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PRELIMINARY ANALYSIS OF THE
ISIS NATIONAL INVENTORY AND ACQUISITION REPORT - 5/30/75

The first International Species Inventory System mammalian species distribution summary (our first national survey) was prepared May 5, 1975. It records data on 12,156 living specimens based on reports from 92 zoos, of whom 44 have completed their entire inventory reports. The report summarizes events occurring during the year 1974, thus, any births or deaths occurring during 1975 are not included. The report contains data on 12,156 living specimens of mammals, of which 1,944 were born in 1974, and 287 deaths were recorded. The 287 deaths represent only a proportion of the deaths occurring in 1974 since we did not begin collecting data until June 1974. Our instructions to the zoos requested they begin with their currently living collection and then report deaths and other changes as they occurred from their beginning date. This means that all animals born in 1974 and still living in the zoo would be recorded, whereas only about 1/4th of the year's deaths are on record. We, therefore, estimate that the actual number of deaths is around 1,144. More accurate data will be available at the end of 1975. Thus, 16% of the 12,156 living specimens on record were born during 1974, and 9% of a total of 13,300 died during 1974. The total number of acquisitions during this period was 3,517 and includes 1,944 births, 784 purchases, 165 trades, 414 donations, and 155 loans. During the same period 760 specimens were released or removed from the individual collections. This included the 287 deaths mentioned above and 249 sales,

74 trades and 88 loans. At the time of reporting, 157 autopsies were recorded for the 287 deaths, yielding an autopsy rate of 55%. This rate would increase with later autopsy reports as these became available, but even at this percentage is higher than the nation-wide rate of human autopsies. Although it will be another six months before complete data are available to allow precise estimates of overall birth rates and death rates, it is already clear that the number of animals being born in zoo collections considerably exceeds the current death rate. This is the result of many successful breeding programs which are producing sufficient numbers of some species such that no additional space is available in qualified zoo collections for these animals. It also reflects the fact that the death rate for many species in captivity is considerably lower than that observed in the wild since zoo collections offer continuous adequate nutrition, treatment for disease and no predator pressure. Rather, a major consideration for future zoo breeding management policy will be carefully regulated breeding to maintain adequate genetic heterogeneity in the gene pools to be maintained in captivity primarily from captive stock. The data base provided by the ISIS program of the AAZPA will make a significant contribution to the achievement of these breeding policy objectives. An example of the kind of information available to the zoos may be illustrated with our available data on an endangered species, the jaguar, Panthera onca. This species is currently considered to contain eight subspecies of which three are currently identified as being held in captivity. The following data are the actual numbers based upon the animals reported, that is 12,156. It is estimated that this represents one-third of the animals held in collections

in North America. Since the sample size is so large and there are a wide spread of zoo exhibitors represented, we feel that a reasonable estimate of the actual numbers in each of the categories to be discussed can be obtained simply by multiplying by three. Thus, the total number of jaguars listed are 125, of which 111 are unidentified with respect to subspecies classification, and 24 are placed in either Panthera onca centralis or Panthera onca onca, or Panthera onca arizonensis. These 125 animals are held in 42 zoos. The sexes are as follows: 66 females, 58 males, and 1 of unknown sex. Eleven of the zoos held animals of one sex only, for a total of 13, yielding 31 zoos with 114 animals in a potentially paired situation. During the time of record, 35 baby jaguars were born and 30 currently remain in these collections. There appear then to have been 13 litters born in 12 zoos, with two deaths occurring during the first 60 days. Thus, the 114 animals minus 30 born during the year yields 84 animals that might potentially be breeders. However, an additional 13 are less than two years old, yielding 71 animals of approximately breeding age. A survey of the data indicated 30 zoos with pairs of animals older than two years that might potentially produce young. Twenty-three of these zoos had pairs between the age of two and ten years, which produced a total of nine litters in eight of the zoos. Seven of the zoos had pairs greater than 10 years of age, which produced three litters. Thus, eleven out of 30 zoos produced a total of 12 litters for a total of 34 animals born. If one multiplies these numbers by three to arrive at an estimate of the total captive jaguar population in North America, the data indicate the presence of 375 animals and

the probability that about 105 births occurred during the year of 1974. The effective breeding population would be in the vicinity of 210 animals, with adequate recruitment to maintain this population and produce a surplus. Consideration will need to be given to the age structure of this effective breeding population in order to insure that its composition will allow a long-term stability of the population and also assure the management of breeding in such a manner as to avoid substantial inbreeding and loss of genetic heterogeneity. This analysis of the ISIS data would indicate that these goals are easily obtainable given the development of explicit breeding management strategies, given the ability to exchange animals readily between qualified zoos, and given the continued development of this data base. The enthusiasm and cooperation of the North American zoos in developing this program represents a unique achievement in man's relationships to captive animals and ultimately to the benefit of these species in the wild. The accomplishment of these goals is clearly within the grasp of the zoos and has been accomplished by sustained cooperative effort between the zoos, private foundations, and several government agencies. It clearly signified the interest of all groups in the welfare of the species and the effort to make a significant contribution towards their ultimate continued survival in natural habitats.

ISIS RECEIVES FULL SUPPORT AT AAZPA CONVENTION

On October 3, 1974, the following motion to provide annual operation funds for ISIS (International Species Inventory System) based on a user's fee was presented to the membership at the 50th AAZPA Convention in Philadelphia, Pennsylvania.

Move that:

- (1) The AAZPA provide \$10,000 in support of ISIS for the current year, beginning October 1, 1974, based upon the provision
- (2) That participant users provide annual operational support at the rate of one dollar per mammal per year, based on their last December 31 inventory.
- (3) The latter will be voluntary for the current year, and will be obligatory at the start of each budget year after June 30, 1975.

The motion was approved with a vote of 90 to 4.

ISIS has since received \$10,000 from the AAZPA, and its first user's fee from the Salisbury Zoo, an ISIS participant. Note that the user's fee is voluntary for the current year. Any other institution wishing to make a payment to ISIS may do so by sending a check, based on the number of mammals in the collection times \$1.00, payable to "ISIS - Minnesota Zoological Garden".

One hundred sixty-five institutions, including zoos, aquariums, dealers, game farms, private breeders, and researchers, have now signed up to participate. To date, the ISIS office has received and processed 3,751 data forms from 45 zoos. Four zoos have completed their mammalian inventories. We are asking all participants to complete their mammalian inventories by December 31, 1974. This will enable us to produce the first National Species Inventory by early 1975, as well as individual zoo's inventories.

The ISIS staff is presently reviewing the format of the data form and will be revising it to fulfill the needs of the user zoological institutions. Any suggestions submitted by December 1st can be considered. Three other phases of the census and inventory program are in the development stage.

- (1) Paul Linger of the Denver Zoo is heading up a sub-committee to formulate a "Life History" form. Any suggestions may be sent directly to Paul.
- (2) Birds will be added to the system by summer or fall of 1975. The taxonomy is being reviewed and revised, and an "egg lay" form is being developed.
- (3) The Physiological Norms program is being revised by Dr. U.S. Seal and Dale G. Makey. We hope to begin systems analysis within a few months and have the norms system operational by the fall of 1975.

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System Manager, ISIS

*To be published in the proceedings of the
Symposium on the Behavior and Ecology of Wolves,
held by Animal Behavior Society in May.*

ISIS-AN ESTABLISHED DATA BANK FOR CAPTIVE WOLVES

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ISIS-AN ESTABLISHED DATA BANK FOR CAPTIVE WOLVES

Modern day zoos, researchers and private breeders are faced with the challenge of developing self-sustaining populations of captive exotic species and perhaps in selected instances of providing the only reservoir for species endangered or on the verge of extinction...good examples being the red wolf (Canus rufus) and the grey wolf (Canus lupus). To meet this problem it is necessary to develop policies for the management of gene goals over multiple generations, and to collect and share data.

North American zoological institutions are confronting this challenge head on through the International Species Inventory System (ISIS). The collection of census and vital statistics data is presently being accomplished by ISIS of the American Association of Zoological Parks and Aquariums (AAZPA). ISIS can also provide pedigrees, studbooks and the data for analysis of breeding relationships within captive populations. Information for management purposes and data needed for life history analysis is also provided.

ISIS had its beginning in Houston, Texas at the October 1973 meeting of the AAZPA when Dr. U.S. Seal and Dale G. Makey of Minnesota proposed the program to the board and membership. The program was adopted and initial financial support was approved. Since then grants and gifts totaling \$67,240.00 have been received by ISIS. An additional \$10,930.00 in operational funds has been provided to this date by 41 participating institutions as their \$1 per mammal per year voluntary assessment voted by the AAZPA at its annual meeting in Philadelphia in October, 1974. This assessment will be mandatory beginning July 1, 1975. However, provisions will be made for those unable to pay the annual fee.

ISIS is housed at the Minnesota Zoological Garden (MZG) offices in St. Paul, Minnesota and will move to the zoo site in Apple Valley, Minnesota upon completion of this new facility. Use of the IBM 370-158 computer, part of the state computer system, is also made possible through the relationship with the Minnesota Zoo. Personnel for ISIS includes Linda Murtfeldt, ISIS System Manager and Zoological Records Supervisor for MZG and data processor, Kim Hastings.

Implementation of ISIS has far exceeded the expectations of all who participated in its original formulation and presentation. Currently, 176 zoological institutions and private individuals have signed as participants. One hundred one zoos are actively submitting data on their mammal collections. Forty-seven institutions have completed their inventories and are on a current basis. Data forms have been received on more than 19,000 mammals. Computer output inventories have been returned to all zoos who have completed their mammal data.

Each participating institution has been provided with a set of three manuals: the ISIS Mammalian Taxonomic Directory, the ISIS World Geographic and Zoological Institution Directory, and the ISIS Institution Procedures. The Taxonomic Directory contains a listing of all living mammalian species, each taxon including the scientific name, a vernacular name, and the approximate distribution in the wild. The primary reference source for the organization of orders, families, and genera is Anderson and Jones (editors), Recent Mammals of the World, the Ronald Press Co., New York, 1967. The taxonomic literature plus regional and country check lists have been utilized for the assembly of the species listings.

The Institution Directory contains a hierarchical code system for the listing of all regions, subregions, countries, states and zoological institutions (zoos, aquariums, museums, dealers, special collections and researchers) throughout the world.

One data sheet is prepared for each animal. This form contains information on taxonomy, individual identification, sire and dam, place of birth or capture location, sex, age, transactions which occur and between whom, price, hybrid status, color phase, death and autopsy information, tag and tattoo numbers, studbook identification, marine mammal permit number, postentry quarantine number, and endangered species permit number. Each institution keeps one copy of the form for its files and sends the original to ISIS. After review for completeness and accuracy by the system manager, the information is punched on keypunch cards and then sent to the computer for input.

The first International Species Inventory System mammalian species distribution summary (our first national survey) was prepared May 5, 1975. It records data on 12,156 living specimens based on reports from 92 zoos, of whom 44 have completed their entire inventory reports. Copies of this report have been sent to all participants who are submitting data. Similar reports will be prepared on an annual basis, and may be obtained on a more frequent basis at cost.

The national species inventory report summarizes events occurring during the year 1974. Thus, any births or deaths occurring during 1975 are not included. The report contains data on 12,156 living specimens of mammals, of which 1,944 were born in 1974, and 287 deaths represent

only a proportion of the deaths occurring in 1974 since we did not begin collecting data until June 1974. Our instructions to the zoos requested they begin with their currently living collection and then report deaths and other changes as they occurred from their beginning date. This means that all animals born in 1974 and still living in the zoo would be recorded, whereas only about 1/4th of the year's deaths are on record. We, therefore, estimate that the actual number of deaths is around 1,144. More accurate data will be available at the end of 1975. Thus, 16% of the 12,156 living specimens on record were born during 1974, and 9% of a total of 13,300 died during 1974. The total number of acquisitions during this period was 3,517 and includes 1,944 births, 784 purchases, 165 trades, 414 donations, and 155 loans. During the same period 760 specimens were released or removed from the individual collections. This included the 287 deaths mentioned above and 249 sales, 74 trades and 88 loans. At the time of reporting, 157 autopsies were recorded for the 287 deaths, yielding an autopsy rate of 55%. This rate would increase with later autopsy reports as these became available, but even at this percentage is higher than the nation-wide rate of human autopsies. Although it will be another six months before complete data are available to allow precise estimates of overall birth rates and death rates, it is already clear that the number of animals being born in zoo collections considerably exceeds the current death rate. This is the result of many successful breeding programs which are producing sufficient numbers of some species such that no additional space is available in qualified zoo collections for these animals. It also reflects the fact that the death rate for many species in captivity is considerably lower than that observed in the wild since zoo collections offer continuous adequate nutrition, treatment for disease and no predator

pressure. Rather, a major consideration for future zoo breeding management policy will be carefully regulated breeding to maintain adequate genetic heterogeneity in the gene pools to be maintained in captivity primarily from captive stock. The data base provided by the ISIS program of the AAZPA will make a significant contribution to the achievement of these breeding policy objectives. An example of the kind of information available to the zoos may be illustrated with our available data on the gray wolf, Canis lupus, a species classified as "vulnerable" by the IUCN, with 2 subspecies, irremotus and lycaon, categorized as "endangered" by the U.S. Department of the Interior. This species is currently considered to contain 25 subspecies of which 8 are currently identified as being held in captivity. The following data are the actual numbers based upon the animals reported, that is 12,156. Private breeders and game farms have not submitted data at this point. Therefore, the numbers given for both estimates of numbers of wolves in captivity and their productivity are underestimates. It is estimated that this total of 12,156 animals represents one-third of the animals held in zoo collections in North America. Since the sample size is so large and there are ^awide spread of zoo exhibitors represented, we feel that a reasonable estimate of the actual numbers in each of the categories to be discussed can be obtained simply by multiplying by three. Thus, the total number of gray wolves listed is 109, of which 50 are unidentified with respect to subspecies classification, and 59 are placed in either Canus lupus lupus (2 specimens), Canus lupus baileyi (19 specimens), Canus lupus irremotus (8 specimens), Canus lupus lycaon (12 specimens), Canus lupus manningi (2 specimens), Canus lupus occidentalis (4 specimens), Canus lupus pallipes (4 specimens), or Canus lupus pambasileus (8 specimens).

These 109 animals are held in 26 zoos. The sexes are as follows: 53 females, 51 males, and 5 of unknown sex. Five of the zoos held animals of one sex only, for a total of 8 animals. Thus, the remaining 21 zoos held a total of 101 animals in a potentially paired situation. During the time of record, 27 baby wolves were born and 26 currently remain in these collections. There appear then to have been 7 litters born in 7 zoos. Thus, the 101 animals minus 27 born during the year yields 74 animals that might potentially be breeders. However, an additional 19 are less than two years old, yielding 55 animals of approximately breeding age. A survey of the data indicated 17 zoos with pairs of animals older than two years that might potentially produce young. Fifteen of these zoos had pairs between the age of two and ten years, which produced a total of 5 litters in 5 of the zoos. Thus, 15 out of 17 zoos produced a total of 5 litters for a total of 27 animals born. If one multiplies these numbers by three to arrive at an estimate of the total captive gray wolf population in North American zoos, the data indicate the presence of 327 animals and the probability that about 81 births occurred during the year of 1974. The effective breeding population would be in the vicinity of 165 animals, with adequate recruitment to maintain this population and produce a surplus. Consideration will need to be given to the age structure of this effective breeding population in order to insure that its composition will allow a long-term stability of the population and also assure the management of breeding in such a manner as to avoid substantial inbreeding and loss of genetic heterogeneity. This analysis of the ISIS data would indicate that these goals are easily obtainable given the development of explicit breeding management strategies, given the ability to exchange animals readily between qualified zoos, and given the continued development of this data base. The enthusiasm

and cooperation of the North American zoos in developing this program represents a unique achievement in man's relationships to captive animals and ultimately to the benefit of these species in the wild. The accomplishment of these goals is clearly within the grasp of the zoos and has been accomplished by sustained cooperative effort between the zoos, private foundations, and several government agencies. It clearly signifies the interest of all groups in the welfare of the species and the effort to make a significant contribution towards their ultimate continued survival in natural habitats.

This evaluation of the effective breeding population of North American wolves is based on a data survey without regard to subspecies identification. The situation is unsatisfactory when subspecies are enumerated since the number of each is very small. The ISIS data would indicate, however, that zoos are capable of managing Canus lupus SSP in captivity if it should be necessary to do so for a subspecies of choice. The almost total unavailability of data from private breeders and game farms makes this resource difficult to include in any long-term captive gene pool management program. This situation might be alleviated if individual breeders would form a liaison with either a local zoo or some central wolf management group. Then, if their breeding stock became a part of a nationally managed gene pool, they would be obligated to assure the transfer of these animals to some institutional base if they were no longer able to maintain them. Otherwise these animals can only be regarded as individually held pets of no value to the survival of the gene pool in question.

Two new subsystems, Life History and Physiological Norms, are in the trial run phase at this time. One thousand data forms of each are being distributed to about 25 zoos for a test run this summer. The Physiological Norms program of the American Association of Zoo Veterinarians (AAZV) will be carried out by zoo veterinarians. It will collect and collate baseline laboratory data and will be used for select specimens of special interest at each institution. The Life History format has been developed by a group of zoo personnel headed by Paul Linger, Assistant Director of the Denver Zoo. It includes behavioral data, management procedures, growth statistics and animal husbandry information. It, too, is designed for use with a select group of animals. However, if an institution wishes, it will be able to complete forms recording both physiological norms and life history data for its entire collection.

Proper management techniques and the development of self-sustaining breeding populations of wolves in captivity may be vital if we are to preserve the red wolf species and could provide information aiding in the long-term management procedures and policies for the preservation of the gray wolf. A central data bank for tabulating vital statistics and life histories is necessary for gathering this information. The International Species Inventory System can provide this service and is programmed to handle select species such as the wolves. A real team effort is necessary if all vital information is to be obtained so that zoological institutions may develop systematic long-term management and propagation programs for captive wolf species, and make a significant contribution towards their ultimate continued survival in natural habitats.

*Original sent to Dr. Burnings,
Bronx Zoo*

ABSTRACT

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ISIS: A Computerized Record System for the Management of Wild Animals in Captivity.

Modern day zoos are faced with the responsibility of developing self-sustaining populations of captive wild species and in selected instances of providing the only reservoir for species extinct or on the verge of extinction in the wild. To accomplish these goals, it is necessary to develop policies for management of captive gene pools over multiple generations, to collect data and share it, to continue work on development of methods for enhancement of reproduction, and to develop methods for managing problems of surplus production. Collection of census and vital statistics data are being accomplished by the ISIS committee of the American Association of Zoological Parks and Aquariums. Approximately 180 zoos and aquariums in the United States and Canada have agreed to participate in this program. Currently 105 zoos are supplying data on a continuing and current basis. Data on approximately 22,000 animals has been received. We project the total captive wild animal population held in zoos in North America at about 36,000 mammals. Zoos receive from the ISIS program on an annual basis a copy of their total inventory, a copy of a summary of their acquisition/release activities during the year, and a copy of a national species inventory which tabulates all of the census data by species. This data base has provided quantitative documentation that many wild species, including a number of species on the endangered species list, are currently well established self-sustaining captive populations in American zoos. The accompanying tables document this for five endangered species including two lemurs and three of the big cats.

STATUS IN AMERICAN ZOOS OF FIVE ENDANGERED SPECIES¹

<u>Species</u>	Estimates ²				
	<u>Number of Zoos Holding the Species</u>	<u>Number of Animals</u>	<u>Sex Ratio Male/Female</u>	<u>1974 Births</u>	<u>1974 Deaths</u>
Ringtail Lemur (<u>Lemur catta</u>)	67	422	1/1.4	60	0
Black Lemur (<u>Lemur macaco</u>)	25	382	1/1.1	60	20
Jaguar (<u>Panthera onca</u>)	126	375	1/1.0	105	24
Leopard (<u>Panthera pardus</u>)	137	580	1/1.1	135	70
Tiger (<u>Panthera tigris</u>)	150	770	1/1.3	260	50

¹ As listed in the U.S. List of Endangered Foreign Mammals, Federal Register, Vol. 35, No. 233, Wednesday, December 2, 1970.

² These estimates are based upon our data collected from 40% of American zoos as of May 5, 1975. The actual numbers were multiplied by 2.5 to obtain the numbers presented in this table.

SOURCES OF FIVE ENDANGERED SPECIES HELD IN AMERICAN ZOO COLLECTIONS

<u>Species</u>	Sample Size			
	Checked	Wild-Born	Zoo-Born	Uncertain
	<u>N</u>	<u>%</u>	<u>%</u>	<u>%</u>
Ringtail Lemur (<u>Lemur catta</u>)	115	8	79	13
Black Lemur (<u>Lemur macaco</u>)	140	19	76	5
Jaguar (<u>Panthera onca</u>)	62	2	69	29
Leopard (<u>Panthera pardus</u>)	96	5	69	26
Tiger (<u>Panthera tigris</u>)	146	2	92	6

*Press release
sent out by IBM*



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UNIQUE REPORT HELPS ZOOS REPLACE ANIMALS

ST. PAUL, Minn., June 30. . . A zoo in Kansas City needed a mate for its marmoset, but couldn't find one. A zoo in Washington, D. C. had one surplus but didn't know Kansas City wanted it.

Kansas City might still be looking for the tiny Brazilian primate if not for a unique report listing mammals and their locations. The report is a product of the International Species Inventory System (ISIS), based at the Minnesota Zoological Garden, and sponsored by the American Association of Zoological Parks and Aquariums. The Garden is tabulating some 50,000 mammals -- representing 850 species -- that live in North American zoos.

An important by-product of the nomenclature is to determine how many animals classified as endangered species are in captivity. These animals include the gray wolf, Siberian tiger and Indian rhinoceros.

Information for ISIS (named for the Egyptian goddess associated with motherhood and protection) is provided by officials of participating zoos. They fill out one form per animal, listing its scientific name and common name, date of birth, parents, and death and cause in case of death.

To process the information, ISIS through the state-owned Garden uses an IBM System/370 Model 158 computer at the state's data processing center in St. Paul. The first report listing census data and vital statistics was sent to some 125 zoos this spring.

"ISIS will do more than simply tabulate the total number and kinds of animals," said Mrs. Linda Murtfeldt, system manager of ISIS and zoological records supervisor. "For example, it will help us determine exactly how many animals on the 'endangered species' list are in captivity. Another of our objectives is to develop information on endangered animals for the AAZPA and the United States Department of the Interior," said Mrs. Murtfeldt.

"We can generate a 'profile' of each animal to pinpoint unwanted genetic defects. This is designed to prevent the mating of an animal with a defect and transmitting it to the next generation."

Zoo officials predict ISIS will help them learn how long certain breeds live in captivity. Preliminary information indicates that animals thrive in zoos -- contrary to what many critics have charged.

The number of animals being born in zoos considerably exceeds the death rate. Zoo officials believe that good breeding programs, plus good medical treatment and diet have dropped the death rate for many species below what it is in their native habitats.

Whatever else ISIS does for zoos, it has already begun relieving the headache of finding mates and homes for surplus animals. One zoo was searching for an echidna (a primitive egg-laying mammal) while another zoo hunted for a Celebes ape. Both found suitable mates via the first ISIS report.

Once the animal population in American zoos has been tabulated, ISIS will start collecting information on birds, reptiles, amphibians, and fish. The long-term goal is to involve zoos all over the world in the project.

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