***Environmental Enrichment In Captive Common Chimpanzees (Pan troglodytes) in Taiping Zoo, Malaysia***
**Munlandy, R. and Lazarus, K., Taiping Zoo, Malaysia**
An environmental enrichment program to stimulate foraging was used on a troop of captive common chimpanzees to obtain positive changes in animal behavior and to reduce boredom and undesirable behavior patterns. Emphasis for the enrichment program was to stimulate and elicit natural behaviors, similar to that found in the wild such as foraging and tool use. Generally, without enrichment, inactive behaviors were high while with enrichment, active behaviors increased. The differences in both cases were found to be very significant.

***Enriching the Lives of Captive Malaysian Elephants (Elephas maximus hirsutus) at the Night Safari***
**Chandra Sekar Menon, Animal Management Officer, Night Safari (Singapore)**
The Singapore Zoo has kept Asian elephants in captivity since 1973, in which time they have become popular by giving rides, performing in the animal shows and posing for pictures with the public. However, recently with the prominence of animal welfare and behavioral enrichment, the assessment and modifications to their daily programme have been undertaken not only by comparing it with other zoo housed elephants but also with their wild conspecifics. The daily programme for the elephants are discussed in this paper.

***Enriching the Lives of Captive Carnivores and Primates through Species Compatible Enclosure Design***
**Avanti Mallapur**
*Zoobiologist, National Institute of Advanced Studies, Bangalore, India*
Species compatible environmental design has a positive influence on the activity budget of captive carnivores and primates. Differences in the behavioural repertoires exhibited by animals housed in small barren enclosures and large complex ones are easily distinct and identifiable. Carnivores that are adapted to living in large territorial ranges exhibit lower levels of behavioural pathologies when they are housed in large complex enclosures than in small barren cages. Canids, being primarily cursorial by nature exhibit high proportions of stereotypic pacing in small barren enclosures. Individuals housed in more naturalistic environments exhibit a wider range of natural behaviours. Arboreal species of carnivores on the other hand exhibit lower levels of abnormal behaviour when they have access to the vertical dimension. Animals housed in large barren enclosures exhibit higher levels of abnormal behaviour than individuals housed in smaller enclosures with elevated sleeping platforms, and trees. Primates maintained in large complex enclosures do not exhibit abnormal behaviours. Individuals that are housed in isolation or in small comparatively barren enclosures exhibit high levels of behavioural abnormalities. Hence, enclosure design has a significant influence on the behavioural repertoire of its occupants. Enclosures that are built taking into consideration the animal's behavioural ecology and socio-biology are found to create an environment that stimulates its occupants to exhibit a more natural behavioural repertoire.

***What is Environment Enrichment?***
**Wilma Redler, Feathered Friends Foundation ETC., Philippines**
Environmental enrichment is enhancing the environment of confined animals in order to encourage natural behaviors and improve their quality of life. Environmental enrichment, also known as behavioral enrichment, includes increasing the complexity of an unstimulating animal enclosure; the physical environment will be supplemented to reduce boredom, stress and species-specific behavior patterns. Environmental enrichment is a tool that can be used to improve the animals' psychological well-being by stimulating the ability to cope with daily changes in the social and physical environment, engaging the animal in species-typical behaviors, and reducing or eliminating maladaptive or pathological behaviors.

***Enrichment Tools for Captive Bred Birds in the Avian Breeding Centre***
**Ma Khin May Nyunt, Jurong Bird Park, Singapore.**
In 1988, the Jurong Bird Park established an off-exhibit avian breeding center to concentrate on the breeding and rearing of endangered bird species in captivity. This facility includes 110 breeding aviaries, 3 mini nursery rooms, an egg incubation room and a class room. This paper describes the different techniques involved in hand-rearing altricial and precocial species. It also highlights problems finding in feeding, rearing and weaning stages by using enrichment tools.

***Infectious Disease Threats to the Conservation of ex situ Asiatic Lions***
**R. Anand, P. K. Malik, G. Prasad and S. K. Mukherjee, Wildlife Institute of India, POB 18, Chandra bani, Dehra Dun, India**
Endangered wild animal populations are predisposed to a lot of threats of extinction arising out of biotic pressure, habitat fragmentation and even stochastic causes of extinction like epizootics. The highly endangered Asiatic lions (*Panthera leo persica*) may be faced with such threats. This was evident from this study on captive Asiatic lions and other sympatrically-occuring carnivores from western India, which were sampled from December 1998 to March 1999. Fifty-six Asiatic lions, including 17 hybrid lions (Afro-Asian crosses) from six captive centers in western India, were tested for antibodies against canine distemper virus (CDV), feline parvovirus (FPV), feline immunodeficiency virus (FIV) and feline leukemia viral (FeLV) antigen. Additionally, 37 leopards, 30 domestic cats and 196 domestic dogs from the vicinity of the lions were tested for some of the above pathogens.

***Captive Breeding Strategies that have been Utilized for Gibbons at the International Center for Gibbon Studies***
**Alan R. Mootnick, International Center for Gibbon Studies, Santa Clarita, CA, USA**
Gibbons (*Hylobates*) are extremely territorial and generally live in widely separated family groups in their natural habitat. Adult pairs of captive gibbons should be housed in large naturalistic enclosures, ideally a minimum of 75 m apart from adult gibbons. Stressful situations can occur in close visual contact of other gibbons. Both males or females can disrupt reproductive activity in neighboring gibbons with aggressive displays, and disrupt their own reproductive success. Both neighboring and aggressive gibbons can spend numerous hours looking at other gibbons. This could cause stress to the gibbons and eventually lead to illness. In those situations females could displace their aggression on their offspring.

***A Report on the Current Status of Captive Clouded Leopards in Taiwan Lin-Ling CHANGCHIEN***
**Taiwan Endemic Species Research Institute, Chi-Chi, Nan-Tor, Taiwan**

A demographic survey on the captive clouded leopards in Taiwan was conducted during July 1998 to March 1999 and September 1999 to May 2000. Keepers were also interviewed for their rearing motivation, disease control, captive environment and food provided, as well as the reproductive parameters of clouded leopards. In addition, the blood samples were taken for the genetic study.

***Wild Cats of Asia: A Status Report on Related Collection and Research Efforts of SEAZA Members and Institutions***
**Warren E. Johnson and Stephen J. O'Brien**
**Laboratory of Genomic Diversity, National Cancer Institute, NCI-Frederick, Frederick, MD, 21702-1201 USA**
During the last two years, numerous SEAZA members and institutions have been supporting research efforts aimed at improving our ability to manage *in situ* and *ex situ* populations of felids. The initial goals of this project are to assemble biological tissues from Asian cats of known geographic origin for genetic and physiological study. Simultaneously, objective molecular genetic criteria are being established to identify species and subspecies, describe contemporary evolutionary history of these species and their living populations, and to determine the exposure and seroprevalence of feline-specific infectious diseases. To date, tissue samples from more than 15 cat species have been collected from institutions in Malaysia, Russia, Singapore, Thailand, Taiwan, and Vietnam. We will present a summary of these collection efforts, our future plans, and some preliminary results of genetic analyses of tigers (*Panthera tigris*), leopards (*Panthera pardus*), and clouded leopards (*Neofelis nebulosa*). The results of these efforts are already being incorporated into decisions on the management of captive populations and promise to become even more important in the future.

***Recent Advances in Our Understanding of Tiger (Panthera tigris) Conservation Genetics: Implications for in Situ and ex situ Management.***
**Stephen J. O'Brien, Warren E. Johnson, Jae-Heup Kim, Shujin Luo, and Janice Martenson**
**Laboratory of Genomic Diversity, National Cancer Institute, NCI-Frederick, Frederick, MD, 21702-1201 USA**
Although tigers once occupied a variety of habitats across most of Asia, their numbers have declined by 95% during the last century and the remaining populations are generally small and fragmented. Tigers have traditionally been divided into eight subspecies, three of which are now considered to be extinct. However, this subspecies classification was based mostly on geographic distribution and purported morphological differences. To establish objective molecular genetic methods to classify tiger subspecies and to better understand tiger evolutionary history, we developed ten sets of tiger mitochondria-specific primers. These primers were designed to avoid the coamplification of homologous gene sequences in the nuclear genome (Numt). DNA was extracted from tissue or blood from 42 individuals, including all of the five extant subspecies. We generated a total of around 13 kb of sequence including the ND5, ND6, CytB, control region, 12S, ND1, ND2, Co1, Co2, and ATP8 mitochondrial genes. We found 40 variable sites which defined 13 haplotypes. We analyzed these segments along with previously collected data from 20 microsatellite loci to make inferences on tiger evolutionary history and current patterns of molecular genetic variation.

***Legal Enforcement on Public Zoo in Thailand, Manop***
**Laoprasert Royal Forest Department**
In Thailand, the first wildlife conservation law was enacted in December 26, 1960. However, no single part of this law mentioned about public zoo activities. The law was amended in February 29, 1992, so called "The Wild Animal Reservation and Protection Act B.E. 2535", mainly to meet the requirements of the CITES Convention. Anyway, public zoo activities are mentioned in Section 5 of the law, from Articles 29-32. Regulation number 9 was also enacted in details to enable proper implementation in public zoo control.

***Conservation Education in Taipei Zoo***
**Li-Yi Cheng and Jessie Chi, Education Department, Taipei Zoo, Taiwan, R. O. C.**
The education objective of Taipei Zoo is to guide people toward a better understanding of natural environment, and to foster appreciation of wildlife. The interpretive system of Taipei Zoo includes long-term education programs, education events, site interpretation on Sunday, thematic exhibitions, website, and public relationship.

***Philippine Tarsier Conservation Program undertaken by the Philippine Tarsier Foundation, Inc.,***
**Danny C. Nazareno**
OUR AIM: Protecting a 45 million-year-old species.
The Philippine Tarsier Foundation aims to: Establish a forest reserve; Protect and manage a tarsier sanctuary; Establish and maintain a wildlife research laboratory; Establish and maintain visitor facilities with a Four Point Program:1)Tarsier Research 2)Tarsier Habitat Management and Protection 3)Community Organizing and Management 4) Ecotourism

***Linking Zoo & Wild people using networks, workshops & training,* Sally Walker, Zoo Outreach Organisation, India.**
CBSG, India has conducted more than one dozen CAMP workshops in India covering nearly 2000 species of animals and plants and in Sri Lanka for Sri Lankan amphibians and reptiles. Now there is a South Asian regional network in place with India, Sri Lanka and Nepal having CBSG offices and Pakistan headed in that direction, a plan for holding CAMP workshops at the regional level involving all the countries is underway to assist the region know the status of its wild genetic resources.

***South Asian Zoo Educator Courses, Central Zoo, Nepal,* Sally Walker, Zoo Outreach Organisation**
The Asian Regional Network of the International Zoo Educators (ARNIZE) desired to organize a zoo education course for South Asia and has encouraged to use western educators as Resourse Persons. Instead ARNIZE organised a training course for the five countries of South Asia which have zoos using expertise from the Central Zoo, from Indian NGO's and from the participants themselves. Although these resources were of meager experience compared to some zoos in the world by pooling their combined techniques a considerable body of information was provided for the course. Moreover, all of what was conveyed "do-able" or applicable in all of the countries which share a common culture as well as similar problems and potention.This paper will describe the course. A similar method will be used in the upcoming SEAZA Zoo Educator course for which five Singapore animal leisure facilities will contribute expertise to zoo educators and potential zoo directors from South East Asia.

***Usage of Zoletil in Tranquilization and Translocation of Tigers in Zoo Melaka,* Razeem Mazlan A., Jawahir J., Mohd Najib O. and Mohd Ermy M.A. Zoo Melaka, Ayer Keroh 75450 Melaka, Malaysia**
Zoletil with the active ingredient consisting of Tiletamine Hydrocloride and Zolazepam Hydrocloride is a new injectible anesthetic containing a dissociative anesthetic. Tiletamine associated to a major tranquilizer and anesthesia with a short

introduction time, very few side effects and maximal safety. Zolazepam is a very good muscle relaxant. Zoletil is a well tolerated at the injection site by both IM and IV routes. In Zoo Melaka which is also considered to be a rescue center for tigers in Malaysia the usage of this drug has helped in safe handling of tigers and in rescue of these animals. Twelve tigers weighing between 80-135 kg in Zoo Melaka and in wild condition were tranquilized with 3-4 mg/kg. The induction time between these animals varied between 5-10 mins. The recovery of these animals was between 1-3 hours depending on the body condition and dehydration status of the animals. During recovery, these animals showed no side effects. The dosage used in tranquilization of these animals were lower than the recommended dosage by the manufacturer in felidae. The wide safety margin of this drug gave the handler and the veterinarian a big comfort zone working with compromised animals. Zoletil is a very good choice of drug in doing short procedures with minimum risk of mortality to the animal.

***Atresia Ani and Rectovaginal-Fistula of Formorsan Sika Deer (Cervus nippon taiouanus): Case Report,*** **Chin Shih-Chien, Taipei Zoo, Taipei, Taiwan, R.O.C.**

A two months old, 8.5kg, female fawn (*Cervus nippon taiouanus*) with complete anorexia and gradual abdominal distention was noticed by the client for several days before it was brought to animal hospital. Taillessness, atresia ani and a trace amount of yellowish-mucoid feces in vagina were found during clinical examination. Besides, dyspnea and distended abdomen with gas were found too. Congenital atresia and rectovaginal-fistula were diagnosed. After supportive treatment and general anesthesia, surgical operation for rectovaginal-fistula ligation and perineal artifical ani plasty were performed by way of right flank laparotomy and perineal approach. The fawn defecated from artifical ani immediately after surgery. It recovered appetite and put on weight gradually. The fawn then grew up as big as normal deer one year after operation. This was the first case report about congenital atresia ani of deer with rectovaginal-fistula in Taiwan.

**The Diet & Feed Adjustment for Ungulates at the Taipei Zoo Ci-Wen Yang, Taipei Zoo, 30 Sec. 2 Hsin Kuang Road, Taipei 11628, Taiwan**

Currently the Taipei City Zoo raises 377 types of ungulates, in 11 families, and 44 species. From 1997 on, we adjusted the types of feed and formulations, which began with fresh forage and edible hay. Included were six kinds of fresh grass, branches, and leaves. These are used for the major food for our ungulates, which effectively reduces the undesirable condition of soft excrement, which was often seen with our giraffes before. We experimented with five kinds of imported hay between 1997 and 1999, eventually eliminating all but one type exclusively; the domestically produced Pangola hays *ad libitum* since October 1999. In light of the damp weather (Monsoon season) at Taipei, especially in wintertime, the hay storehouse is air-conditioned and kept at the constant temperature of 16~18°C. Two dehumidifiers are kept on all day to control the relative humidity under 75%.We also increase different alfalfa elements in the feed and bring the content of vitamin E in compound feed from 100 IU/kg to 400 IU/kg. In the instance of our local Formosan serow, we started to increase the supply of compound feed and vitamin E additive to their diet in 1997, and improved the feeding method of branches and leaves. Consequently, there are less episodes of diarrhoea and higher survival rates of young animals in the winter. The serow at the zoo multiplied from 4 in 1997 to 11 in 2000. The numbers of ungulates at the zoo are more than three hundred, so we attempted in May 2000 to add anthelmintic (flubendazole) in the compound pellet feed for parasite control. Numerous Ascaris were purged from our Mongolian wild horses and zebras only one day after administration. The same method (ivermectin 0.2mg/kg body weight) was used to purge nematode in October 2000, which also provided good effects. In the future as part of our parasite control efforts we will add suitable doses of anthelmintic in the compound feed pellets to address the specific need of certain species.

***Phylogenetic Analysis of Gibbons at Taipei Zoo,*** **Kuang-Yu Hu*, Nien-Hsiu Lin*, and Ci Wen Yang** - * Department of Biochemistry, National Defense Medical Center, Taipei, Taiwan, Taipei Zoo, Taipei, Taiwan, R.O.C.**

To identify the species of gibbons at the Taipei Zoo, mitochondrial DNAs from their hair follicle samples were isolated and subjected to polymerase chain reaction (PCR) -sequencing. DNA sequences for both the 252 (1141)-base-pair (bp) segment of the cytochrome b gene and the 896-bp fragment of ND4 and ND5 (NADH Dehydrogenase complex) genes were successfully determined and used to construct phylogenetic trees. Preliminary genetic data indicate that 30 gibbons at the Taipei Zoo are *H. leucogenys*, *H. gabriellae* (2 numbers), *H. muelleri* (4 numbers), *H. agilis* (4 numbers), *H. lar* (17 numbers), *H. syndactylus* (1 number), and one suspected hybrid of *H. klossii*. In addition, 3 living specimens outside the Taipei Zoo are *H. muelleri* (1 number) and *H. leucogenys* (2 numbers). Except for the gibbon G2, the molecular analysis is consistent with morphological analysis. Moreover, for gibbons G11, G13, G15, G16, G18, and G25, which were doubtfully identified by morphological analysis, molecular analysis provides a method of choice for classification. Those findings indicate that 9 of the gibbons housed at the Taipei Zoo were incorrectly identified. The result derived from this study will be essential to the success of the Taipei Zoo Gibbon Conservation Project.

***A Macaca cyclopis gets Diabetes Mellitus*****, Wang, Pao-Jung & Wang, Lih-chiann Taipei Zoo**

One Formosan macaque (*Macaca cyclopis*) was found in coma on the afternoon of the 28th of July 2000. We took the emergency procedure right away and made some examination on it. This dehydrated, hypothermic, and unconscious male macaque which weighs only 7.5 Kg, had blood glucose of 710 mg/dl and 500mg/dl in the next morning. Observing hyperglycemia, polyuria, polydipsia, loss of weight and weakness, we thought we have a macaque with Diabetes mellitus. Because of its very high blood glucose level, we gave it insulin injection, dosage starting from 0.5 unit/kg, and the blood glucose level reduced gradually. We monitoring the blood glucose every hour for three days, then increased the insulin dosage into 0.8 unit/kg to keep the blood glucose level around 160 mg/dl each morning before breakfast. Changing the diet into a balanced hypo caloric diet and administering insulin injection once daily for four months has made the macaque active and it enjoys its new life.

***International Wild Cat Complex: An Ongoing Project at Khao Kheow Open Zoo, Thailand,*** **Sophon Dumnui**

Khao Kheow Open Zoo established its own plan to help conservation of the World's Felidae species called "International Wild Cat Complex". We are planning to collect as many species as possible in 70 enclosures. The whole total is 120,000 square meter; exhibit area takes up 29,575.20 square meter or 24% of the whole area. The exhibit was designed and separated according to natural habitats into; Dark world exhibit, rocky outcrop/mountain, temperate woodland, open exhibit area, swamp, marsh land, rain forest, desert and grassland. The purpose of building the cat complex is to provide education for the visitors and enrichment for the animals. For example, in the temperate mountain building, we will install artificial snow generator or in the desert building, we will be installing

high-energy spotlight to heat the air inside the enclosure to simulate the temperature of the desert.We will undertake breeding programs on each species to promote *ex situ* population. If the animal do not breed naturally, then the zoo will use biotechniques to help propagate the animals. Khao Kheow Open Zoo has it's own Sperm-bank of some wildcat species, and study of female reproductive physiology is in process.

***Suitable Habitat and Range Distribution of Pittas in Relation to Khao Kheow Open Zoo Forest Areas***
**Dr. Rattapan Pattanarangsan and Urairikha Kongprom**
Study of 13 pitta nests in Khao Kheow Open Zoo Forest Areas, Chonburi province. Eleven nests were Blue-winged Pitta's. Other two were Eared Pitta's. Study on physical geography of the nesting area and nests revealed some feature of the habitats and nesting behavior. Average daytime relative humidity and temperature were 82.27%(82.27 +56) and 29.05 °c (29.05 +1.03) respectively. Average soil humidity was 14.01%(14.01 + 1.41). Average slope of the nesting site was 24.88 degree (24.88 + 7.16). Average elevation of nesting site was 207.85 meter above normal sea level (207.85 +56.61). Average density of annual plant was 5.11/m2 (5.11 +2.91). Average density of trees was 0.25/m2 (0.25 + 0.09). Average number of eggs/nest was 3.99 (3.99 +0.99). Average width, length and depth of nest were 35.69 cm. (36.69 +5.12), 43.00 cm. (43.00 +8.33) and 17.44 cm. (17.44 +3.06) respectively. Nest components in percentage of weight were: twigs 56.69 %, dead leaves 3.57 %, small pieces of branches and leaves 39.74 %. The nearest distance between two nests was 15.15 m.. There was only one successful nest out of thirteen, that chicks could break the nest and leave (7.69%).

***Philippine Eagle Examination Protocol*, Roberto P. Puentespina, Jr., DVM and Domingo O. Tadena, Phillipines.**
This protocol is the product from hands on experiences regarding rehabilitation and general care of Philippine Eagles (*Pithecophaga jefferyi*) and other Philippine raptors by the Philippine Eagle Foundation, Inc. This is intended as part of a monograph for Philippine raptors, its *ex situ* conservation and management.

***Trends and Standards in Barrier Design*, Brij Kishor Gupta, Scientist, Central Zoo Authority, Ministry of Environment and Forests, Bikaner House, Anexe - IV, Shahjahan Road, New Delhi.**
Zoos should provide naturalistic animal enclosures with a physical and visual barrier by using different kinds of barrier techniques. The use of vegetation, rocks, mounds and logs, similar to original habitat of the species helps in creating a habitat and an illusion of the animals within a " natural habitat". The barrier design is a crucial and important part of animal exhibit design that includes variety of techniques including hidden barriers, moats and fences. In designing a barrier for species, it is important to know the behavior and biology of the animals so the minimum depth and width of the barrier can be maintained to avoid animal escape.To work out the standards and minimum barrier width and depth for a species, a study was conducted by Central Zoo Authority at six large Indian Zoos during January - June 2000. During the study the data on existing barrier dimension on selected species was collected and analyzed. The recommended dimension has been outlined in the category of grazing/non-grazing animals, jumping/non-jumping animals and aquatic animals. A set of suggestive line drawings on different types of barrier for different species have also been prepared for the use of zoo authorities, zoo managers and others interested in the field.

***Captive Breeding of the Visayan Tarictic Hornbill at the Negros Forests and Ecological Foundation, Inc. - Biodiversity Conservation Center, Bacolod City, Negros Occidental***
**Em Lastica**
The Visayan Tarictic Hornbill is one of the five Tarictic Hornbills only known in the Philippines. It is also considered endangered. This fact is more likely due to the fast disappearing forests of the Philippines, as well as pressures from hunters who kill them for food or to sustain the demands of the illegal pet trade. Breeding and hand rearing of Tarictic Hornbills were already successful in other parts of the world, i.e. at Jurong BirdPark, Singapore and at the Los Angeles Zoo. None were reported bred in captivity in its own country. On the 29th of April, 1999, a Visayan Tarictic Hornbill was born in the NFEFI Biodiversity Conservation Center, and fledged on the 12th of June. His sibling emerged six days later. This year, two pairs have successfully reared two fledglings. These events prove that there is a future for *in-situ* captive breeding of one of the most endangered hornbills of the country.

***The Art of Graphics*, Suzanne gendron, Ocean Park Corporation, Hong Kong.**
A simple definition of Graphics is a graphic representation (as a picture, a map or graph) used especially for illustration. To us in the Zoo and Aquarium industry, Graphics means a whole lot more! It covers the factual text boxes that identify an animal to the interactive activities designed to capture the curiousity of our guests. With this talk, the process for designing graphics for an exhibit will be described and a few examples of the wide assortment of graphics found around the world will be shown.

For membership in SEAZA, write, phone, fax or email to ZOOS SEA
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For questions about obtaining full Proceedings (abstracts listed here), send an email to Tiffany or Edward Cham <cham@pacific.net.ph>. For specific one or two articles, contact S. Walker, ZOO after a few weeks.

As for the next SEAZA conference, the tentative dates fixed are from the 7th - 10th October 2001, at Bukit Merah, near Taiping, Perak, Malaysia. Email Dr. Keven Lazarus : <drkevinl@hotmail.com>