnesota Zoological Garden, 12101 Johnny Cake Ridge Road, Apple Valley, Minnesota, 55124. ISIS information was compiled from records stored on microfiche; I used copies available at one of the participating zoos, the National Zoological Park, Washington, D.C. Currently, the ISIS system maintains records for mammals and birds only, with information on over fifty thousand living animals. Biological data recorded include age, sex, place of birth, and parentage, in addition to summary data on the captive population (sex ratio, age distribution, etc.).

Although ISIS receives data from fewer institutions than does IZY, ISIS provides the most up-to-date information on species in captivity. Participation in ISIS is growing yearly, although it is presently limited mostly to North American institutions. As of June 1, 1981, 123 North American and 8 European zoos submitted data to the ISIS network.

Please note the following points in reference to the ISIS data:

- ISIS contains information concerning the number of captive-born and wild-born specimens in captivity. These two categories do not, however, always equal the total number reported to be maintained in captivity because many zoos do not know the origin of some of their

specimens. Therefore, the captive-bred information recorded in the appendices reflects the minimum number of captive-born animals. For example, in 1981 ISIS reported 276 orangutans (Pongo pygmaeus) in captivity, with 165 captive-born and 67 wild-born individuals listed, which actually totals 232 individuals.

- ISIS compilers do not currently identify in their Species Distribution Report those animals that are second-generation captive-born. However, because data on parentage is collected by ISIS, in some instances second-generation captive-born animals can be traced, but this information is not included in this paper.

3. Inventory of Live Reptiles and Amphibians. ISIS does not presently contain data pertaining to reptiles and amphibians, and during the period of my analysis, IZY had not yet published information for the years following 1979. To fill this gap, reptile and amphibian information for the years 1979 through 1981 was compiled from Inventory of Live Reptiles and Amphibians in North American Collections (Inventory), by Frank Slavens (1980, 1981).

Inventory is a compilation of information solicited from public and private collections by Mr. Slavens. In 1980, 49 public and 33 private collections responded with information for 912 species. By 1981, participation had increased to 160 collections (70 public and 90 private) for 927 species.

Information supplied in Inventory is not always equivalent to that provided by IZY and ISIS because each system uses a different format. Consequently, I found it difficult to develop a standard method of recording reptile information in Appendix C of this report.

Please note the following points in reference to the Inventory data:

- Inventory provided no information on the number of captive-born specimens. Therefore, the numbers in the reptile and amphibian "rare" columns refer only to the quantity of animals known to exist in collections.

- Whenever possible, I have reported the number of births under the "bred" column. Numbers given in Appendix C indicate the total number of young reported born during the year. Many institutions indicated that a species had reproduced but did not provide data (e.g., "species produced young during 1980"). Other institutions reported that a certain number of animals were born or hatched but gave no indication as to how many survived. In some instances no current information exists, only the past breeding history of a species (prior to my reporting period) is given (e.g., "bred successfully 1972, 1974"). All information provided by Inventory that does not fit the format of this paper is either footnoted accordingly or noted with the symbol " # ".

- There were a few instances in which institutions reported the number of young that failed to survive (e.g., Morelet's crocodile, Crocodylus moreletii). This information is recorded in Appendix C,

identical in format to the breeding data given by IZY and ISIS: the total number born, followed by, in parenthesis, the number failing to survive.

The information in Inventory is limited to North American collections, but analysis of the data suggests that private collectors may play an important role by maintaining and breeding certain rare species in captivity. A good example may be the endangered Jamaican boa (Epicrates subflavus) of which 111 of the 155 animals (71.6%) reported in captivity in 1980 were maintained by one private collector.

B. Data compilation.

1. Rare column. The "rare" column lists the number of specimens in captivity followed by, in parenthesis, the number of those that were born in captivity, e.g., the numbers 32(24) indicate that there are 32 animals in collections, of which 24 are captive born.

The IZY and Inventory data for the "rare" column represent the status of collections on 1 January of each year. ISIS data are compiled through December 31 of each year. Therefore it is assumed that those individuals present in collections on December 31, 1980 are maintained into 1981.

There is no overlap of information for the three data sources. Information compiled for 1979 contains numbers of specimens maintained in 1979 but includes number of specimens born in 1978. For example, Volume 20 of IZY (1980) reports information on those animals that were born in 1978 (and therefore included in the "bred" column for 1978), and maintained in captivity as of January 1, 1979 (these animals maintained in 1979 are included under the "rare" column for 1979). This particular volume of IZY (1980) does not include data on species born during 1979.

ISIS provides information on mammals and birds current as of December 31 for each year, 1979 for this particular example. It is assumed that those specimens reported in captivity on December 31, 1979 were maintained into 1980. This information is then reflected in the 1980 "rare" column. Also, data on those species born in 1979 were given and recorded in the 1979 "bred" column.

The same is true for the Inventory and IZY reptile and amphibian data - no overlap occurs. Inventory (1980) contains information on those species born ("bred") in 1979 and maintained as of January 1, 1980 (therefore the animals maintained in 1980 are included under the "rare" column for 1980).

2. Bred column. The "bred" column depicts the total number of animals born followed by, in parenthesis, the number failing to survive as reported by institutions to IZY, ISIS, and Inventory. For example, the numbers 14(2) indicate that 14 animals were born, and 2 did not survive. Although the time criterion for survival was not indicated by zoos responding to the IZY survey, in many major zoos it is considered to be 30 days or more (Olney, 1980). ISIS compilers collect mortality data for all age groups but do not give information directly relating births and neonatal deaths. For purposes

of this paper, I used six months as the survival criterion for the ISIS information.

There are inconsistencies in the reporting of the survival data: some zoos or institutions reported only how many animals were born without indicating how many of them had died; some reported only the number of survivors. For example, in 1977 Patuxent Wildlife Research Center reported 2,128 births for masked bob-white (Colinus virginianus ridgwayi). I could not determine if this figure represents the total number hatched, with no deaths reported, or if it is the total minus any deaths that may have occurred.

All data are for the calendar year indicated, except information from Perth and Sydney, Australia, which report (for IZY only) from July through June.

3. Taxonomic identification. Species names sometimes differ among data sources used in this paper and their listing on CITES Appendix I. For example, the Laysan duck is Anas laysanensis under CITES but is listed as Anas platyrhynchus laysanensis in IZY. I assumed these were the same animal and other sources listed below confirmed this assumption. In some instances, I had difficulty determining the accuracy and spelling of scientific and common names due to the lack of a definitive source. Mammal Species of the World: A Taxonomic and Geographic Reference (Honacki, et al., 1982 - hereafter called Mammals) was used to accurately identify the scientific names of mammals. I used A Complete Checklist of the Birds of the World (Howard and Moore, 1980 - hereafter called Birds) as the main source for verifying scientific names of birds and World Checklist of Endangered Amphibians and Reptiles (Groombridge, 1981 - hereafter referred to as Reptiles) as a reference for reptiles and amphibians. Common Names of Species Listed on Appendices I and II (CITES Secretariat, 1981) was used as the principal source for usage and spellings of English common names, in addition to other references.

In cases where a species is referred to by either of two scientific names, one name is written inside a parenthesis. For instance, the radiated tortoise is referred to as Geochelone (Testudo) radiata in this report.

4. Species and subspecies listing. If an animal is listed on CITES Appendix I by genus or species, and I found subspecies data in the sources, those data were included. The symbol " † " is used to designate the inclusion of subspecies data. This symbol appearing immediately following the species name indicates that all information given includes subspecies data. When data are reported for only one subspecies, the information is footnoted accordingly. Conversely, when a subspecies is listed on CITES Appendix I but information is reported by IZY, ISIS, and Inventory for the species only, the data are not included.

5. Genus and family listing. In many instances, an entire genus or family is listed on CITES Appendix I. In these cases, only those species falling under the genus or family, listed in the references (Mammals, etc.) and reported to be maintained and/or bred in captivity are recorded in the appendices. For example, the genus Bettongia (rat-kangaroos) is listed on

CITES Appendix I. Of the three species of rat-kangaroos listed in Mammals, Bettongia lesueuri, B. gaimardi, and B. penicillata, only the latter species appears to be maintained in captivity; no data are reported for the other two species. Therefore, only B. penicillata appears in Appendix A.

I did not report data for those genera listed on CITES Appendix I in which no member species are reported to be in captivity (e.g., South American river dolphins, Sotalia spp.). I only listed the genus in its respective table with the symbol "nd," denoting no data, recorded for every year.

6. Localized populations. In certain cases, only a localized population for a species has Appendix I status. For example, the Indian population of rusty-spotted cat (Felis rubiginosa) is listed on Appendix I. I included data for all F. rubiginosa because it is impossible to determine the population origin of individuals listed in the data sources. I followed the same procedure for all similar cases concerning specific populations.

7. How to interpret data in the appendices. In most instances, the data recorded in the appendices represent, at best, the minimum number of animals being maintained and bred in captivity. Not all zoos responded to the surveys and not all breeding data may have been reported. Since IZY and ISIS data are, in general, restricted to zoos and related establishments, information is seldom available for private collections. In addition, information from many primate-breeding laboratories is not reflected in the appendices.

Several private aviculturists and reptile collectors have achieved excellent breeding success for certain rare species. Breeding data compiled by some private collectors are provided for reptiles by Slavens (1980, 1981) and for birds by Muller (1981).

One problem with both the "bred" and "rare" categories is that not all zoos have been consistent in their reporting over the years. This can be particularly misleading in the case of an animal that is maintained in only one or two collections. If data are absent for that particular species in one year and recorded in the next, one cannot determine whether the zoos merely failed to report for the year in question or whether the absence is due to lack of births represented in the "bred" column, or due to deaths represented in the "rare" column.

Information may suddenly be reported for a species that had no data in previous years. For example, there were no data reported for the red spider monkey (Ateles geoffroyi panamensis) prior to 1980. One institution in 1980 reported it had one female, 10 years old. Such instances may occur when an institution first joins ISIS or when an institution responds to the Inventory or IZY survey for the first time. Taxonomic re-ordering could also cause information to suddenly appear for a particular species. Decreases in numbers of specimens between consecutive years also occur without a corresponding number of deaths being reported. Although the sources provide no explanation, this may happen if a species is misclassified for one of the years involved, if an institution fails to report for that particular year, or if animals leave reporting institutions.

III. Results

Following the Third Meeting of the Parties in New Delhi, March 1981, a total of 3 families, 27 genera, 265 species, and 68 subspecies of mammals, birds, reptiles, or amphibians were listed on CITES Appendix I. The 3 families and 27 genera total 92 species (Table 1). Therefore a total of 357 mammal, bird, reptile, and amphibian species and 68 subspecies receive Appendix I protection.

The maintenance and breeding data for all CITES Appendix I species are given in the appendices (mammals in Appendix A, birds in Appendix B, reptiles and amphibians in Appendix C). Appendix D contains the maintenance and breeding data totals for the mammal, bird, reptile, and amphibian genera and families specifically listed on Appendix I.

Over half of the animal species (excluding fish and molluscs) listed on Appendix I are mammals (Fig. 2). The breakdown for all Appendix I listings by class is as follows: 181 species and 39 subspecies of mammals; 105 species and 23 subspecies of birds; 59 species and 5 subspecies of reptiles; and 12 species and 1 subspecies of amphibians (Table 1).

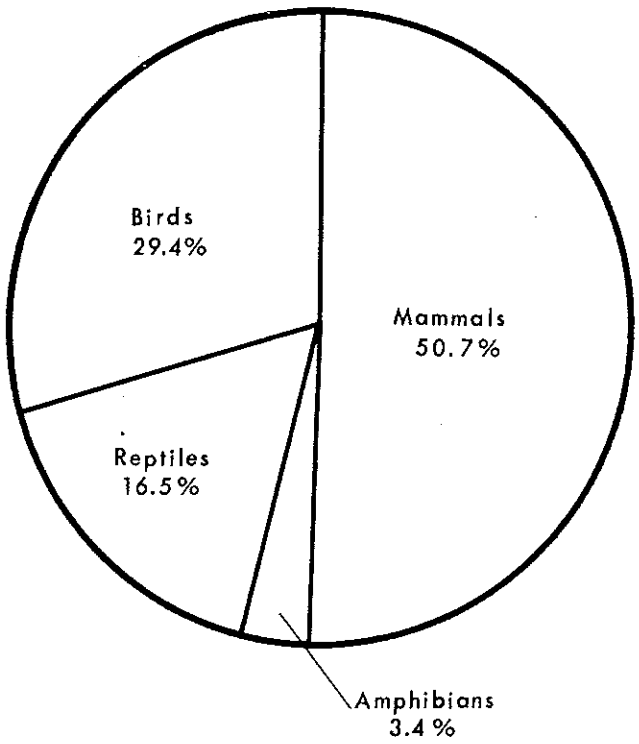

Fig. 2. Animal species listed on CITES Appendix I (total 357 mammal, bird, reptile, and amphibian species).

Table 1. Number of species and subspecies listed on CITES Appendix I.

	Family listings		Genera listings		Specific listings			
	No. of families	No. of species in families	No. of genera	No. of species in genera	No. of species	No. of subspecies		Totals
Mammals	2	9	20	55	117	39	=	181 species 39 subspecies
Birds	–	–	1	1	104	23	=	105 species 23 subspecies
Reptiles	1	6	5	13	40	5	=	59 species 5 subspecies
Amphibians	–	–	1	8	4	1	=	12 species 1 subspecies
Total	3	= 15 spp.	27	= 77 spp.	265 spp.	68 ssp.		

A total of 357 species and 68 subspecies are listed on CITES Appendix I (including combined number of species in each genus and family).

The following analysis relates only to species listed on CITES Appendix I. I did not attempt to analyze subspecies data, other than to provide information on the number of subspecies listed on Appendix I for each class (Table 1).

A. Number of species maintained in captivity.

Sixty percent of all species listed on Appendix I are recorded as maintained in captivity, a total of 215 species (Table 2). Any species that had at least one specimen reported in captivity for the years 1977 through 1981 was considered as being "maintained," including those species with only "bred" data. The class breakdown reveals that over half (52.1%) of the CITES Appendix I species maintained in captivity are mammals (112 spp.). The percentages for the other classes are 26.5% for birds (57 spp.), 20.5% for reptiles (44 spp.), and 1% for amphibians (2 spp.) (Fig. 3).

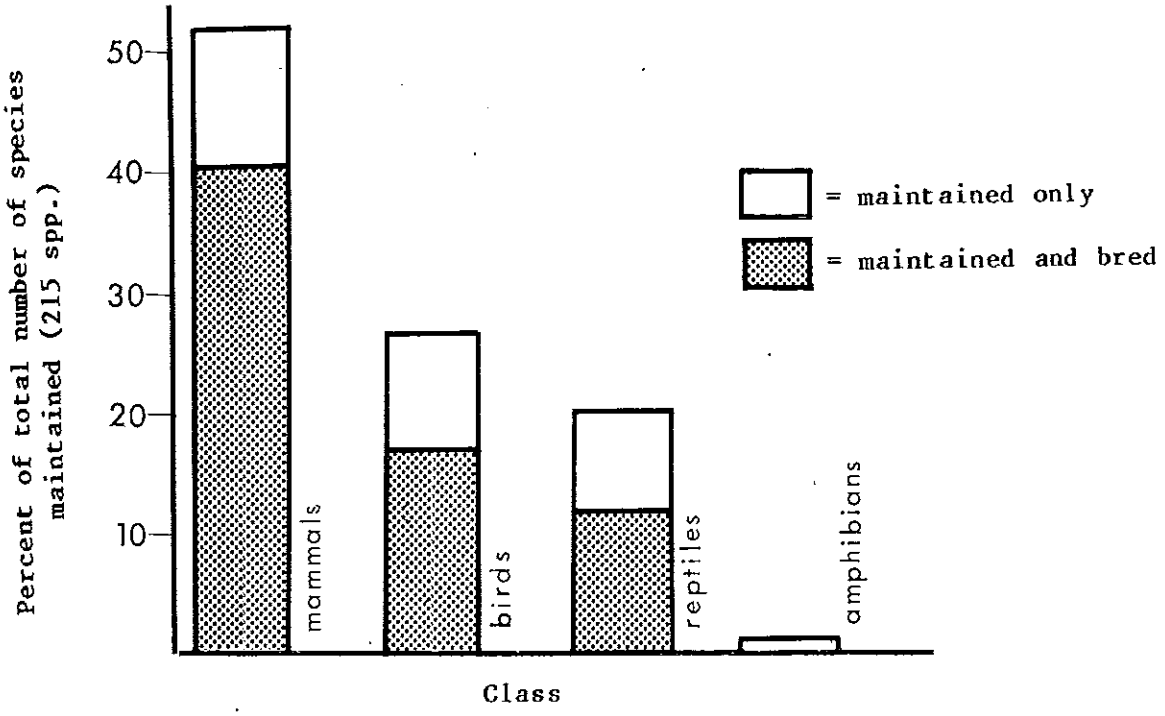

Fig. 3. Appendix I species maintained and bred in captivity, by class, as a percentage of the total number of species maintained (215).

B. Number of species bred in captivity.

A total of 150 Appendix I species were reported to have produced young from 1977 through 1981, equalling 42% of all species listed on Appendix I. Again, mammals composed the largest percentage (58.7%) of this total, with 88 species producing captive-born young. Birds (37 spp.) totalled 24.7%, followed by reptiles (25 spp.) with 16.7%. No amphibians were reported to have produced young.

When comparing the number of Appendix I species bred, by class, to the total number of species actually maintained in captivity (215), the pattern remains consistent, with mammals accounting for the highest percentage (40.9%) (Fig. 3). One-quarter (25.6%) of all Appendix I species reported to be maintained in captivity did not produce any young from 1977 through 1981.

Nearly 80% (88 spp.) of the 112 mammal species maintained in zoos produced young. The percentage of species bred compared to species maintained is less for the other classes: 64.9% for birds; 56.8% for reptiles; and 0% for amphibians (Table 2).

Table 2. Number of CITES Appendix I species maintained and bred in captivity.

Class	No. of species listed	Species maintained		Species bred	
		No.	% of species listed[a]	No.	% of species maintained[b]
Mammals	181	112	61.9	88	78.6
Birds	105	57	54.3	37	64.9
Reptiles	59	44	74.6	25	56.8
Amphibians	12	2	16.7	0	0
Total	357	215	60.2	150	69.8

[a] These percentages are the ratio of the number of species maintained in each class divided by those listed on Appendix I.
[b] These percentages are the ratio of the number of species bred in each class divided by those maintained.

C. Mammals.

Out of the 181 mammal species listed on Appendix I, 112 (61.9%) are reported to be maintained in captivity (Fig. 4). Eighty-eight (48.6%) of these produced young during the four-year study period (Table 3).

The four mammalian orders with the largest number of species maintained in captivity are Primates (48 spp.), Carnivora (24 spp.), Artiodactyla (21 spp.), and Perissodactyla (8 spp.) (Table 3, Figs. 5, 6, 7). Percentages for species bred as compared to species maintained for these four orders were also high: 81.2%, 83.3%, 85.7%, and 100%, respectively. The breeding success of these four orders is especially noteworthy when comparing it to that of the remaining nine mammalian orders listed on Appendix I. For these nine orders combined, only 27.3% of the species maintained were reported to have produced young.

Table 3. Number of mammal species maintained and bred in captivity, by order.

Order	No. of species listed	Species maintained		Species bred	
		No.	% of species listed[a]	No.	% of species listed[b]
MAMMALS					
Marsupialia	16	1	6.2	1	6.2
Primates	66	48	72.7	39	59.0
Edentata	1	1	100.0	0	0
Pholidota	1	0	0	0	0
Lagomorpha	2	1	50.0	0	0
Rodentia	8	3	37.5	1	12.5
Cetacea	16	0[c]	0	0	0
Carnivora	28	24	85.7	20	71.4
Pinnipedia	4	1	25.0	0	0
Proboscidea	1	1	100.0	1	100.0
Sirenia	3	3	100.0	0	0
Perissodactyla	10	8	80.0	8	80.0
Artiodactyla	25	21	84.0	18	72.0
Total	181	112	61.9	88	48.6

a These percentages are the ratio of the number of species maintained in each order, divided by those listed on Appendix I.

b These percentages are the ratio of the number of species bred in each order, divided by those listed on Appendix I.

c Although one blue whale (Balaenoptera musculus) was reported to be in captivity in 1980, information was found to be erroneous (N. Flesness, pers. comm.).

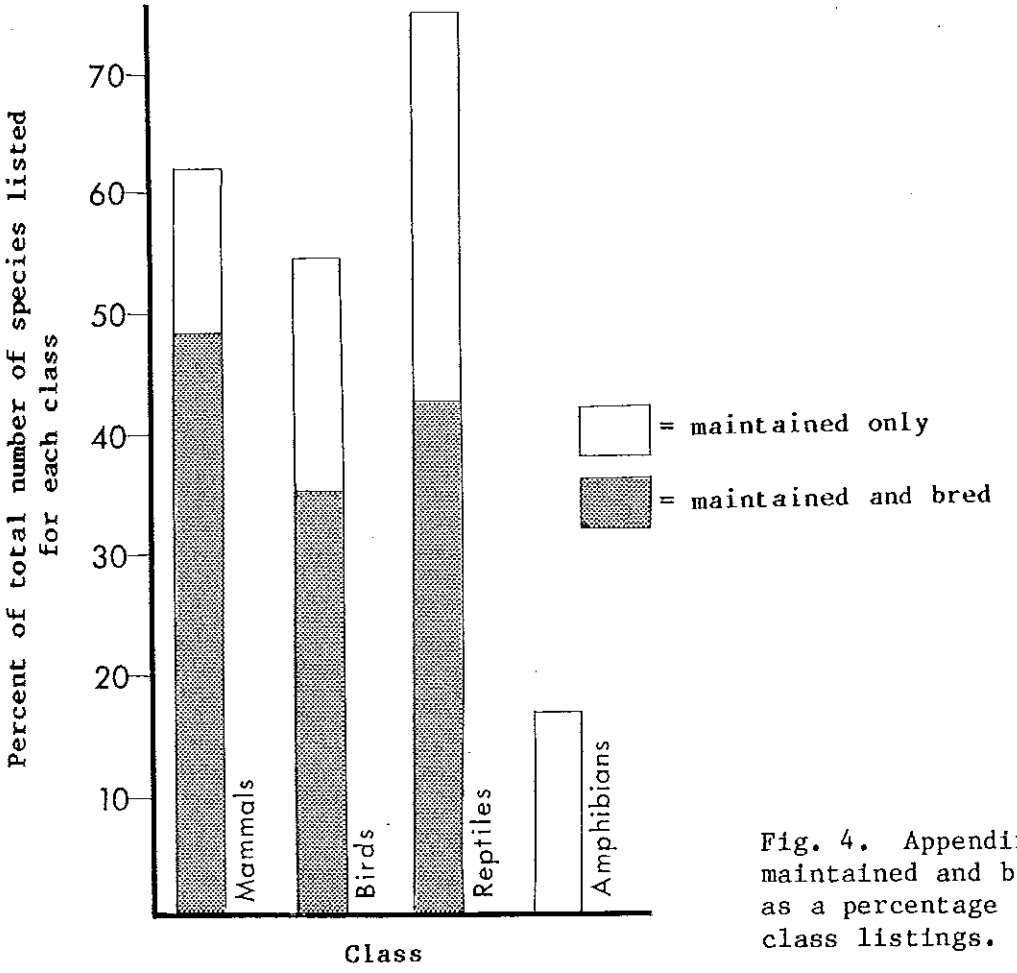

Fig. 4. Appendix I species maintained and bred in captivity, as a percentage of individual class listings.

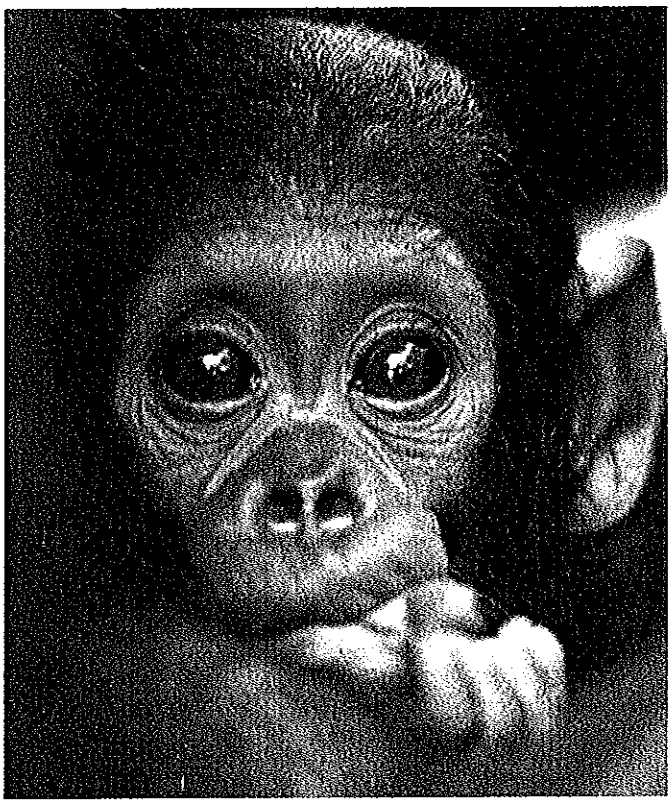

Fig. 5. Of all Appendix I species, chimpanzees (Pan troglodytes) have the highest number of individuals reported to be maintained in captivity - 1,367 animals in 1981. Photo by Geza Teleki.

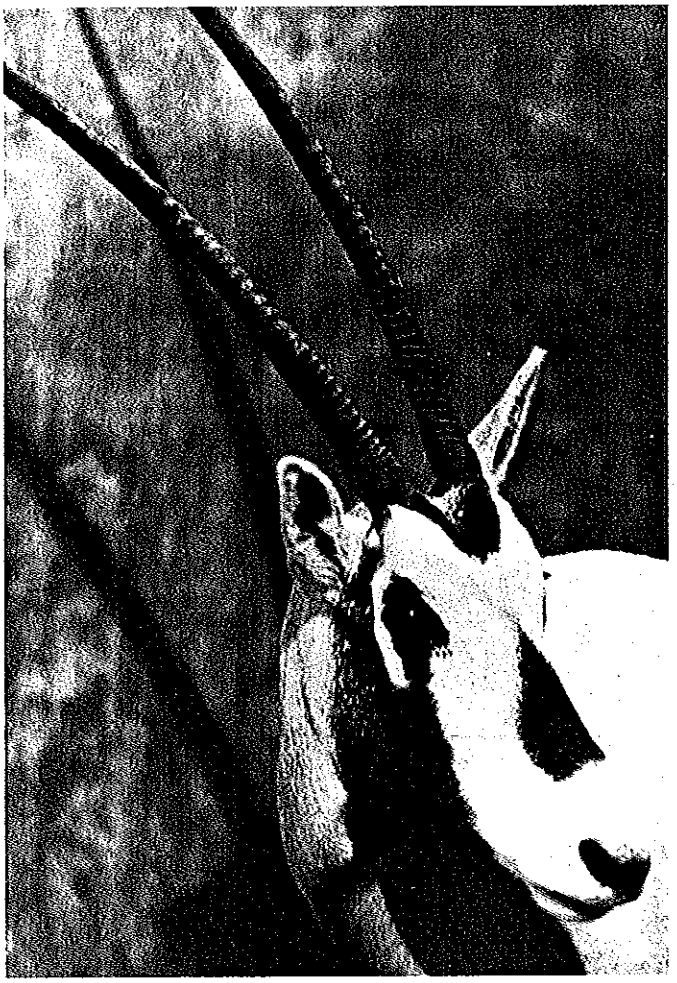

Fig. 6. Formerly extinct in the wild, Arabian oryx (Oryx leucoryx) are doing well in captivity, with 171 individuals reported in collections in 1981. The species has recently been introduced to the wild in Oman. Photo by World Wildlife Fund.

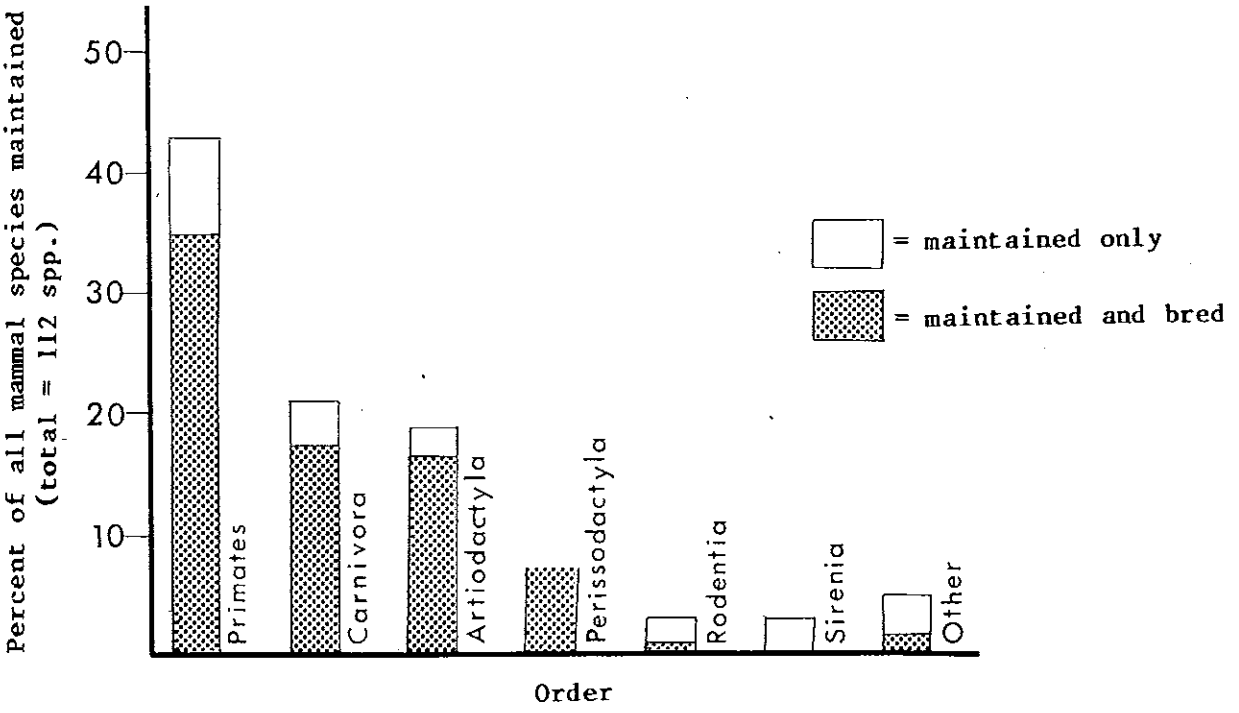

Fig. 7. Appendix I mammal species maintained and bred in captivity, by order.

D. Birds.

Birds constitute the second largest group in terms of number of species listed on Appendix I (105), number of species maintained (57), and number of species bred (37) (Table 4, Fig. 8). Only 54.3% of all Appendix I bird species, however, are recorded as maintained as compared to 61.9% for mammals and 74.6% for reptiles (Table 2, Fig. 4).

A total of 19 bird orders are listed on Appendix I, with the order Galliformes containing the largest number of species (23) (Table 4). Compared to the mammalian orders, the bird orders have lower percentages in terms of number of species bred in relation to number of species maintained. The percentages are as follows: Gruiformes 71.4%, Galliformes 70.6%, Psittaciformes 45.4%, and Falconiformes 44.4% (Fig. 9). For the other 15 bird orders combined, 85% of the species recorded as held in captivity produced young. This figure is somewhat misleading, however, because no species were maintained for eight of these orders.

Fig. 8. Rothschild's mynah (Leucopsar rothschildi) has the highest number of individuals reported to be maintained in captivity for all Appendix I bird species. Photo by National Zool. Park, Smithsonian Instit.

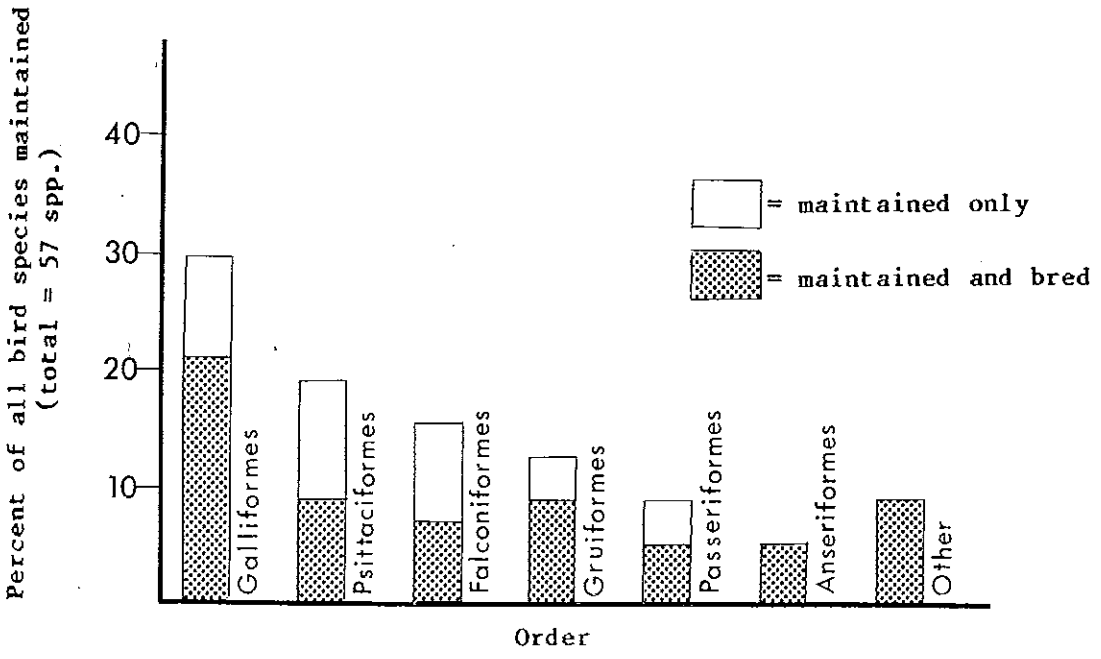

Fig. 9. Appendix I bird species maintained and bred in captivity, by order.

Table 4. Number of bird species maintained and bred in captivity, by order.

Order	No. of species listed	Species maintained		Species bred	
		No.	% of species listed[a]	No.	% of species listed[b]
BIRDS					
Rheiformes	1	1	100.0	1	100.0
Tinamiformes	1	1	100.0	1	100.0
Sphenisciformes	1	1	100.0	1	100.0
Podicipediformes	1	0	0	0	0
Procellariiformes	1	0	0	0	0
Pelecaniformes	2	0	0	0	0
Ciconiiformes	2	1	50.0	1	50.0
Anseriformes	5	3	60.0	3	60.0
Falconiformes	12	9	75.0	4	33.3
Galliformes	23	17	73.9	12	52.2
Gruiformes	11	7	63.6	5	45.4
Charadriiformes	3	0	0	0	0
Columbiformes	2	1	50.0	1	50.0
Psittaciformes	24	11	45.8	5	20.8
Strigiformes	3	0	0	0	0
Apodiformes	1	0	0	0	0
Coraciiformes	1	0	0	0	0
Piciformes	1	0	0	0	0
Passeriformes	10	5	50.0	3	30.0
Total	105	57	54.3	37	35.2

[a] These percentages are the ratio of the number of species maintained in each order, divided by those listed on Appendix I.

[b] These percentages are the ratio of the number of species bred in each order, divided by those listed on Appendix I.

E. Reptiles.

Of the 59 reptile species listed on Appendix I, 74.6% (44 spp.) are reported to be maintained in captivity (Table 5, Fig. 4). This is the highest ratio of species maintained compared to species listed for any class of animals. Only 25 species (42.4% of the reptile species listed on Appendix I), however, produced young from 1977 through 1981 (Table 5).

The order Crocodylia has the largest number of species maintained (15 spp.) and bred (12 spp.) of all Appendix I reptile orders (Fig. 10). The 12 crocodilian species constitute nearly half (48%) of all reptile species recorded as breeding in captivity (Table 5).

There are varying degrees of success for the five reptile orders listed on Appendix I in terms of the number of species bred as a percentage of the number of species maintained (Fig. 10). The percentages range from a low of 0% (Rhynochocephalia) to a high of 83.3% (Serpentes). Of the total 44 species of reptiles maintained, 25 (56.8%) successfully bred (Table 2).

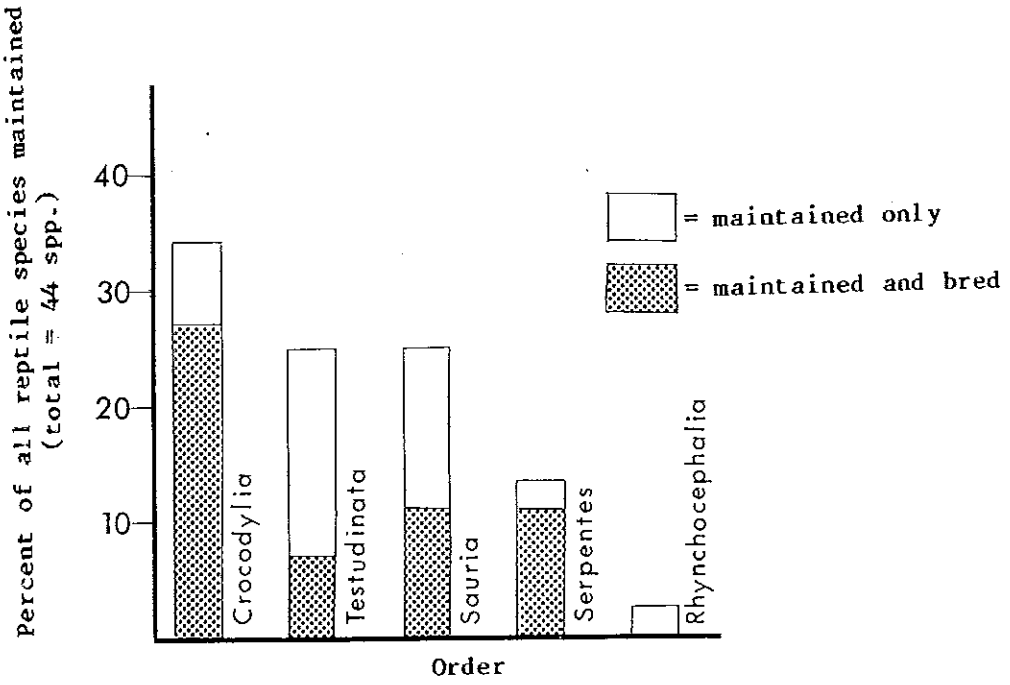

Fig. 10. Appendix I reptile species maintained and bred in captivity, by order.

F. Amphibians.

Two amphibian orders totalling 12 species are listed on Appendix I, with eight species belonging to the genus Nectophrynoides. Only two species, both belonging to the order Urodela, are recorded as maintained in captivity, totalling 16.7% of amphibian species listed on Appendix I (Table 5). No amphibian species successfully produced young during the four-year period (Table 5).

Table 5. Number of reptile and amphibian species maintained and bred in captivity, by order.

Order	No. of species listed	Species maintained		Species bred	
		No.	% of species listed[a]	No.	% of species listed[b]
REPTILES					
Testudinata	22	11	50.0	3	13.6
Crocodylia	15	15	100.0	12	80.0
Rhynchocephalia	1	1	100.0	0	0
Sauria	14	11	78.6	5	35.7
Serpentes	7	6	85.7	5	71.4
Total	59	44	74.6	25	42.4
AMPHIBIANS					
Urodela	2	2	100.0	0	0
Salienta	10	0	0	0	0
Total	12	2	16.7	0	0

a These percentages are the ratio of the number of species maintained in each order, divided by those listed on Appendix I.

b These percentages are the ratio of the number of species bred in each order, divided by those listed on Appendix I.

G. Species with more than 100 individuals in captivity.

To assess which species are potentially self-sustaining or close to it, an arbitrary number of individuals per population was chosen as a baseline. Many zoologists suggest that 100 individuals in a captive population is the minimum number necessary to achieve a genetically-diverse, self-sustaining population (Perry, et al., 1973; Pinder & Barkham, 1978; Muckenhirn, 1980). A high percentage of captive-born individuals in a population is another criterion considered vital to achieving the goal of self-sustaining populations. Perry (et al., 1973) suggests that at least 50% of the population should have been bred in captivity.

This paper, however, includes a discussion pertaining to only the former criterion, captive populations exceeding 100 individuals. The reader should refer to Perry's work and others cited in the reference section for a discussion of both criteria.

I have singled out those species whose combined captive populations are equal to or exceed 100 individuals (Table 6)[2]. Less than one-third (67 spp.) of the 215 mammal, bird, reptile, and amphibian species maintained in zoos are reported to have populations in captivity exceeding 100 individuals for any one year. Mammals compose over half of this total, with 36. Twenty bird species (30% of the total) have reported populations of at least 100 individuals. Reptiles compose approximately 15% of the total, with 10 species having over 100 animals in captivity. Only one Appendix I amphibian species, the Japanese giant salamander (Andrias japonicus, Fig. 11), has over 100 individuals in captivity, representing less than 2% of the total number of species with numbers exceeding 100 in captivity.

Since few zoos have the space or resources to support a population of over 100 animals of the same species, zoos worldwide have begun to work cooperatively on breeding programs. Through breeding loans, detailed record-keeping, and studbooks, genelines can be monitored and regulated, reducing the likelihood of inbreeding and preserving genetic diversity. The AAZPA's Species Survival Plan programs and the IUCN/Species Survival Commission's (SSC) Captive Breeding Specialist Group are both addressing these issues.

H. Second generation captive-born young. (F_2 births).

A successful breeding program requires that captive-born animals reproduce in captivity; that is, animals which themselves are born and raised in captivity must produce viable offspring[3]. The successful birth of a

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2 I do not wish to imply that maintaining over 100 animals of one species will assure a self-sustaining population. Rather, it is one criterion that should be considered when trying to predict the breeding success of a captive population. Naturally, the sex ratio, age distribution, fecundity, and other factors play vital roles in a population attaining self-sustenance.

3 IZY's criteria for an F_2 generation may not coincide with the CITES definition (Article 2.12).

Table 6. CITES Appendix I species with more than 100 individuals reported in captivity.

MAMMALS

Primates

Lemur catta (ring-tailed lemur)
Lemur fulvus (brown lemur)
Lemur macaco (black lemur)
Lemur mongoz (mongoose lemur)
Lemur variegatus (ruffed lemur)
Callimico goeldii (Goeldi's marmoset)
Leontopithecus (Leontideus) rosalia (golden lion tamarin)
Saguinus oedipus [incl. S. geoffroyi] (cotton-top tamarin)
Cercopithecus diana (roloway) (Diana monkey)
Macaca silenus (lion-tailed macaque)
Papio (Mandrillus) sphinx (mandrill)
Hylobates concolor (crested or black gibbon)
Hylobates lar (white-handed gibbon)
Hylobates muelleri (Bornean grey gibbon)
Pongo pygmaeus (orangutan)
Pan troglodytes (chimpanzee)
Gorilla gorilla (gorilla)

Rodentia

Chinchilla laniger (long-haired chinchilla)[1]

Carnivora

Canis lupus (Indian grey wolf)[2]
Ursus arctos (Italian brown bear)[3]
Lutra lutra (Eurasian otter)
Acinonyx jubatus (cheetah)
Neofelis nebulosa (clouded leopard)
Panthera onca (jaguar)
Panthera pardus (leopard)
Panthera tigris (tiger) [excluding P. t. altaica]
Panthera uncia (snow leopard)

Proboscidea

Elephas maximus (Asian elephant)

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[1] Only the South American population of Chinchilla laniger is listed on CITES Appendix I. The data sources do not indicate how many of the long-haired chinchillas in captivity are of South American origin.

[2] Only the Indian population of Canis lupus is listed on CITES Appendix I. The data sources do not indicate how many of the grey wolves in captivity are of Indian origin.

[3] Only the Italian population of Ursus arctos is listed on CITES Appendix I. The data sources do not indicate how many of the brown bears in captivity are of Italian origin.

Table 6. Continued.

MAMMALS (cont.)

Perissodactyla

Equus grevyi (Grevy's zebra)
Equus przewalskii (Przewalski's horse)
Tapirus indicus (Malayan tapir)
Ceratotherium (Diceros) simum (white rhinocerosos)
Diceros bicornis (black rhinoceros)

Artiodactyla

Cervus duvauceli (swamp deer)
Cervus eldi (Eld's or brow-antlered deer)
Oryx leucoryx (Arabian oryx)

Total 36 mammal species

BIRDS

Sphenisciformes

Spheniscus humboldti (Humboldt or Peruvian penguin)

Ciconiiformes

Geronticus eremita (hermit ibis)

Anseriformes

Anas laysanesis (laysan duck)
Branta sandvicensis (Hawaiian goose or nene)

Falconiformes

Vultur gryphus (Andean condor)
Haliaeetus albicilla (white-tailed sea eagle)
Haliaeetus leucocephalus (bald eagle)

Galliformes

Catreus wallichii (cheer pheasant)
Crossoptilon crossoptilon (white eared pheasant)
Crossoptilon mantchuricum (brown eared pheasant)
Lophophorus impeyanus (Himalayan monal pheasant)
Lophura edwardsi (Edward's pheasant)
Lophura swinhoii (Swinhoe's pheasant)
Polypectron emphanum (Palawan peacock-pheasant)
Syrmaticus humiae (bar-tailed or Hume's pheasant)
Syrmaticus mikado (Mikado pheasant)

Gruiformes

Grus japonensis (red-crowned or Manchurian crane)
Grus vipio (Japanese white-naped crane)

Table 6. Continued.

Psittaciformes

Alazona leucocephala (Cuban Amazon)

Passeriformes

Leucopsar rothschildi (Rothschild's mynah)

Total 20 bird species

REPTILES

Testudinata

Geochelone (Testudo) elephantopus (Galapagos giant tortoise)
Geochelone (Testudo) radiata (radiated tortoise)

Crocodylia

Crocodylus moreletii (Morelet's crocodile)
Crocodylus niloticus (Nile crocodile)
Crocodylus palustris (mugger crocodile)
Osteolaemus tetraspis (West African dwarf crocodile)
Gavialis gangeticus (gavial)

Sauria

Cyclura cornuta (rhinoceros iguana)

Serpentes

Epicrates inornatus (Puerto Rican boa)
Epicrates subflavus (Jamaican boa)

Total 10 reptile species

AMPHIBIANS

Urodela

Andrias (Megalobatrachus) japonicus (Japanese giant salamander)

Total 1 amphibian species

Note: I encountered some difficulty in dealing with those species for which IZY did not provide "rare" data, although "bred" data are given (see page 4). In those cases where the number in the "bred" column was greater than 100 or close to 100, species were included in this table. For example, the long-haired chinchilla (Chinchilla laniger) is included, although it has no "rare" data reported by IZY, because 93 animals were reported to be born in 1978.

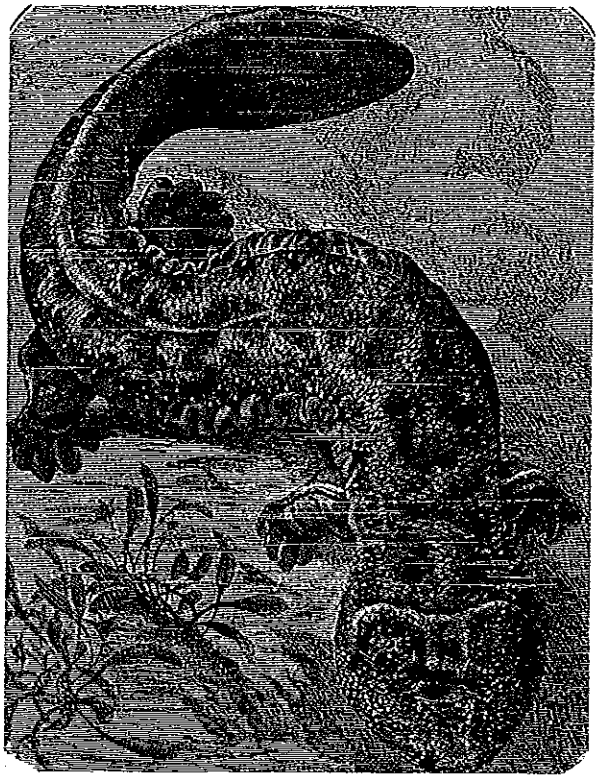

Fig. 11. Japanese giant salamander (Andrias japonicus) is the only Appendix I amphibian species reported to be maintained in captivity with numbers exceeding 100 individuals, although no births have ever been recorded. This example shows that tabulation of numbers does not necessarily indicate breeding success.

second-generation, captive-born individual is often regarded as the first evidence that a species is doing well in captivity. This F_2 generation provides the basis for a self-sustaining population. Those species that were reported to have successfully bred at least two generations of captive-born individuals were noted by an asterisk (*) in Appendix A, B, and C. The term "successful" is used because only those F_2 individuals that survived past the neonatal period (30 days) were recorded in the appendices.

For mammals, birds, reptiles, and amphibians combined, a total of 67 species produced successful F_2 births. This represents approximately one-third (31.2%) of all Appendix I species maintained in captivity.

Over one-third (37.5%) of all mammal species maintained in captivity (42 out of 112 species) were recorded as producing F_2 births, involving six orders of mammals (Fig. 12). Primates composed nearly half of all successful mammal F_2 births (45.2%) with 19 species represented (Appendix A). Other mammals with F_2 offspring included 9 species of Carnivora (6 of which are big cats), 8 species of Artiodactyla, 4 species of Perissodactyla, and 1 species each for Marsupialia and Proboscidea.

Based on the total number of species maintained for each class, birds attained the highest percentage, with 24 out of the 57 species in captivity recorded as producing F_2 births (42.1%) (Fig. 12). Successful F_2 births were reported for 10 orders of birds. Nearly half (45.8%) of these F_2 births involved 11 species of the order Galliformes. Three species each from the orders Anseriformes and Psittaciformes and one each from the seven other avian orders produced successful F_2 births.

The rhinoceros iguana (Cyclura cornuta, Fig. 13) of the order Sauria is the sole reptile species reported to have produced successful F_2 offspring, representing only 2.3% of the 44 reptile species maintained in captivity (Fig. 12).

Neither of the two amphibian species in captivity were reported to have produced an F_2 generation over the four-year period (Fig. 12).

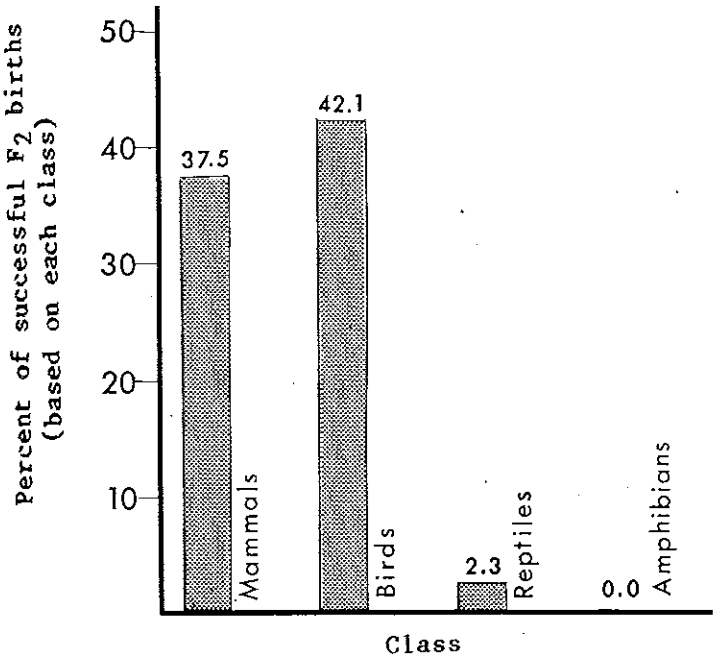

Fig. 12. Successful second-generation captive-born births (F_2).

Fig. 13. Rhinoceros iguana (Cylcura cornuta) is the only Appendix I reptile species that has successfully produced a second generation (F_2) of captive-born young between 1977 and 1981. Photo by Jessie Cohen, National Zool. Park, Smithsonian Instit.

IV. Discussion

Generally, the information presented in this report is encouraging - 60% of the 357 mammal, bird, reptile, and amphibian species listed on CITES Appendix I are reported to be maintained in captivity and over 40% have produced young. There are, however, 55 Appendix I species that are maintained in captivity but over the four-year period have not been reported to have successfully produced young. Although it is unrealistic to expect that all Appendix I species be maintained and bred in captivity, the lack of successful breeding for such species presently in collections serves as a reminder that this issue needs to be addressed.

A. Bias toward mammals.

The actual numbers reported in this paper appear to reveal a bias toward mammals. This is particularly evident in terms of the number of mammal species listed on CITES Appendix I (Table 1). The 181 mammal species listed on Appendix I exceed the combined total of 176 species for birds, reptiles, and amphibians. The order Primates alone includes 66 Appendix I species. Mammals also have the greatest number of species reported to have bred (88), in addition to the highest percentage of species bred compared to species maintained for all four animal classes (78.6%) (Table 2).

When checking the number of species maintained as a percentage of species listed by class on Appendix I, the bias toward mammals is less evident. Over 50% of the mammal, bird, and reptile species listed on Appendix I are maintained in captivity (Table 2). The highest percentage is for reptiles, with nearly three-quarters of the 59 listed species reported to be maintained in captivity (Fig. 4). The high percentages recorded for birds and reptiles, however, may possibly be attributed to the smaller number of species listed on CITES Appendix I. Amphibians are poorly represented, with only 17% of those species listed on Appendix I reported as maintained in captivity.

Currently, those wild species that are related to domesticated animals are the most successful breeders in captivity (Muckenhirn, 1980). For example, carnivores and hoofed stock (orders Artiodactyla and Perissodactyla) constitute nearly one-third (30.7%) of all Appendix I species that produced young between 1977 and 1981. Also, animals that are closely related to humans breed well in captivity. Primates alone compose an additional 26.0%, making the total for these four mammalian orders equal to 56.7% of all species that were reported as producing offspring.

The only Appendix I amphibian species maintained in captivity with numbers exceeding 100 individuals is the Japanese giant salamander (Andrias japonicus). This species provides a good example of how misleading it can be

to interpret data at face value. The large numbers of salamanders found in collections indicate that the species is doing well in captivity. The data reveal, however, that no Japanese giant salamanders were born in captivity between 1977 and 1981 (Appendix C). Therefore, all specimens reported to be in captivity probably were taken from wild populations.

B. Zoos and conservation.

In the early 1970's, zoos had the reputation of being consumers rather than producers of wildlife (Perry, et al., 1973). Over the past decade, the role of zoos has changed significantly. This new role of zoos as wild animal breeders is partly due to the implementation of CITES, which has made it increasingly difficult to import wild animals (Bendiner, 1981).

In addition, the establishment of breeding programs by zoos helped to eliminate the necessity of taking specimens from the wild other than for occasional recruitment of new genetic material. The American Association of Zoological Parks and Aquariums (AAZPA) and the IUCN/Species Survival Commission's Captive Breeding Specialist Group have both initiated programs to increase the role of zoos in conservation by creating breeding programs for species threatened with extinction.

C. The role of Scientific Authorities.

CITES requires a Scientific Authority to determine that the import or export of any Appendix I specimen will be "for purposes not detrimental to the survival of the species" involved [CITES Art. III Sec. 3(a), 1973]. Several conditions should be met before approval for trade in Appendix I specimens is granted (Doc. 3.27, CITES Secretariat, 1982):

1) The possibility that the import neither directly nor indirectly would contribute to the specimen's removal from the wild.

2) The allowance of the import would in no way contribute to the death or removal of any additional specimens from the wild.

3) There should be no reasonable alternative uses of the specimens that are more likely to contribute to the conservation of the species.

In order to answer these questions, the U.S. Scientific Authority (Office of the Scientific Authority, U.S. Fish and Wildlife Service) uses studbooks, ISIS records, and other available information on captive wild animals to determine the necessity and value of importing or exporting the specimen for zoological purposes (R. Jachowski, Chief, U.S. Office of Scientific Authority, pers. comm.). This report can provide an additional resource. The maintenance and breeding information presented in this paper also can be an aid to Scientific Authorities in other countries.

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VI. Key to Appendices

COLUMN HEADINGS

RARE Denotes number of specimens in captivity and, in parenthesis, the number of those that were born in captivity. (Modeled after IZY's section entitled "Census of Rare Animals in Captivity.")

BRED Denotes total number of animals born and, in parenthesis, the number failing to survive. (Modeled after IZY's section entitled "Species of Wild Animals Bred in Captivity and Multiple Generation Births.")

SYMBOLS

(See text for additional information.)

***** Denotes one or more of the animals born was a second (F_2) or subsequent captive-generation birth. Those second-generation individuals that failed to survive past the neonatal period (30 days) were not recorded. (IZY is the only data source that reports this information.)

† Denotes the information reported includes subspecies data in addition to species data.

nd Denotes data not given. Either species was not listed in data source, or species was listed but with no data reported.

+ Denotes the number given is a minimum (only IZY indicates figures as such).

B Indicates that a zoo is known to have a breeding group of a certain species, but has failed to indicate numbers born. (IZY is the only data source with this information.)

<> Denotes the reporting of breeding data only, with no information given regarding numbers of specimens maintained in captivity. (Used only for IZY data.)

# Denotes some information is available for a particular reptile species, although not in the format of this paper. (This occurs only for Inventory data.)

spp. Denotes species.

ssp. Denotes subspecies.

Note: The following designations are the same as those used in Appendices I and II as at 6 June 1981 (CITES Secretariat, 1982):

p.e. Denotes a species that is possibly extinct.

****** Denotes "one or more geographically separate populations, subspecies or species of that species or taxon are included in Appendix II and that these populations, subspecies or species are excluded from Appendix I." (CITES Secretariat, 1982:1).

Note: The numbers below following the name of a species or higher taxon denote only designated geographically-separate populations of that species or taxon are included in Appendix I:

+201 Population of South America
+202 Populations of Bhutan, India, Nepal, and Pakistan
+203 Italian population
+205 Asian population
+206 Indian population
+208 Himalayan population

Note: The numbers below following the name of a species or higher taxon denote designated geographically-separate populations or subspecies of that species or taxon are excluded from Appendix I:

-102 Panthera tigris altaica (=amurensis)
-103 Australian population
-105 Population of North America, excluding Greenland
-108 Population of Papua New Guinea

SOURCES

Data sources:

IZY International Zoo Yearbook (Olney, 1979 & 1980)
ISIS International Species Inventory System (1979 & 1980)
Inventory Inventory of Live Reptiles and Amphibians in North American Collections (Slavens, 1980 & 1981)

References:

Mammals Mammal Species of the World: A Taxonomic and Geographic Reference (Honacki, et al., 1982)
Birds A Complete Checklist of the Birds of the World (Howard & Moore, 1980)
Reptiles World Checklist of Endangered Amphibians and Reptiles (Groombridge, 1981)

Appendix A.

CITES Appendix I mammal species maintained and bred in captivity.

Appendix A. CITES Appendix I mammal species maintained and bred in captivity.

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
MARSUPIALIA								
Bettongia penicillata[1] (brush-tailed bettong or rat-kangaroo)	22(22)	3(0)	21(21)	3(0)	64(54+)	16(1)*	54(46+)	11(0)
Caloprymnus campestris p.e. (desert rat-kangaroo)	nd	nd	nd	nd	nd	nd	nd	nd
Lagorchestes hirsutus (rufous hare-wallaby)	nd	nd	nd	nd	nd	nd	nd	nd
Lagostrophus fasciatus (banded hare-wallaby)	nd	nd	nd	nd	nd	nd	nd	nd
Onychogalea fraenata (bridled nailtail wallaby)	nd	nd	nd	nd	nd	nd	nd	nd
Onychogalea lunata (crescent nailtail wallaby)	nd	nd	nd	nd	nd	nd	nd	nd
Lasiorhinus krefftii (Northern hairy-nosed wombat)	nd	nd	nd	nd	nd	nd	nd	nd
Chaeropus ecaudatus p.e. (pig-footed bandicoot)	nd	nd	nd	nd	nd	nd	nd	nd
Macrotis lagotis (rabbit bandicoot or bilby)	nd	nd	nd	nd	nd	nd	nd	nd
Macrotis leucura (lesser rabbit bandicoot)	nd	nd	nd	nd	nd	nd	nd	nd
Perameles bougainville (barred bandicoot or marl)	nd	nd	nd	nd	nd	nd	nd	nd
Sminthopsis longicaudata (long-tailed dunnart)	nd	nd	nd	nd	nd	nd	nd	nd
Sminthopsis psammophila (sandhill dunnart)	nd	nd	nd	nd	nd	nd	nd	nd
Thylacinus cynocephalus p.e. (thylacine)	nd	nd	nd	nd	nd	nd	nd	nd

PRIMATES

Allocebus spp. (hairy-eared dwarf lemurs)	nd	nd	nd	nd	nd	nd	nd	nd
Cheirogaleus major[2] (greater dwarf lemur)	2(2)	nd	2(0)	nd	2(0)	nd	2(0)	nd
Cheirogaleus medius[2] (fat-tailed dwarf lemur)	37(34)	12(2)	33(26)	15(8)	32(25)	7(2)	25(18)	nd
Hapalemur griseus[3] (grey gentle lemur)	4(4)	1(0)	3(3)	1(0)	15(9)	1(0)*	17(9)	1(0)
Lemur catta[4] (ring-tailed lemur)	349(278)	45(13)	344(264)	45(10)	<>	106(18)*	<>	127(32)
Lemur coronatus[4a] (crowned lemur)	9(6)	2(0)	7(4)	nd	21(16)	1(0)*	16(14)	2(0)
Lemur fulvus[4b] (brown lemur)	240(209)	45(10)	198(168)	58(16)	391+(322+)[B]	47(11)*	376(293+)[B]	40(7)
Lemur macaco† [4] (black lemur)	130(112)	32(11)	111(92)	22(6)	309(213+)[B]	57(11)*	298(182+)	47(14)
Lemur mongoz[4] (mongoose lemur)	36(22)†	1(1)†	42(18)†	1(1)	135(87)	3(3)	152(92)	5(3)
Lemur rubriventer[4] (red-bellied lemur)	8(7)	2(2)	8(7)	1(0)	4(3)[4c]	nd	1(0)	nd
Lemur variegatus† [4d] (ruffed lemur)	163(139)	45(17)	135(109)	45(9)	165(134)	55(11)*	127(96)[B]	40(12)
Lepilemur spp. (sportive lemurs)	nd	nd	nd	nd	nd	nd	nd	nd

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1 Genus Bettongia is listed on CITES Appendix I. B. penicillata is the only species for which data are given.
2 Genus Cheirogaleus is listed on CITES Appendix I.
3 Genus Hapalemur is listed on CITES Appendix I. H. griseus is the only species for which data are given.
4 Genus Lemur is listed on CITES Appendix I.
4a ISIS lists name as Lemur mongoz coronatus.
4b Includes L. albifrons, L. rufus, L. collaris, L. sanfordi, according to Mammals, which are considered subspecies of Lemur macaco under ISIS and IZY.
4c Includes 3(3) hybrids of an unstated cross.
4d Mammals lists the species as Varecia variegata and mentions that ISIS lists it as Lemur variegatus. IZY lists species name as Lemur (Varecia) variegatus.

Appendix A. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Microcebus murinus[5] (lesser mouse lemur)	26(23)†	7(2)†	24(19)†	5(1)†	85(71)	10(2)*	97(78)	6(0)
Microcebus rufus[5] (russet mouse lemur)	nd	nd	nd	nd	3(2)[6]	nd	nd	nd
Phaner spp. (fork-marked mouse lemur)	nd	nd	nd	nd	nd	nd	nd	nd
Avahi spp.[7] (woolly indris)	nd	nd	nd	nd	nd	nd	nd	nd
Indri spp. (indris)	nd	nd	nd	nd	nd	nd	nd	nd
Propithecus verreauxi[8] (Verreaux's sifaka)	1(1)†[9]	nd	1(1)†[9]	nd	1(1)	nd	4(2)	nd
Daubentonia madagascariensis (aye-aye)	nd	nd	nd	nd	nd	nd	nd	nd
Callimico goeldii (Goeldi's marmoset)	53(39)	5(0)	36(21)	10(4)	106(61)	29(2)*	72(30)	17(5)
Callithrix aurita (white-eared marmoset)	1(1)	nd	2(2)	nd	6(6)	nd	10(6+)	6(3)
Callithrix flaviceps (buff-headed marmoset)	nd	nd	nd	nd	nd	nd	nd	nd
Leontopithecus (Leontideus) rosalia[10] (golden lion tamarin)	158(147)	53(24)	116(111)	50(29)	182(151)	56(24)*	169(134)	54(22)
Saguinus bicolor (bare-faced or pied tamarin)	nd	nd	nd	nd	1(0)	nd	1(0)	nd
Saguinus leucopus (white-footed tamarin)	nd	nd	1(0)	2(2)	2(1)	nd	8(4)	3(2)
Saguinus oedipus (incl. S. geoffroyi) (cotton-top tamarin)	203(118)	51(31)	208(122)	61(36)	491(224+)	145(75)*	454(175)	133(46)
Alouatta palliata (villosa) (mantled howler)	nd	nd	nd	nd	nd	1(1)	nd	1(1)
Ateles geoffroyi frontatus (black-browed spider monkey)	nd	nd	nd	nd	nd	nd	nd	nd

Ateles geoffroyi panamensis (red spider monkey)	1(0)	nd	1(0)	nd	nd	nd	nd	nd
Brachyteles arachnoides (woolly spider monkey)	nd	nd	nd	nd	1(0)	nd	nd	nd
Cacajao calvus[11] (white or bald uakari)	1(0)	nd	2(0)	nd	7(0)	nd	5(0)	nd
Cacajao melanocephalus[11] (black-headed uakari)	nd	nd	nd	nd	3(0)	nd	3(0)	nd
Cacajao rubicundus[11a] (red uakari)	9(2)†	nd	10(2)†	nd	22(6)	1(0)	27(7)	nd
Chiropotes albinasus (white-nosed saki)	nd	nd	3(0)	nd	4(0)	nd	3(0)	nd
Saimiri oerstedii (red-backed squirrel monkey)	3(0)	nd	13(2)	nd	55(12)[B]	10(3)	nd	nd
Cercocebus galeritus galeritus (Tana River mangabey)	nd	nd	nd	nd	nd	nd	nd	nd
Cercopithecus diana (roloway) (Diana monkey)	118(68)†	8(1)†	108(57)†	4(0)†	<>	23(2)*	<>	30(6)†
Colobus badius kirkii (Zanzibar red colobus)	nd	nd	nd	nd	nd	nd	nd	nd
Colobus badius rufomitratus (Tana River red colobus)	nd	nd	nd	nd	nd	nd	nd	nd
Macaca silenus (lion-tailed macaque)	147(118)	11(3)	133(102)	12(3)	332(215+)	43(10)*	298(193)	25(11)
Nasalis larvatus (proboscis monkey)	12(6)	nd	18(9)	2(0)	47(23)	6(1)	41(14)	4(4)
Presbytis entellus (Hanuman or entellus langur)	41(29)†	5(1)†	37(29)†	6(1)†	<>	16(9)*	<>	16(3)

5 Genus Microcebus is listed on CITES Appendix I.
6 Listed as L. m. rufus (red mouse lemur) in IZY, although it is listed on Appendix I as Microcebus rufus.
7 Genus Avahi is listed on CITES Appendix I. Mammals lists Avahi as a "junior synonym" for Lichanotus.
8 Genus Propithecus is listed on CITES Appendix I.
9 ISIS lists data only for Propithecus verreauxi coquereli.
10 Genus Leontopithecus (Leontideus) is listed on CITES Appendix I.
11 Genus Cacajao is listed on CITES Appendix I.
11a Some disagreement as to whether Cacajao rubicundus is a distinct species from C. calvus. Mammals lists C. calvus including rubicundus - but also notes one source listing it as a distinct species. ISIS gives separate numbers for C. calvus and C. rubicundus. IZY lists it as C. calvus rubicundus.

Appendix A. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Presbytis geei (golden langur)	nd	nd	nd	nd	14(0)	nd	4(0)	3(1)
Presbytis pileatus[12] (capped langur)	nd	nd	nd	nd	<>	1(0)	<>	1(0)
Presbytis potenziani (Mentawai leaf monkey)	nd	nd	nd	nd	nd	nd	nd	nd
Pygathrix nemaeus (Douc langur)	11(5)	2(1)	11(5)	3(1)	48(28)	13(5)*	51(25)	6(1)
Simias concolor[13] (pig-tailed langur)	nd	nd	nd	nd	nd	nd	nd	nd
Papio (Mandrillus) leucophaeus (drill)	35(23)†	1(0)†	30(20)†	3(0)†	64(36)B	4(1)*	nd	5(3)
Papio (Mandrillus) sphinx (mandrill)	162(110)	14(5)	168(107)	22(6)	<>	58(14)*	<>	53(13)
Hylobates agilis[14] (agile or dark-handed gibbon)	8(2)	nd	8(2)	1(0)	<>	4(2)	<>	1(0)
Hylobates concolor[14] (crested or black gibbon)	38(6)†	1(0)	33(5)†	1(0)	110+(10)B	4(0)	nd	2(0)
Hylobates hoolock[14] (Hoolock gibbon)	12(2)	nd	10(1)	1(0)	nd	1(0)	nd	nd
Hylobates klossi[14] (Kloss' gibbon or dwarf siamang)	nd	nd	nd	nd	4(0)	nd	3(0)	nd
Hylobates lar[14] (white-handed gibbon)	179(84)†	12(4)†	173(78)†	18(3)†	<>	26(6)	<>	34(9)
Hylobates moloch[14] (silvery or Javan grey gibbon)	10(4)†	nd	9(4)†	nd	46(10)	1(0)	nd	1(0)
Hylobates muelleri[14] (Bornean grey gibbon)	nd	nd	nd	nd	214(29)B	2(0)	nd	nd
Hylobates pileatus[14] (pileated gibbon)	20(3)	1(0)	18(2)	nd	54(9)	nd	61(12)	2(1)
Hylobates (Symphalangus) syndactylus[14a] (siamang)	81(34)†	12(6)†	81(30)†	4(2)	<>	14(7)*	<>	19(5)

Pongo pygmaeus[15] (orangutan)	276(165)†	20(3)†	244(146)†	16(1)†	736(358)	42(6)	723(341)	55(9)
Pan paniscus[15] (pygmy chimpanzee)	12(8)	4(2)	11(6)	1(0)	30(12)	2(0)	32(11)	3(0)
Pan troglodytes[15] (chimpanzee)	1367(454)†	75(19)†	1302(414)†	87(16)†	<>	57(9)*	<>	61(15)
Gorilla gorilla[15] (gorilla)	217(84)†	16(5)†	187(60)†	6(1)†	485(114)	17(3)*	483(103)	17(7)
EDENTATA								
Priodontes giganteus (maximus) (giant armadillo)	4(0)	nd	4(0)	nd	6(0)	nd	6(0)	nd
PHOLIDOTA								
Manis temminckii (cape, Temminck's, or common African ground pangolin)	nd	nd	nd	nd	nd	nd	nd	nd
LAGOMORPHA								
Caprolagus hispidus (hispid hare)	nd	nd	nd	nd	nd	nd	nd	nd
Romerolagus diazi (volcano rabbit)	nd	nd	nd	nd	8(0)	nd	nd	nd
RODENTIA								
Cynomys mexicanus (Mexican prairie dog)	nd	nd	1(0)	nd	1(0)	nd	12(0)	nd

12 Mammals lists the name as Presbytis pileata. Listed on CITES Appendix I and in IZY and ISIS as Presbytis pileatu.
13 Mammals lists the genus Simias as included under Nasalis. Simias concolor is listed on CITES Appendix I.
14 Genus Hylobates is listed on CITES Appendix I.
14a Symphalangus syndactylus is listed on CITES Appendix I. Mammals lists the species name as Hylobates syndactylus.
15 Entire family Pongidae is listed on CITES Appendix I.

Appendix A. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Leporillus conditor (stick-nest rat)	nd	nd	nd	nd	nd	nd	nd	nd
Pseudomys fumeus (smoky mouse)	nd	nd	nd	nd	nd	nd	nd	nd
Pseudomys praeconis (shark bay mouse)	nd	nd	nd	nd	nd	nd	nd	nd
Xeromys myoides (false water rat)	nd	nd	nd	nd	nd	nd	nd	nd
Zyzomys pedunculatus (Macdonnell range rock-rat)	nd	nd	nd	nd	nd	nd	nd	nd
Chinchilla brevicaudata[16] +201 (South American chinchilla)	nd	nd	1(0)	nd	nd	nd	nd	nd
Chinchilla laniger[16] +201 (long-haired chinchilla)	53(37)	11(3)	45(30)	8(3)	<>	93(34)	<>	62(19)
CETACEA								
Lipotes vexillifer (white flag dolphin)	nd	nd	nd	nd	nd	nd	nd	nd
Platanista spp. (susus)	nd	nd	nd	nd	nd	nd	nd	nd
Physeter catodon (macrocephalus) (sperm whale)	nd	nd	nd	nd	nd	nd	nd	nd
Sotalia spp. (S. American river dolphins)	nd	nd	nd	nd	nd	nd	nd	nd
Sousa spp. (hump-backed dolphins)	nd	nd	nd	nd	nd	nd	nd	nd
Neophocaena phocaenoides (finless porpoise)	nd	nd	nd	nd	nd	nd	nd	nd
Phocoena sinus (cochito or gulf porpoise)	nd	nd	nd	nd	nd	nd	nd	nd
Eschrichtius robustus (glaucus) (grey whale)	nd	nd	nd	nd	nd	nd	nd	nd

Balaenoptera borealis (sei whale)	nd	nd	nd	nd	nd	nd	nd	nd
Balaenoptera musculus (blue whale)	nd	nd	1(0)[17]	nd	nd	nd	nd	nd
Balaenoptera physalus (fin whale)	nd	nd	nd	nd	nd	nd	nd	nd
Megaptera novaeangliae (humpback whale)	nd	nd	nd	nd	nd	nd	nd	nd
Balaena (Eubalaena) spp.[18] (bowhead whale)	nd	nd	nd	nd	nd	nd	nd	nd
CARNIVORA								
Canis lupus† ** +202 (Indian grey wolf)	286(245)	26(10)	234(198)	20(2)	<>	307(40)*	<>	367(67)
Speothos venaticus (bush dog)	17(14)	7(1)	14(8)	nd	23(18)	15(6)*	19(8)	6(2)
Vulpes velox hebes (northern swift fox)	nd	nd	nd	nd	nd	nd	nd	nd
Helarctos malayanus (sun bear)	63(14)	2(1)	59(12)	1(0)	<>	15(12)	<>	12(7)
Selenarctos thibetanus† [19] (Asiatic black bear)	45(16)	3(0)	42(15)	1(1)	<>	52(10)	<>	nd
Tremarctos ornatus (spectacled bear)	46(24)	5(4)	44(22)	4(1)	96(40)	5(4)	94(36)	7(3)
Ursus arctos† **+203 (Italian brown bear)	175(104)	16(7)	171(104)	22(7)	<>	139(37)*	<>	189(39)
Ursus arctos isabellinus[20] (red bear)	nd	nd	nd	2(2)	nd	nd	nd	nd
Ursus arctos nelsoni[20] (Mexican grizzly bear)	nd	nd	nd	nd	nd	nd	nd	nd
Ursus arctos pruinosus[20] (Tibetan brown bear)	nd	nd	nd	nd	nd	nd	nd	nd

16 Genus Chinchilla (South American population only) is listed on CITES Appendix I.
17 Reported by one zoo to ISIS, although found to be erroneous (Flesness, pers. comm.).
18 Genus Eubalaena is listed on CITES Appendix I. Mammals lists genus Balaena as including Eubalaena.
19 According to Mammals, some disagreement exists as to whether Selenarctos is a subgenus of Ursus.
20 Data on this subspecies may possibly be included in Ursus arctos total. Both IZY and ISIS report data for the species Ursus arctos, in addition to 7 subspecies listed separately.

Appendix A. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Aonyx congica (microdon)[21] (West African clawless otter)	nd	nd	nd	nd	nd	nd	nd	nd
Enhydra lutris nereis (southern sea otter)	nd	nd	nd	nd	8(0)	nd	nd	nd
Lutra felina (marine otter)	nd	nd	nd	nd	nd	nd	nd	nd
Lutra longicaudis (platensis/annectens) (S. American river otter)	nd	nd	nd	nd	1(0)	nd	3(0)	nd
Lutra lutra (Eurasian otter)	2(0)	nd	2(0)	nd	109(32)	8(0)	96(27)	5(1)
Lutra provocax (southern river otter)	nd	nd	nd	nd	nd	nd	nd	nd
Mustela nigripes (black-footed ferret)	nd	nd	nd	nd	nd	nd	3(0)	nd
Pteronura brasiliensis (giant otter)	nd	nd	nd	nd	25(4)	7(5)	26(3)	9(7)
Prionodon pardicolor (spotted linsang)	1(0)	nd	1(0)	nd	nd	nd	nd	nd
Hyaena brunnea (brown hyaena)	13(8)	nd	13(10)	nd	69(31)	11(5)	60(28)	nd
Acinonyx jubatus (cheetah)	123(64)	2(2)	136(61)	4(0)	563(181)	74(18)*	513(143+)	45(9)
Felis bengalensis bengalensis (Indian leopard cat)	11(9)	nd	7(5)	2(1)	nd	nd	nd	nd
Felis (Lynx) caracal ** +205 (Asian caracal)	54(40)	10(3)	42(29)	4(1)	<>	57(13)	<>	45(10)
Felis concolor coryi (Florida puma)	nd	nd	nd	nd	nd	nd	nd	nd
Felis concolor costaricensis (Costa Rican puma)	nd	nd	nd	nd	nd	nd	nd	nd
Felis concolor cougar (eastern puma)	nd	nd	nd	nd	nd	nd	nd	nd

Felis jacobita (Andean cat)	nd	nd	nd	nd	nd	nd	nd	nd
Felis marmorata (marbled cat)	8(6)	4(2)	7(5)	1(0)	10(4)	nd	7(4)	2(1)
Felis nigripes (black-footed cat)	2(1)	nd	2(1)	nd	18(9)	4(0)	15(5)	4(3)
Felis pardalis mearnsi (Costa Rican ocelot)	nd	nd	1(1)	nd	nd	nd	nd	nd
Felis pardalis mitis (Brazilian ocelot)	nd	nd	nd	nd	nd	nd	nd	nd
Felis planiceps (flat-headed cat)	7(2)	nd	7(2)	nd	9(1)	nd	10(2)	nd
Felis rubiginosa ** +206 (Indian rusty-spotted cat)	1(1)	nd	nd	nd	4(2)	1(0)	5(0)	1(0)
Felis (Lynx) rufa escuinapae[22] (Mexican bobcat)	nd	nd	nd	nd	nd	nd	nd	nd
Felis temmincki (Asiatic golden cat)	22(11)	2(2)	24(11)	1(1)	64(29)	17(11)	nd	10(5)
Felis tigrina oncilla (little spotted or tiger cat)	nd	nd	nd	nd	nd	nd	nd	nd
Felis wiedii nicaraguae (Central American margay)	nd	nd	nd	nd	nd	nd	nd	nd
Felis wiedii salvinia (Guatemalan margay)	nd	nd	nd	nd	nd	nd	nd	nd
Felis yagouaroundi cacomitli (Tamaulipas jaguarundi)	nd	nd	nd	nd	nd	nd	nd	nd
Felis yagouaroundi fossata (Guatemalan jaguarundi)	nd	nd	nd	nd	nd	nd	nd	nd
Felis yagouaroundi panamensis (Panamanian jaguarundi)	nd	nd	nd	nd	nd	nd	nd	nd
Felis yagouaroundi tolteca (Sinaloan jaguarundi)	nd	nd	nd	nd	nd	nd	nd	nd
Neofelis nebulosa (clouded leopard)	71(52)	12(9)	48(28)	7(5)	157(73)	12(5)*	136(68)	19(9)
Panthera leo persica (Asiatic lion)	42(41)	9(1)	35(35)	27(14)	160(104+)	28(5)*	101(76)	28(4)

21 Mammals lists Aonyx congica as including Aonyx microdon. A. microdon is listed on CITES Appendix I.
22 Mammals lists the species name as Lynx rufus.

Appendix A. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Panthera onca (jaguar)	189(149)	22(5)	180(136)	10(6)	<>	134(43)*	<>	141(36)
Panthera pardus[†] (leopard)	254(208)	25(8)	267(217)	10(4)	242(106)	219(69)*	216(179)	307(111)
Panthera tigris[†23] ** -102 (tiger)	232(214)	35(5)	186(165)	12(1)	264(231)	261(104)*	598(448)	328(105)
Panthera uncia (snow leopard)	119(100)	29(7)	97(78)	16(4)	169(105)	27(8)*	161(104)	48(24)
PINNIPEDIA								
Arctocephalus townsendi (Guadalupe fur seal)	nd	nd	nd	nd	nd	nd	nd	nd
Monachus monachus[24] (monk seals)	nd	nd	nd	nd	nd	nd	2(0)	nd
PROBOSCIDEA								
Elephas maximus (Asian elephant)	145(15)	1(0)	134(15)	nd	<>	5(1)*	<>	2(1)
SIRENIA								
Dugong dugon ** -103 (dugong or sea cow)	nd	nd	nd	nd	4(0)	nd	2(0)	nd
Trichechus inunguis (South American manatee)	nd	nd	nd	nd	4(0)	nd	4(0)	nd
Trichechus manatus (Caribbean, North American or West Indian manatee)	1(0)	nd	1(0)	nd	19(2)	nd	16(2)	1(0)

PERISSODACTYLA								
Equus grevyi (Grevy's zebra)	150(101)	20(2)	136(84)	18(4)	439(233)	72(15)*	401(200+)	63(13)
Equus hemionus hemionus (Mongolian wild ass)	nd	nd	nd	nd	5(0)	nd	4(0)	nd
Equus onager (hemionus) khur[25] (Indian wild ass)	nd	nd	nd	nd	4(2)	1(1)	5(2)	1(1)
Equus przewalskii[26] (Przewalski's horse)	376(375)	10(1)	372(371)	44(10)	338(338)	52(7)*	299(299)	51(7)
Equus zebra zebra (cape mountain zebra)	nd	nd	nd	nd	nd	nd	nd	nd
Tapirus bairdii (Central American tapir)	16(7)	3(1)	18(8)	1(0)	19(5)	1(0)	20(6)	2(0)
Tapirus indicus (Malayan tapir)	43(21)	2(1)	42(19)	5(0)	137(46)	4(0)*	129(45)	12(2)
Tapirus pinchaque (mountain tapir)	4(2)	nd	4(2)	1(0)	7(1)	1(0)	7(1)	1(0)
Rhinoceros unicornis[27] (Indian rhinoceros)	19(10)	1(0)	19(10)	nd	71(30)	5(1)*	45(28)	1(0)
Ceratotherium (Diceros) simum[†,27] (white rhinoceros)	135(27)	7(1)	137(27)	12(1)	420+(63+)	20(2)	398+(50+)	14(1)
Diceros bicornis[27] (black rhinoceros)	52(21)[†]	3(1)[†]	52(18)[†]	1(1)	160(53)	8(1)	164(55)	12(1)
ARTIODACTYLA								
Babyrousa babyrussa (babirusa)	3(3)	nd	3(3)	1(0)	49(26+)	9(2)	39(15+)	2(2)

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23 Totals do not include Panthera tigris altaica data (subspecies is listed on CITES Appendix II). Data for other P. tigris subspecies are included.

24 Genus Monachus is listed on CITES Appendix I.

25 Mammals lists Equus onager as including khur. Some disagreement as to whether hemionus = onager, or whether onager is a distinct species. Equus hemionus khur is listed on CITES Appendix I.

26 Mammals lists Equus caballus (domesticated stock) as including przewalskii. Disagreement exists over whether they are conspecific or separate species. E. przewalskii is listed on CITES Appendix I.

27 Entire family Rhinocerotidae is listed on CITES Appendix I.

Appendix A. (continued).

Scientific Name (Common Name)	ISIS				IZY			
	1981 Rare	1980 Bred	1980 Rare	1979 Bred	1979 Rare	1978 Bred	1978 Rare	1977 Bred
Sus salvanius (pygmy hog)	nd	nd	nd	nd	10(5)	7(5)	6(6)	5(0)
Vicugna vicugna (vicuna)	7(7)	nd	8(8)	nd	66(62)	13(2)*	66(60)	15(6)
Cervus (Axis or Hyelaphus) calamianensis[28] (calamian deer)	nd	nd	nd	nd	8(2)	4(3)	7(1)	2(1)
Cervus (Axis or Hyelaphus) kuhli (Kuhl's deer)[29]	nd	nd	nd	nd	64(58)	16(0)*	53(49)	9(2)
Cervus (Axis or Hyelaphus) porcinus annamiticus (Ganges hog deer)	nd	nd	nd	nd	nd	nd	nd	nd
Blastocerus dichotomus (marsh deer)	nd	nd	nd	nd	2(1)	nd	3(2)	nd
Cervus duvauceli (swamp deer)	133(130)	38(10)	76(73)	29(10)	264(260)	66(18)*	215(210)	61(18)
Cervus elaphus hanglu (Kashmir stag deer)	nd	nd	nd	nd	nd	nd	nd	nd
Cervus eldi† (Eld's or brow-antlered deer)	44(43)	11(1)	37(36)	10(3)	102(83)	39(12)*	129(103)	39(8)
Dama mesopotamica[30] (Persian fallow deer)	nd	nd	2(2)[31]	nd	20(16)	4(0)*	12(12)	2(1)
Hippocamelus antisensis (North Andean huemal)	nd	nd	nd	nd	nd	nd	nd	nd
Hippocamelus bisulcus (South Andean huemal)	nd	nd	nd	nd	nd	nd	nd	nd
Moschus moschiferus ** +208 (Himalayan musk deer)	nd	nd	nd	nd	7(2)	4(3)	15(3+)	nd
Ozotoceros bezoarticus (pampas deer)	nd	nd	nd	nd	38(9)[32]	nd	18(8)	2(0)
Pudu pudu (Chilean or southern pudu)	5(3)	nd	5(3)	1(0)	34(24)	nd	30(19)	9(0)

Antilocapra americana peninsularis (Baja pronghorn)	nd	nd	nd	nd	nd	nd	nd	nd
Antilocapra americana sonoriensis (Sonoran pronghorn)	nd	nd	nd	nd	nd	nd	nd	nd
Bison bison athabascae (wood bison)	28(11)	5(0)	25(8)	6(1)	64(50)	nd	42(18)	2(0)
Bos frontalis (gaurus)[33] (gaur)	82(81)	18(2)	64(63)	14(1)	72(65)	21(5)*	77(64+)	16(3)
Bos (grunniens) mutus[34] (wild yak)	24(22)	1(0)	26(23)	5(1)	5(1)	1(0)	nd	nd
Bubalus (Anoa) depressicornis (lowland anoa)	5(5)	nd	5(5)	1(0)	15(11)†	nd	32(16)†	nd
Bubalus (Anoa) mindorensis (tamaraw)	nd	nd	nd	nd	2(0)	nd	2(0)	nd
Bubalus (Anoa) quarlesi[35] (mountain anoa)	nd	nd	nd	nd	19(7)	2(1)	18(6)	4(2)
Capra falconeri chialtanensis (Chialtan markhor)	nd	nd	nd	nd	nd	nd	nd	nd
Capra falconeri megaceros[36] (Kabul or straight-horned markhor)	3(3)	nd	3(3)	nd	15(15)	5(0)*	12(12)	3(0)
Capricornis sumatraensis (mainland serow)	nd	nd	nd	nd	12(0)	1(0)	10(0)	2(1)

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28 Axis (Hyelaphus) calamianensis is listed on CITES Appendix I. Mammals lists Cervus porcinus as including calamianensis.

29 Axis (Hyelaphus) kuhli is listed on CITES Appendix I. Mammals lists Cervus porcinus as including kuhli.

30 Mammals lists Cervus dama as including mesopotamica. Dama mesopotamica is listed on CITES Appendix I.

31 Listed as Cervus mesopotamicus in ISIS.

32 Data were reported by 6 zoos and 1 private collection maintained in Buenos Aires. The 9 captive-born animals reported were all from the zoos.

33 Mammals lists Bos frontalis as including gaurus. B. gaurus is listed on CITES Appendix I.

34 ISIS data include Bos mutus and B. m. mutus (wild yak) and do not include B. m. grunniens (domestic yak).

35 Listed as Anoa depressicornis quarlesi (mountain anoa) in IZY. Data are compiled separately from Bubalus (Anoa) depressicornis. Bubalus quarlesi was formerly included in Anoa depressicornis (Mammals).

36 IZY reports data for Capra falconeri megaceros (incl. jerdoni). C.f. jerdoni (straight-horned markhor) is listed separately from C. f. megaceros on CITES Appendix I.

Appendix A. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Hippotragus niger variani (giant sable antelope)	nd	nd	nd	nd	nd	nd	nd	nd
Nemorhaedus goral (common goral)	1(0)	nd	1(0)	nd	30(17+)	6(1)*	28(12)	nd
Novibos (Bos) sauveli (kouprey)	nd	nd	nd	nd	nd	nd	nd	nd
Oryx leucoryx (Arabian oryx)	171(169)	28(9)	123(119)	24(4)	180(143)	46(8)*	122(114)	28(3)
Ovis ammon hodgsoni (Nyan or great Tibetan sheep)	nd	nd	nd	nd	nd	nd	nd	nd
Ovis orientalis ophion[37] (Cyprian mouflon)	nd	nd	nd	nd	8(4)	1(1)	169(129+)	2(2)
Ovis vignei (urial)	nd	nd	nd	nd	nd	nd	1(1)	nd
Pantholops hodgsoni (chiru or Tibetan antelope)	nd	nd	nd	nd	nd	nd	nd	nd
Rupicapra rupicapra ornata (abruzzi chamois)	nd	nd	nd	nd	nd	nd	nd	nd

37 Mammals lists Ovis aries as including orientalis. Ovis orientalis ophion is listed on CITES Appendix I. The large disparity in number of animals in captivity between years can be attributed to the difference in the number of collections reporting data to IZY. In 1978, 22 collections reported data on this subspecies, but in 1979 only 2 collections did so. IZY lists subspecies name as Ovis orientalis ophion.

Appendix B.

CITES Appendix I bird species maintained and bred in captivity.

Appendix B. CITES Appendix I bird species maintained and bred in captivity.

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
RHEIFORMES								
Pterocnemia pennata (lesser or Darwin's rhea)	52(49)†	69(37)†	30(30)†	58(51)†	<>	40(35)*	<>	38(30)
TINAMIFORMES								
Tinamus solitarius (solitary tinamou)	nd	nd	nd	nd	<>	11(2)*	<>	11(2)
SPHENISCIFORMES								
Spheniscus humboldti (Humboldt or Peruvian penguin)	63(6)	nd	68(6)	nd	<>	122(66)*	<>	122(65)
PODICIPEDIFORMES								
Podilymbus gigas (Atitlan grebe)	nd	nd	nd	nd	nd	nd	nd	nd
PROCELLARIIFORMES								
Diomedea albatrus (short-tailed albatross)	nd	nd	nd	nd	nd	nd	nd	nd

PELECANIFORMES								
Sula abbotti (Abbott's booby)	nd	nd	nd	nd	nd	nd	nd	nd
Fregata andrewsi (Christmas Island frigate bird)	nd	nd	nd	nd	nd	nd	nd	nd
CICONIIFORMES								
Ciconia ciconia boyciana (oriental white stork)	nd	nd	nd	nd	23(1)	nd	26(0)	nd
Geronticus eremita (hermit ibis)	11(3)	1(0)	10(2)	nd	250(194+)	33(2)*	255(202)	41(4)
Nipponia nippon (Japanese crested ibis)	nd	nd	nd	nd	nd	nd	nd	nd
ANSERIFORMES								
Anas aucklandica nesiotis (Campbell Island flightless teal)	1(0)	nd	1(0)	nd	nd	nd	nd	nd
Anas laysanensis[1] (laysan duck)	56(52)	2(0)	51(47)	12(0)	<>	173(24)*	<>	108(11)
Anas oustaleti (Marianas duck)	nd	nd	nd	nd	nd	nd	nd	nd
Branta canadensis leucopareia (Aleutian Canada goose)	5(5)	nd	4(4)	nd	<>	81(1)	<>	32(0)
Branta sandvicensis (Hawaiian goose or nene)	147(129)	36(6)	115(97)	27(2)	595(595)	175(15)*	585+(583+)	203(26)
Cairina scutulata (white-winged wood duck)	11(4)	2(0)	6(1)	nd	80(69)	21(1)*	53(0)	18(0)
Rhodonessa caryophyllacea p.e. (pink-headed duck)	nd	nd	nd	nd	nd	nd	nd	nd

[1] Birds lists name as Anas platyrhynchos laysanensis. Also listed as Anas platyrhynchos laysanensis in IZY. A. laysanensis is listed on CITES Appendix I.

Appendix B. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
FALCONIFORMES								
Gymnogyps californianus (California condor)	nd	nd	nd	nd	1(0)	nd	1(0)	nd
Vultur gryphus (Andean condor)	32(7)	4(0)	30(7)	2(0)	211(20)	11(2)	187(11)	6(3)
Aquila heliaca (imperial eagle)	5(0)†	nd	3(0)†	nd	89(0)	nd	77(6)	nd
Chondrohierax wilsonii[2] (Cuban hook-billed kite)	nd	nd	nd	nd	nd	nd	nd	nd
Haliaeetus albicilla (white-tailed sea eagle)	3(0)†	2(0)†	3(0)†	1(0)†	110(16)	3(0)	96(8)	1(0)
Haliaeetus leucocephalus (bald eagle)	55(5)†	nd	47(5)†	1(0)†	122(7)	9(3)	116(0)	3(0)
Harpia harpyja (harpy eagle)	5(0)	nd	5(0)	nd	29(0)	nd	25(0)	1(1)
Pithecophaga jefferyi (Philippine or monkey-eating eagle)	nd	nd	nd	nd	5(0)	nd	5(0)	nd
Falco araea (Seychelles kestrel)	nd	nd	nd	nd	nd	nd	nd	nd
Falco newtoni aldabranus (Aldabra kestrel)	nd	nd	nd	nd	nd	nd	nd	nd
Falco peregrinus (pelegrinoides/babylonicus) (peregrine falcon)	6(0)†	nd	3(0)†	nd	nd	nd	1(0)†	nd
Falco punctatus (Mauritius kestrel)	nd	nd	nd	nd	B	1(0)	nd	nd
Falco rusticolus **-105 (Eurasian gyrfalcon)	nd	nd	nd	nd	nd	nd	nd	nd

Macrocephalon maleo (maleo fowl)	4(0)	nd	4(0)	nd	15(0)	nd	9(0)	nd
Crax blumenbachii (red-billed curassow)	1(0)	nd	1(0)	nd	4(0)	nd	3(1)	nd
Mitu mitu mitu[3] (greater razor-billed curassow)	8(6)	7(2)	5(3)	3(1)	nd	nd	nd	nd
Oreophasis derbianus (horned guan)	nd	nd	nd	nd	1(0)	nd	nd	nd
Penelope albipennis (white-winged guan)	nd	nd	nd	nd	nd	nd	nd	nd
Pipile (Aburria) jacutinga (black-fronted piping guan)	nd	nd	nd	nd	nd	nd	nd	nd
Pipile (Aburria) pipile pipile (Trinidad white-headed piping guan)	nd	nd	nd	nd	nd	nd	nd	nd
Tympanuchus cupido attwateri (Attwater's prairie chicken)	nd	nd	nd	nd	nd	nd	nd	nd
Catreus wallichii (cheer pheasant)	2(2)	nd	nd	nd	136(120+)	219(47)*	85(75)	51(15)
Colinus virginianus ridgwayi (masked bob-white)	nd	nd	nd	nd	496(490)	2435(0)	430(430)	2128(0)
Crossoptilon crossoptilon (white eared pheasant)	10(7)	nd	11(9)†	nd	169(159+)	108(30)*	116(99)	65(16)
Crossoptilon mantchuricum (brown eared pheasant)	9(4)	nd	3(2)	nd	159(139+)	43(4)*	147(122)	29(3)
Lophophorus impeyanus (Himalayan monal pheasant)	34(22)	1(0)	34(2♀)	2(1)	<>	97(27)*	<>	86(18)
Lophophorus lhuysii (Chinese monal pheasant)	nd	nd	nd	nd	4(0)	nd	1(0)	nd
Lophophorus sclateri (Sclater's monal pheasant)	nd	nd	nd	nd	nd	nd	1(0)	nd
Lophura edwardsi (Edwards' pheasant)	13(10)	nd	16(13)	2(1)	142(142)	77(32)*	135(135)	70(20)

2 Listed as Chondrohierax uncinatus wilsonii in Birds. Chondrohierax wilsonii is listed on CITES Appendix I.
3 Listed as Crax mitu mitu in Birds and by ISIS. Listed as Mitu mitu mitu on CITES Appendix I.

Appendix B. (continued).

Scientific Name (Common Name)	ISIS				IZY			
	1981 Rare	1980 Bred	1980 Rare	1979 Bred	1979 Rare	1978 Bred	1978 Rare	1977 Bred
Lophura imperialis[4] (imperial pheasant)	nd	nd	nd	nd	15(15)	2(0)*	17(0)	nd
Lophura swinhoii (Swinhoe's pheasant)	35(26)	7(2)	40(31)	1(1)	<>	194(42)*	<>	200(60)
Polyplectron emphanum (Palawan peacock-pheasant)	47(42)	29(8)	46(41)	16(1)	167(124+)	78(33)*	147(115)	66(21)
Syrmaticus ellioti (Elliot's pheasant)	18(16)	10(3)	18(17)	15(5)	135(132+)[B]	80(23)*	130(106)	97(22)
Syrmaticus humiae (bar-tailed or Hume's pheasant)	7(6)†	22(15)†	18(15)†	14(7)†	93(91)	55(6)*	92(77)	55(12)
Syrmaticus mikado (Mikado pheasant)	13(13)	7(1)	14(14)	4(1)	165(124+)	54(19)*	162(142)	73(15)
Tetraogallus caspius (Caspian snowcock)	nd	nd	nd	nd	nd	nd	nd	nd
Tetraogallus tibetanus (Tibetan snowcock)	nd	nd	nd	nd	nd	nd	nd	nd
Tragopan blythii (Blyth's tragopan)	nd	nd	nd	nd	nd	nd	nd	nd
Tragopan caboti (Cabot's tragopan)	nd	nd	nd	nd	1(0)	nd	18(10)	5(0)
Tragopan melanocephalus (western tragopan)	nd	nd	nd	nd	nd	nd	nd	nd
GRUIFORMES								
Grus americana (whooping crane)	3(3)	nd	nd	nd	26(9)	7(0)	28(9)	3(0)
Grus canadensis nesiotes (Cuban sandhill crane)	nd	nd	nd	nd	nd	nd	nd	nd
Grus canadensis pulla (Mississippi sandhill crane)	4(4)	nd	nd	nd	nd	3(0)	16(0)	1(0)

Grus japonensis (red-crowned or Manchurian crane)	21(20)	1(0)	nd	nd	130(50)	18(6)*	81(46)	14(2)
Grus leucogeranus (Siberian or great white crane)	9(6)	nd	nd	nd	14(6)	5(4)[5]	9(0)	2(0)[5]
Grus monacha (hooded crane)	27(10)	4(1)	12(4)	1(0)	97(8)	6(2)	79(5)	3(0)
Grus nigricollis (black-necked crane)	nd	nd	nd	nd	8(0)	nd	4(0)	nd
Grus vipio (Japanese white-naped crane)	56(37)	7(1)	34(27)	13(5)	136(35)	16(6)	109(30)	2(0)
Tricholimnas sylvestris[6] (Lord Howe wood rail)	nd	nd	nd	nd	nd	nd	nd	nd
Rhynochetos jubatus (kagu)	nd	nd	nd	nd	7(0)	nd	8(0)	nd
Chlamydotis undulata (houbara bustard)	nd	nd	nd	nd	nd	nd	nd	nd
Choriotis nigriceps (great Indian bustard)	nd	nd	nd	nd	nd	nd	nd	nd
Eupodotis bengalensis[7] (bengal bustard or florican)	nd	nd	nd	nd	nd	nd	nd	nd
CHARADRIIFORMES								
Numenius borealis (Eskimo curlew)	nd	nd	nd	nd	nd	nd	nd	nd
Tringa guttifer (spotted or Nordmann's greenshank)	nd	nd	nd	nd	nd	nd	nd	nd
Larus relictus (relict gull)	nd	nd	nd	nd	nd	nd	nd	nd

4 All data from IZY are for hybrid phenotypes.
5 Eggs taken from the wild.
6 Listed as Rallus sylvestris (Lord Howe wood rail) in Birds. Listed on CITES Appendix I as Tricholimnas sylvestris.
7 Not listed in Birds, could possibly be Houbaropsis bengalensis (bengal florican).

Appendix B. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
COLUMBIFORMES								
Caloenas nicobarica (nicobar pigeon)	77(39)†	14(3)†	61(32)†	5(2)†	<>	30(5)*	<>	31(2)
Ducula mindorensis (mindoro zone-tailed pigeon)	nd	nd	nd	nd	nd	nd	nd	nd
PSITTACIFORMES								
Amazona arausiaca (red-necked Amazon)	nd	nd	nd	nd	4(0)	nd	4(0)	nd
Amazona barbadensis (yellow-shouldered Amazon)	nd	nd	nd[8]	nd	nd	nd	nd	nd
Amazona brasiliensis (red-tailed Amazon)	nd	nd	nd	nd	nd	nd	nd	nd
Amazona guildingii (St. Vincent Amazon)	nd[8]	nd	nd	nd	17(1)	nd	17(1)	nd
Amazona imperialis (imperial Amazon)	nd	nd	nd	nd	3(0)	nd	3(0)	nd
Amazona leucocephala† (Cuban Amazon)	8(0)	nd	8(0)	nd	129+(37+)	11(0)*	126(10+)	12(2)
Amazona pretrei pretrei (red-spectacled Amazon)	nd	nd	nd	nd	nd	nd	nd	nd
Amazona rhodocorytha (red-crowned Amazon)	nd	nd	nd	nd	nd	nd	nd	nd
Amazona versicolor (St. Lucia Amazon)	nd	nd	nd	nd	18(0)	nd	8(0)	nd
Amazona vinacea (vinaceous Amazon)	1(0)	nd	2(0)	nd	nd	nd	nd	nd
Amazona vittata (Puerto Rican Amazon)	nd	nd	nd	nd	nd	nd	nd	nd

Anodorhynchus glaucus p.e. (glaucous macaw)	nd	nd	nd	nd	nd	nd	nd	nd
Anodorhynchus leari (indigo or Lear's macaw)	nd	nd	nd	nd	nd	nd	nd	nd
Aratinga guarouba (golden conure)	15(2)	3(2)	14(2)	nd	nd	17(6)	nd	16(6)
Cyanopsitta spixii (Spix's macaw)	nd	nd	nd	nd	nd	nd	nd	nd
Cyanoramphus auriceps forbesi (Forbes' yellow-fronted parakeet)	nd	nd	nd	nd	nd	nd	nd	nd
Cyanoramphus novaezelandiae[9] (red-fronted parakeet)	12(9)†	4(0)†	14(9)†	1(0)†	<>	33(9)*	<>	35(8)
Cyclopsitta (Opopsitta) diophthalma coxeni (Coxen's double-eyed fig parrot)	nd	nd	nd	nd	nd	nd	nd	nd
Geopsittacus occidentalis p.e. (night parrot)	nd	nd	nd	nd	nd	nd	nd	nd
Neophema chrysogaster (orange-bellied parrot)	nd	nd	nd	nd	nd	nd	nd	nd
Pezoporus wallicus (ground parrot)	nd	nd	nd	nd	nd	nd	nd	nd
Pionopsitta pileata (pileated or red-capped parrot)	2(0)	nd	2(0)	nd	nd	nd	nd	nd
Psephotus chrysopterygius (golden-shouldered parrot)	nd	nd	1(0)†	nd	86(82)†	17(5)*[10]	60(48)[11]	3(3)†
Psephotus pulcherrimus p.e. (paradise parrot)	nd	nd	nd	nd	nd	nd	nd	nd
Psittacula krameri echo[12] (Mauritius or ring-neck parakeet)	nd	nd	nd	nd	nd	nd	nd	nd

8 No data listed for numbers of animals in captivity. However, there was one "loan to" reported, but with no information given either from which institution or to which institution the loan was made.

9 Note decrease between 1981 and 1980 "Rare" data, despite increase in number of births in 1980. This decrease is most probably due to the 1 death recorded and 5 animals traded out of the ISIS network.

10 Data are for Psephotus chrysopterygius dissimilis only.

11 Data are for Psephotus chrysopterygius chrysopterygius only.

12 Birds lists Psittacula echo (Mauritius parakeet) as a distinct species. Psittacula krameri (rose-ringed parakeet) is listed in Birds, but with no subspecies called echo.

Appendix B. (continued).

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Psittacus erithacus princeps (principe grey parrot)	nd	nd	nd	nd	nd	nd	nd	nd
Pyrrhura cruentata (blue-throated conure)	nd	nd	nd	nd	nd	nd	nd	nd
Rhynchopsitta pachyrhyncha[13] (thick-billed parrot)	11(2)†	1(0)	12(2)†	nd	75(17)B	8(3)	76(14)	8(2)
Strigops habroptilus (kakapo or owl parrot)	nd	nd	nd	nd	nd	nd	nd	nd
STRIGIFORMES								
Tyto soumagnei (Madagascar grass owl)	nd	nd	nd	nd	nd	nd	nd	nd
Athene blewitti (forest spotted owlet)	nd	nd	nd	nd	nd	nd	nd	nd
Ninox novaeseelandiae royana[14] (Norfolk Island boobook owl)	nd	nd	nd	nd	nd	nd	nd	nd
Ninox squamipila natalis (Christmas Island hawk owl)	nd	nd	nd	nd	nd	nd	nd	nd
Otus gurneyi[15] (giant scops owl)	nd	nd	nd	nd	nd	nd	nd	nd
APODIFORMES								
Ramphodon (Glaucis) dohrnii (hook-billed hermit)	nd	nd	nd	nd	nd	nd	nd	nd
TROGONIFORMES								
Pharomachrus mocinno costaricensis (Costa Rican resplendent quetzal)	nd	nd	nd	nd	nd	nd	nd	nd

Pharomachrus mocinno mocinno (Mexican resplendent quetzal)	nd	nd	nd	nd	nd	nd	nd	nd
CORACIIFORMES								
Buceros bicornis homrai[16] (northern great pied hornbill)	nd	nd	nd	nd	nd	nd	nd	nd
Rhinoplax vigil (helmeted hornbill)	nd	nd	nd	nd	nd	nd	nd	nd
PICIFORMES								
Campephilus imperialis (imperial woodpecker)	nd	nd	nd	nd	nd	nd	nd	nd
Dryocopus javensis richardsi (Tristram's white-bellied black woodpecker)	nd	nd	nd	nd	nd	nd	nd	nd
PASSERIFORMES								
Pitta kochi (Koch's pitta)	nd	nd	nd	nd	nd	nd	nd	nd
Cotinga maculata (banded cotinga)	1(0)	nd	1(0)	nd	nd	nd	nd	nd
Xipholena atro-purpurea (white-winged cotinga)	nd	nd	nd	nd	nd	nd	nd	nd

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13 Genus Rhynchopsitta is listed on CITES Appendix I.

14 Birds does not list subspecies Ninox novaeseelandiae royana (Norfolk Island boobook owl). However, Ninox novaeseelandiae undulata is listed, with Norfolk Island given as its geographical range.

15 Birds lists species as Mimizuku gurneyi (giant scops owl). Listed as Otus gurneyi (giant scops owl) on CITES Appendix I.

16 Subspecies Buceros bicornis homrai is not listed in Birds.

Appendix B. (continued).

Scientific Name (Common Name)	ISIS				IZY			
	1981 Rare	1980 Bred	1980 Rare	1979 Bred	1979 Rare	1978 Bred	1978 Rare	1977 Bred
Atrichornis clamosus (noisy scrub-bird)	nd	nd	nd	nd	nd	nd	nd	nd
Dasyornis brachypterus longirostris[17] (western bristlebird)	nd	nd	nd	nd	nd	nd	nd	nd
Dasyornis broadbenti littoralis p.e. (western rufous bristlebird)	nd	nd	nd	nd	nd	nd	nd	nd
Picathartes gymnocephalus (white-necked bald crow or rockfowl)	4(0)	nd	4(0)	nd	41(3)	nd	37(4)	1(1)
Picathartes oreas (grey-necked bald crow or rockfowl)	nd	nd	nd	nd	3(2)	nd	3(2)	nd
Zosterops albogularis (white-chested white eye)	nd	nd	nd	nd	nd	nd	nd	nd
Meliphaga cassidix (helmeted honeyeater)	nd	nd	nd	nd	nd	nd	nd	nd
Carduelis (Spinus) cucullatus (red sisken)	nd	nd	nd	nd	nd	nd	nd	4(0)
Leucopsar rothschildi (Rothschild's mynah)	202(171)	76(27)	133(114)	49(15)	623(464+)	242(121)*	630(373+)	196(85)

17 Birds lists Dasyornis longirostris (western bristlebird) as a separate species from D. brachypterus (eastern bristle bird). Dasyornis brachypterus longirostris is listed on CITES Appendix I.

Appendix C.

TES Appendix I reptile and amphibian species maintained and bred in captivity.

Appendix C. CITES Appendix I reptile and amphibian species maintained and bred in captivity.

Scientific Name (Common Name)	Inventory 1981 Rare	Inventory 1980 Bred	Inventory 1980 Rare	Inventory 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
TESTUDINATA								
Batagur baska (common batagur)	2	nd	1	nd	nd	nd	nd	nd
Geoclemys (Damonia) hamiltonii (black pond turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Geoemyda (Nicoria) tricarinata (three-keeled land turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Kachuga tecta tecta (Indian tent turtle)	2	nd	2[1]	nd	nd	nd	nd	nd
Morenia ocellata (Burmese swamp turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Terrapene coahuila (aquatic box turtle)	24	3,#	12[2]	#	nd	nd	nd	nd
Geochelone (Testudo) elephantopus (Galapagos giant tortoise)	165†	nd[3]	145†	nd	163(29)	nd	155(11)	nd
Geochelone (Testudo) radiata (radiated tortoise)	82	1[4]	59	nd	122(26)	5(0)	119(11+)	nd
Geochelone (Testudo) yniphora (Madagascar tortoise)	5	nd	5	nd	5(0)	nd	6(0)	nd
Gopherus flavomarginatus (Bolson tortoise)	1	nd	1	nd	nd	nd	nd	nd
Psammobates (Testudo) geometricus (geometric tortoise)	nd	nd	nd	nd	nd	nd	nd	nd
Chelonia mydas[5] (green turtle)	2	nd	nd	nd	nd	nd	nd	nd
Eretmochelys imbricata[5] (hawksbill turtle)	1	nd	nd	nd	nd	nd	nd	nd
Lepidochelys kempii[5] (Kemp's or Atlantic ridley)	1	nd	1	nd	nd	nd	nd	nd

Lepidochelys olivacea[5] (olive or Pacific ridley)	nd	nd	nd	nd	nd[6]	nd	nd	nd
Dermochelys coriacea (leatherback turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Lissemys punctata punctata (Indian flap-shell turtle)	4	nd	nd	nd	nd	nd	nd	nd
Trionyx ater (black soft-shell turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Trionyx gangeticus (Ganges soft-shell turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Trionyx hurum (peacock-marked soft-shell turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Trionyx nigricans (dark soft-shell turtle)	nd	nd	nd	nd	nd	nd	nd	nd
Pseudemydura umbrina (short-necked turtle)	nd	nd	nd	nd	nd	nd	22(0)	3(0)
CROCODYLIA								
Alligator sinensis (Chinese alligator)	24	22(2),#	nd[7]	nd[8]	55(0)	nd	46(0)	nd
Caiman crocodilus apaporiensis (Rio Apaporis spectacled caiman)	2	nd	nd	nd	nd	nd	nd	nd
Caiman latirostris (broad-nosed caiman)	1	nd	nd	nd	92(4)	12(11)	77(4)	nd

1 Listed in Inventory as "Kachuga tentoria ssp., possibly K. tecta.
2 Listed in Inventory as the Coahuilan box turtle.
3 Only data given in Inventory: one institution "successfully bred during 1967, 1969, 1970, 1972. 52 of these offspring are still living and are approaching young adulthood."
4 One institution reported in Inventory - "multiple litters," another institution reported 1 born.
5 Entire family Cheloniidae is listed on CITES Appendix I.
6 IZY reports 9,000 eggs collected from the wild.
7 Inventory reports that New York Zoological Park "has a breeding project containing 4 or 5 pooled specimens."
8 New York Zoological Park reports possible 3 young produced during 1979. "Group efforts are being made to breed this rare species."

Appendix C. (continued).

Scientific Name (Common Name)	Inventory 1981 Rare	Inventory 1980 Bred	Inventory 1980 Rare	Inventory 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Melanosuchus niger (black caiman)	11	nd	2	nd	28(0)	nd	26(0)	nd
Crocodylus acutus (American crocodile)	60	2[9]	18	nd	nd	nd	nd	15(6)
Crocodylus cataphractus (African slender-snouted crocodile)	5	1	3†	nd	nd	nd	nd	nd
Crocodylus intermedius (Orinoco crocodile)	7	5	2	nd	10(0)	nd	12(0)	nd
Crocodylus moreletii (Morelet's crocodile)	30	38(25)	58	23(10)	120(85)	25(0)	27(0)	nd
Crocodylus niloticus (Nile crocodile)	41	13	12	nd	<>	125(4)	<>	60(4)
Crocodylus novaeguineae mindorensis (Mindoro or Philippine crocodile)	4	nd	4	nd	nd	nd	nd	nd
Crocodylus palustris (mugger crocodile)	5	nd	7†	nd	392(305)	138(10)	147(60)	13(3)
Crocodylus porosus **-108 (salt-water or estuarine crocodile)	16†	nd	8†	nd	nd	nd	nd	2(2)
Crocodylus rhombifer (Cuban crocodile)	12	nd	12	nd	55(14)[B]	3(0)	40(4)	nd
Crocodylus siamensis (Siamese crocodile)	16	7	16	nd	nd	nd	nd	nd
Osteolaemus tetraspis (West African dwarf crocodile)	165†	13[10]	72†	3[11]	<>	60(2)	<>	35(0)
Tomistoma schlegelii (false gavial or gharial)	26	nd	15	nd	nd	nd	nd	nd
Gavialis gangeticus (gavial or gharial)	3	nd	1	nd	22(0)	nd	102(0)	nd

RHYNCHOCEPHALIA								
Sphenodon punctatus (tuatara)	4	nd	2†	nd	17(0)	nd	17(0)	nd
SAURIA								
Brachylophus fasciatus[12] (Fiji banded or crested iguana)	15	#	18	nd	22(5)	nd	23(3)	3(0)
Cyclura cornuta[13] (rhinoceros iguana)	74†	nd	44†	nd	<>	99(8)*	<>	13(1)
Cyclura cychlura[13a] (Exuma Island iguana)	3	nd	5	nd	nd	nd	nd	nd
Cyclura nubila[13b] (Cayman Island iguana)	4†	nd	3	nd	nd	nd	nd	nd
Cyclura ricordi[13] (Hispaniola ground iguana)	nd	nd	nd	nd	nd	11(5)	nd	2(2)
Cyclura rileyi[13] (San Salvador Island iguana)	1†	nd	1	nd	nd	nd	nd	nd
Sauromalus varius (San Esteban Island chuckwalla)	3	#	1	nd	nd	nd	nd	nd
Varanus bengalensis (Bengal monitor)	35	1[14]†	39†	nd[15]†	nd	nd	nd	nd
Varanus flavescens (yellow monitor)	2	nd	2	nd	nd	nd	nd	nd

9 1 institution reported that out of 45 eggs laid, 2 hatched.
10 2 institutions reported data: first reported that out of 17 eggs laid, 9 hatched; the other reported 4 born.
11 1 institution reported that out of 16 eggs laid, 3 hatched.
12 Genus Brachylophus is listed on CITES Appendix I.
13 Genus Cyclura is listed on CITES Appendix I.
13a Reptiles reports Cyclura cychlura as including C. figginsi. Data are for C. figginsi as reported in Inventory.
13b Reptiles reports Cyclura nubila as including C. macleayi (Cuban iguana).
14 Inventory reports 2 eggs which were laid July 20, 1979 (see footnote [15]) and were still considered viable on 12/3/79 (135 days). Another institution reported 15 eggs laid, 1 hatched.
15 Inventory reports eggs deposited July 20, 1979, several eggs eaten by male, 7 left, of which only 2 determined to be fertile for Varanus bengalensis nebulos (clouded monitor).

Appendix C. (continued).

Scientific Name (Common Name)	Inventory 1981 Rare	Inventory 1980 Bred	Inventory 1980 Rare	Inventory 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
Varanus griseus (grey or desert monitor)	2†	nd	1	nd	nd	nd	nd	nd
Varanus komodoensis (Komodo dragon)	2	nd	3	nd	20(4)[B]	nd	20(4)	nd
SERPENTES								
Acrantophis dumerili[16] (Dumeril's boa)	60	37	34	#	24(11)	nd	25(3)	nd
Acrantophis madagascariensis[16] (Madagascar boa)	12	#	8†	nd	27(6)†	nd	31(14)	nd
Bolyeria spp. (Round Island boas)	nd	nd	nd	nd	nd	nd	nd	nd
Casarea dussumieri[17] (keel-scaled boa)	nd	nd	nd	nd	6(0)	nd	4(0)	nd
Epicrates inornatus (Puerto Rican boa)	104	#	87	#	105(68)	2(0)	99(71)	9(0)
Epicrates subflavus (Jamaican boa)	155	#	61	#	433(394)	167(20)	295(255)	196(41)
Python molurus molurus (Indian rock python)	42	#	34	#	nd	64(3)	nd	nd
Sanzinia madagascariensis (Madagascar tree boa)	30	#	21	#	37(14)	3(0)	40(3)	5(0)

AMPHIBIANS								
URODELA								
Andrias (Megalobatrachus) davidianus (Chinese giant salamander)	8	nd	7[18]	nd	30(0)	nd	27(0)	nd
Andrias (Megalobatrachus) japonicus (Japanese giant salamander)	5†	nd	5†	nd	117(0)	nd	81(0)	nd
SALIENTIA								
Bufo periglenes (orange toad)	nd	nd	nd	nd	nd	nd	nd	nd
Bufo superciliaris (Cameroon toad)	nd	nd	nd	nd	nd	nd	nd	nd
Nectophrynoides spp. (viviparous African toads)	nd	nd	nd	nd	nd	nd	nd	nd
Atelopus varius zeteki (golden frog)	nd	nd	nd	nd	nd	nd	nd	nd

16 Genus Acrantophis is listed on CITES Appendix I.
17 Genus Casarea is listed on CITES Appendix I.
18 Listed in Inventory as Andrias japonicus davidianus.

Appendix D.

Genera and families listed on CITES Appendix I.

Appendix D. Genera and families listed on CITES Appendix I .

Scientific Name (Common Name)	ISIS 1981 Rare	ISIS 1980 Bred	ISIS 1980 Rare	ISIS 1979 Bred	IZY 1979 Rare	IZY 1978 Bred	IZY 1978 Rare	IZY 1977 Bred
MAMMALS								
MARSUPIALIA								
Bettongia spp. (rat-kangaroos)	22(22)	3(0)	21(21)	3(0)	64(54+)	16(1)	54(46+)	11(0)
PRIMATES								
Allocebus spp. (hairy-eared dwarf lemurs)	nd	nd	nd	nd	nd	nd	nd	nd
Cheirogaleus spp. (dwarf lemurs)	39(36)	12(2)	35(26)	15(8)	34(25)	7(2)	27(18)	nd
Hapalemur spp. (gentle lemurs)	4(4)	1(0)	3(3)	1(0)	15(9)	1(0)	17(9)	1(0)
Lemur spp. (lemurs)	935(773)	172(54)	845(662)	172(42)	1025(775+)	272(54)	810(545+)	263(66)
Lepilemur spp. (sportive or weasel lemurs)	nd	nd	nd	nd	nd	nd	nd	nd
Microcebus spp. (mouse lemurs)	26(23)	7(2)	24(19)	5(1)	88(73)	10(2)	97(78)	6(0)
Phaner spp. (fork-marked mouse lemur)	nd	nd	nd	nd	nd	nd	nd	nd
Avahi spp. (woolly indris)	nd	nd	nd	nd	nd	nd	nd	nd
Indri spp. (indris)	nd	nd	nd	nd	nd	nd	nd	nd
Propithecus spp. (sifakas)	1(1)	nd	1(1)	nd	1(1)	nd	4(2)	nd
Leontopithecus (Leontideus) spp. (golden tamarins)	158(147)	53(24)	116(111)	50(29)	182(151)	56(24)	169(134)	54(22)
Cacajao spp. (uakaris)	10(2)	nd	12(2)	nd	32(6)	1(0)	35(7)	nd

Hylobates spp. (gibbons)	348(135)	26(10)	332(122)	25(5)	428+(58)[B]	52(15)	64(12)	59(15)
Pongidae spp. (gorillas, orangutans, and chimpanzees)	1872(711)	115(29)	1744(626)	110(18)	1251(484)	118(18)	1238(455)	136(31)
RODENTIA								
Chinchilla spp. +201 (chinchillas)	54(37)	11(3)	46(30)	8(3)	nd	93(34)	nd	62(19)
CETACEA								
Platanista spp. (susus)	nd	nd	nd	nd	nd	nd	nd	nd
Sotalia spp. (S. American river dolphins)	nd	nd	nd	nd	nd	nd	nd	nd
Sousa spp. (hump-backed dolphins)	nd	nd	nd	nd	nd	nd	nd	nd
Balaena (Eubalaena) spp. (bowhead whale)	nd	nd	nd	nd	nd	nd	nd	nd
PINNIPEDIA								
Monachus spp. (monk seals)	nd	nd	nd	nd	nd	nd	2(0)	nd
PERISSODACTYLA								
Rhinocerotidae spp. (rhinoceroses)	206(58)	11(2)	208(55)	13(2)	651+(146)+	33(4)	607+(133)	27(2)
BIRDS								
PSITTACIFORMES								
Rhynchopsitta spp. (thick-billed parrots)	11(2)	1(0)	12(2)	nd	75(17)	8(3)	76(14)	8(2)
REPTILES								
TESTUDINATA								
Cheloniidae spp. (marine turtles)	4	nd	1	nd	nd[1]	nd	nd	nd

1 Eggs taken from the wild.

Appendix D. (continued).

Scientific Name (Common Name)	Inventory				IZY			
	1981 Rare	1980 Bred	1980 Rare	1979 Bred	1979 Rare	1978 Bred	1978 Rare	1977 Bred
SAURIA								
Brachylophus spp. (Fiji iguanas)	15	#	18	nd	22(5)	nd	23(3)	3(0)
Cyclura spp. (West Indian rock iguanas)	82	nd	53	nd	nd	110(13)	nd	15(3)
SERPENTES								
Acrantophis spp. (Madagascar boas)	72	37	42	#	51(17)	nd	56(17)	nd
Bolyeria spp. (Round Island boas)	nd	nd	nd	nd	nd	nd	nd	nd
Casarea spp. (keel-scaled boas)	nd	nd	nd	nd	6(0)	nd	4(0)	nd
AMPHIBIANS								
SALIENTIA								
Nectophrynoides spp. (viviparous African toads)	nd	nd	nd	nd	nd	nd	nd	nd

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