Nutrition Training Report : Training in Captive Animal Nutrition for Conservation and Welfare of Captive Wildlife for the South Asian Zoo Association for Regional Cooperation (SAZARC)

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Summary:
An intensive workshop highlighting Animal Nutrition, Diet Assessment, and Feeding Management was presented to Heads of important South Asian zoos, as a component of the annual SAZARC meeting, held 1 through 6 December 2003. The workshop was hosted by the National Zoological Gardens and Pinnewala Elephant Orphanage, Sri Lanka as part of the Fourth Annual Meeting of SAZARC. A series of lectures comprising basic knowledge in feeding husbandry for enhanced conservation, health, and welfare of animal collections, followed by creation of working groups to identify nutrition priorities, discuss issues, and improve collaboration and regional information sharing, highlighted the week with participants from India, Pakistan, Bangladesh, Nepal, and Sri Lanka. Follow-up to the workshop includes distribution of CDs with all notes and information on presentations to all participants, as well as identification and fulfillment of priority projects identified by each of the Working Groups for dissemination within SAZARC, and presentation at the 5th Annual Meeting planned in Pakistan.

Technical presentations on specific topics were presented daily, followed by exercises and working group discussions, comprising four 4-hour sessions over the course of this workshop. Links between nutrition and reproduction, nutritional diseases and their assessment, and presentation of foods for enrichment purposes were incorporated into lectures as appropriate. Topics included: Basic Feedstuffs and Nutrients. Following this set of lectures, individuals identified local agencies from which nutrition composition data may be obtained for applied feeding programs: Universities (biochemistry, nutrition depts), agricultural research institutes, central food research institutes (CFTRI), VRI vet research institutes (IVRI), PCSIR, BSTI, National Institute Nutrition, Institute Food & Nutrition, ICAR, WII, Dept Food Technology, Dept Livestock, Dept Food & Drug, Nutrition Lab in Zoo represent some examples of the many resources available.

Initial Working Groups were established in several broad areas (Carnivores, Herbivores, Primates, Avians & Reptiles), and identified 3 priority (native) species in their topical area. Average body weights were determined, and energy requirements for Basal Metabolism, Maintenance and Growth were calculated for each of the priority species within Working Groups. Species selected (Carnivore Working Group): Tiger – 150 kg; Leopard – 70 kg; Rusty Spotted Cat – 1.5 kg; Python – 30 kg; Pelican - 5 kg.
(Herbivore Working Group): Elephant – 4000 kg; Spotted deer – 50 kg; Rabbit – 1.5 kg.
(Primate Working Group): Grey langur – 12 kg; Rhesus macaque – 20 kg. (Avian & Reptile Working Group): Peafowl – 8 kg; Owl – 750 g; Hornbill – 2 kg; Gharial – 50 kg

From a generic foods list with energy value(s) given (provided by instructor), Working Group participants calculated amount(s) of food needed to meet daily energetics requirements of these various species. Multi-national SAZARC Working Groups at Nutrition Workshop, Colombo, Sri Lanka, December 2003.

Carnivore Nutrition, including identification and assessment of necessary supplements for various meat mixtures compared to whole prey, was discussed. Lists of meat types, particular considerations for preparation/ feeding (with regard to regional religious observation), and lists of potential whole prey used in feeding programs at various facilities in South Asia were compiled.

Whole Prey & Insects fed regionally include:
snakes, rabbits, sparrows, herons, frogs, chicks, guinea pigs, pigeons, crickets, lizards, live fish, cockroaches, grasshoppers, rats, mice, mealworms, earthworms, fowl (ducks, quail), ants, termites. A detailed list of fish species used was complied: [Fresh water] – *Cutla cutla*, Mirigal – aah fish, *Rohu rohu, Khoksi, Singhi, Magur* – catfish, Tilapia, *Channa punetata*, Eels, Guppi; [Marine species] – Sardines, *Salaya, Hurulla,* Sprats

Supplements used for various meat-based diets included:
a. Meat-based diet – Ca, P (di- and tri-), Vit A, Mg, Cu, E in tablets. Milk for lactating females. Liver. Cod liver oil, Bone meal, Vit D liquid. Eukanuba
b. Fish-based diet: B vits (B1) & E, specialty mix (Glaxo)
c. Insect-based diet: cuttlefish bone

Using Zootrition software, we evaluated the nutritional efficacy of some locally-available supplements for meat-based feeding programs.

Carnivore Working Group: B.S. Bonal – India; R.K. Sahu – India; B.K Gupta – India; C.S. Yalakki – India; G.K Dubey – India; S. Mahmud – Bangladesh; M.S. Khan – Bangladesh; A.K. Saha – Bangladesh; M.M. Qazi – Pakistan; G. Wijesinghe – Sri Lanka; Dammika – Sri Lanka

Identified Priority Project: Document, detail, validate, and widely circulate protocols used for the hand-rearing of tiger cubs. Often, young must be removed just after cubbing due to cannabalism or orphaning, and each facility has procedures in place. Need to summarize these into a single document that can be circulated as originating from SAZARC (goal for 2004), then expand library to other species (lions, bears, wolves).

Protocol outline - Isolate in rearing facility; 600-900 g size: keep in warm place and feed colostrum from goat, bitch or another tiger or supply human milk replacers; 1500 g (after 1 mo) Lactogen I (up to 2 mo of age) then Lactogen II with minerals, vitamin liquids as prescribed ; 5-6 kg – up to 3 mo of age. Feed every 3 hours, beginning at 10 ml with gradual increases of 10 ml… increasing to 25 ml per meal after 1 week. After 3 mo provide soup (meat/chicken), then mixed meat, along with the milk. After 3 mo, provide meat with supplements, and large bones to lick, bite, and play with. Adds nutrients plus environmental enrichment.

Herbivore Nutrition, and application of livestock information to zoo species, provided another focused discussion. The Working Group compiled a list of various manufactured dietary products (10-12 different pellets), locally available grains, as well as a list (approximately 14 spp.) of native browses and trees fed to various species in zoo collections. The variety of locally available native produce, and potential nutritional differences in these vegetables and fruits compared with those more commonly found in zoo publications from Western countries (such as higher fiber, less sugar, differing mineral, vitamin, and pigmentation potential) was considered, and needs to be investigated in more detail in applied feeding programs.

Herbivore Working Group: *M.M. Rahman – Bangladesh; Pubudu Weerarathne – Sri Lanka; Kamal Edirisinghe – Sri Lanka; Mohammad Tariq Ayub – Pakistan*
R.K. Shreshta – Nepal; Sumate Kamolnorranath – Thailand; Ravi Sharma Aryal – Nepal

Identified Priority Project: More comprehensive compilation and study of nutrients contained in various browse species used as animal feed at South Asian zoos. Browse species identified: *Ficus* spp.; Coconut leaf; Jak (*Artocarpus*); Palm (*Caryota*); Banana leaf, fruit, stem; Acacia; Bamboo; Green leaves; Maize leaves; Para grass; Raw rice (green), grain; Salad leaves; Sugar cane

Fresh browse as a component of herbivore diets requires further detailed investigation in South Asian facilities.

Avian ("Bird Bites") and Considerations in Reptile & Amphibian Nutrition were highlighted in a third day of lectures. The focus on differing ecological feeding habits within each of these groups re-emphasized nutrition principles already discussed under the previous day's overviews, with avian and herpetological examples. Further, specific feeding and possible health problems associated with frugivory and granivory (as specialized niches) were discussed, and various examples of the use of natural materials in food presentation were incorporated. Recipes for creating nutritionally balanced omnivore mixes, using locally available ingredients and labor, were shared.
Primate Working Group: U. Khan – Pakistan; M. Lateef – Pakistan; A.Q. Mehal – Pakistan; R. Jayalethi – Sri Lanka; P. Arunthathy – Sri Lanka

A total of 34 species of primates exhibited in South Asian zoos (full species list provided in meeting briefing book) were listed and separated into 3 to 4 major diet groups comprising apes (chimpanzees and orangutans), leaf-eating primates (colobines), and medium as well as small-sized monkeys.

Zoos were generally seen to feed primates predominantly on fruit even to the leaf eaters. The categories of the primates need to be clearly defined and some zoos are seen to give milk (some with sugar), which is not suitable for primates, especially for adults. Following this initial view, dietary adequacy will be further investigated, incorporating nutritional principles outlined in the workshop.

Identified Priority Project: Establish the probable links between nutrition and breeding difficulties of the Hoolock gibbon in captivity. Possibly design a study of dispersal of food resources in the wild, as well as nutritional analyses of those foods, for applied feeding programs and conservation.

Elephant Nutrition, including Neonates & Geriatric considerations, completed the lecture series. This session was held at Pinnewala Elephant Orphanage on Saturday, 6 December. An immediate follow-up to this section includes an expressed interest by the veterinary staff and Prof. Indira Silva, University of Peradeniya to summarize and publish, in a peer-reviewed scientific journal, information on the successful hand-rearing program at Pinnewala. E. Dierenfeld has offered to assist with this task as needed, in her role as Nutrition Advisor for the AZA Elephant Taxon Advisory Group.

Likely Output and Plans for Dissemination

Anticipated results of the training include improvements in understanding of the critical role of nutrition in captive animal health, physiological and psychological well-being, reproduction and longevity. I have already received email feedback from several of the participants, expressing their appreciation for the training, as well as their belief that institutional feeding and nutrition programs will improve with this awareness. Training materials are being produced by the SAZARC office for dissemination to participants, which can be used in subsequent training programs both within and outside their home facilities. We also anticipate enhanced cooperation both nationally and regionally – within the association – through the identification and implementation of tools and outlets for dissemination of nutrition information. Ultimately, we intend to prepare and provide an Internet-based Nutrition Handbook for use in South Asian zoos, with local animal species and available feedstuffs (using a modification of one prepared for Latin American zoological facilities – currently available on www.zcog.org). The Zoo Outreach Organization will disseminate the materials through their publication department and Asian network. A follow-up session is being planned for next year's meeting in Pakistan, where we expect progress reports from each of the Working Groups.

The **World Association of Zoos and Aquaria WAZA** through their **Committee for Inter-Regional Cooperation in Conservation (CIRCC)** and member zoos around the world, contributed a training grant for this nutrition training which made it possible for five participants from far away to attend and take part in the training.

The **Universities Federation for Animal Welfare (UFAW)** contributed a travel grant to Dr. Dierenfeld which covered her airfare and ground transportation (JFK, NY to Colombo, Sri Lanka) for participation in the workshop.

The Schommbrun Zoo, Vienna, Austria, contributed a generous grant which enabled 7 individuals from far away South Asian countries to attend and take part in the training.

Lord Robin Russell of Woburn Safari Park contributed a generous grant which enabled 6 individuals from far away to attend and take part in this useful training.