Management and Conservation of Captive Tigers,
Chapter 8, continued

Tiger Global Conservation Strategy (GCS)

The IUCN/SSC CBSG Tiger Global Conservation Strategy (GCS) is a strategy for the management of tigers at the international level that links *in situ* and *ex situ* conservation activities for the recovery and/or long-term maintenance of captive and wild populations. This document represents the first version of a Global Conservation Strategy (GCS) [originally termed Global Animal Survival Plan, and since renamed) for tigers under the aegis of the Captive Breeding Specialist Group (CBSG), Species Survival Commission of the World Conservation Union (IUCN). It is the result of an international tiger workshop conducted 9-10 July 1992 at the Edinburgh Zoo, Scotland, and was revised at the Annual Meeting of the IUCN/SSC CBSG in Antwerp, Belgium on 3 September 1993.

The purpose of the Tiger GCS is to initiate a global captive conservation program for tigers by providing a strategic framework for the most efficient application, and most economic allocation, of zoo resources for the species. In part, it accomplishes its global responsibilities by:

- Adopting global goals for tigers, in part by considering recommendations from Conservation Assessment Management Plans and Global Captive Action Plans;
- Dividing responsibility for achieving minimum target population sizes of tigers among the regional programs;
- Arranging interactions for tiger or genome exchanges among regional management programs to achieve global and regional goals;
- Developing a global masterplan to guide the propagation and management of tigers at the international level.

A primary focus of the Tiger GCS is on captive management programs that can serve as genetic and demographic reservoirs to support the survival and/or the

recovery of wild populations in the future. Another focus is to identify where and how the world captive community can assist with the transfer of captive management information and technology to wild populations, and to develop priorities for limited financial support from the captive community for *in situ* conservation by linking *ex situ* and *in situ* programs.

The Tiger GCS recommends a global minimal target population size of 250 tigers in captivity for each of the five taxa, and suggests how this can be most satisfactorily distributed among various regional programs. Minimum target population sizes are defined as the smallest population size to meet the genetic and demographic objectives; actual population sizes in different regions may be much larger. This population size of 250 tigers for each taxon will be sufficient to preserve 90% of the genetic diversity of each population for 100 years.

As a first priority, captive management programs for each subspecies should be developed in its country of origin. For maximum security against risks, extension of the captive management program to at least one additional region outside the range country is also recommended for each taxon.

- Initiate significant captive breeding programs for *P. tigris sumatrae, P.t. amoyensis, P.t. corbetti*, and *P.t.tigris* outside the range states for these taxa.
- Suggest the non-range-state responsibilities for these programs be divided by: North America developing a *corbetti* program; Europe, a *tigris* program; and eventually a region outside China, possibly Japan, an *amoyensis* program.
- Assist in the development and integration of captive breeding programs in the region of origin.

The Tiger GCS recognizes the potential value of genome resource banking and assisted reproductive techniques for enhancing populations of tigers both in captivity and in the wild. It also recognizes the value of results obtained in Population and Habitat Viability Analysis (PHVA) Workshops, which focus primarily on the distribution, status and threats to wild populations, and culminates in the drafting of an action plan. To date, only the Sumatran tiger has been the subject of a PHVA workshop; the other tiger taxa are in need of similar workshops.

Tiger GCS Committee Members

Global Coordinator	Ronald Tilson (Minnesota Zoo)
Regional Coordinators: European EEP Tiger Coordinator	Sarah Christie (London Zoo)
North American SSP Tiger Coordinator	Ronald Tilson (Minnesota Zoo)
Japanese SSCJ Tiger Coordinator	Masayoshi Gondo (Kobe Oji Zoo)
Australasian ASMP Tiger Coordinator	David Pepper-Edwards (Taronga Zoo)
Indian IESBP Tiger Coordinator	S.K. Patnaik (Nandankanan Zoological Park)
	Jansen Manansang (Taman Safari

Indonesian PKBSI Tiger Coordinator	Indonesia)
Southeast Asian SEAZA Tiger Coord.	On advice of SEAZA
Chinese CAZGA Tiger Coordinator	Xiang Peilon (Chongquing Zoo)
Russian Tiger Coordinator	On advice of Moscow Zoo
International Studbook Keeper	Peter Muller (Leipzig Zoo)
IUCN/SSC CBSG Executive Office	Ulysses Seal (IUCN/SSC CBSG)
IUCN/SSC Cat Specialist Group	Peter Jackson (IUCN/SSC CSG)

The Tiger GCS has been recognized as a strategic document to manage captive tigers on an international level by the Australasian ASMP, Indonesian PKBSI, Southeast Asian SEAZA, Indian IESBP, Japanese SSCJ, North American AZA, and European EEP. The Tiger GCS will then be submitted to the IUCN/SSC for recognition; the Tiger GCS Committee will then proceed with its implementation globally.

Linking *in situ* and *ex situ* Tiger Conservation

Beyond the concerns for the captive population there is a need to model the status of wild tiger populations, the effects of current removal rates from the wild populations and the contribution these tigers can make to captive populations. All populations, however large or small, are at some risk of extinction. The smaller the population, the more likely it will occur. Countering the trend toward even smaller populations of wild tigers requires that conservationists develop interactive strategies for managing fragmented wild populations and for using captive populations for backup and support.

Zoos are responding in several ways. One is by growing larger, by building new facilities, and by developing offsite breeding centers for endangered species. These actions increase the overall captive carrying capacity, and will thus provide more space for additional SSPs. Zoos also are working hard at expanding their captive carrying capacity by developing assisted reproductive technology, specifically aimed at embryo transfer, artificial insemination and gamete freezing. If successful, even moderately, zoos could increase the effective size of a few hundred living animals to thousands of potential animals by cryopreservation of genetic material. These technologies should not be viewed as a resolution to the extinction process, but as additional alternatives for the long-term conservation of species.

Another way zoos can contribute is to assist with the transfer of knowledge and technology that empowers range countries to develop and manage their own programs. The development of captive breeding programs in regions of origin and encouraging these range states to concentrate on their endemic subspecies is one of the highest priorities of the Tiger Global Conservation Strategy (GCS). This is the most powerful contribution the Tiger SSP can make to the conservation of tigers globally. It is also logical, because it is our skill, knowledge, and technology that is most needed in tiger range countries, and these are our most available assets.

With this perspective in mind, the Tiger GCS Committee identified some major

components of a comprehensive tiger conservation plan. These *in situ* and *ex situ* projects are listed below:

Molecular DNA Study. The most promising method to distinguish tiger subspecies is through molecular DNA technology. As of today, this technology is only in its infancy, is relatively expensive, and has limited availability. Because the subspecies issue is so critical to determining evolutionary significant units (significant to the management of populations), the Tiger GCS supports continued research to clarify taxonomic distinctness of extant taxa, including: a) distinction between P.t. tigris and P.t. corbetti; b) distinction between P.t. sumatrae and mainland forms; c) distinction between P.t. altaica and southern forms; and d) estimation of genetic diversity among fragmented wild tiger populations. This molecular DNA study is currently underway and supported by S. O'Brien, National Cancer Institute, Frederick, MD.

Population and Habitat Viability Analyses. Because we know so little about wild tigers, the single most frustrating aspect in tiger conservation is trying to estimate their numbers in the wild and the degree of fragmentation they suffer. Another obstacle is not knowing what the threats are to these populations, particularly the extent of poaching. As of today, the PHVA process is the single most effective method to derive reasonable estimates of these variables. Together these estimates permit an assessment of the viability of each population. The Tiger GCS strongly supports assisting conservation agencies in tiger range countries to conduct Population and Habitat Viability Analyses (PHVAs) for their extant tigers. This process has already commenced with Sumatran tigers in Sumatra, Indonesia (conducted in November 1992). The next highest priorities are for Siberian (in the Russian Far East), South China (in China), and Indochinese tigers (in Malaysia, Thailand, Laos, and Vietnam). Although tigers may be found in North Korea, Cambodia and Myanmar, we do not believe they have the appropriate conservation infrastructure in place to benefit by a PHVA.

A Case Study— Sumatran Tiger PHVA

The first Sumatran Tiger Population and Habitat Viability Analysis Workshop was held 22-26 November 1992 at Padang, West Sumatra, Indonesia. The declining status of all tigers, and the Sumatran tiger in particular, is due to habitat loss and fragmentation, resulting in populations too small for long term survival in the majority of the national parks and game reserves established to protect them. Poaching for medicinal and economic purposes further exacerbates the small, fragmented population dilemma. Other factors contributing to the overall decline in tiger numbers include decreasing prey availability and increasing tiger control as a result of livestock depredation and human-tiger interactions.

Results of the workshop indicated that there were about 400 Sumatran tigers living in five national parks and two game reserves, with another 100 tigers living in

unprotected areas which will soon be lost to agriculture. Poaching is ongoing and uncontrolled, and forest disturbance has further fragmented these populations. The largest population of about 110 tigers is estimated to be in Gunung Leuser National Park; the remaining populations are about one-half this size or smaller. These small populations are extremely vulnerable to poaching or removing problem animals, and because of their isolation and fragmentation, will need interactive management strategies for long-term viability. This led to the development of an Indonesian Sumatran Tiger Action Plan which outlines short-term and long-term goals to address these problems (Tilson et al. 1994).

Geographic Information System (GIS). To prepare for a PHVA and to assist conservation agencies in tiger range countries to develop an accurate and standardized mapping system, a map-linked database using Atlas Geographic Information System (GIS) software needs to be developed. Satellite imagery overlays of vegetation cover of tiger habitat (from World Conservation Monitoring Center-WCMC) can be matched up with range country land-use and forest status maps and geographical maps. This database gives a comprehensive spatial analysis of tiger habitat which allows distinctions such as lowland rain forest from montane forest from mangrove forest, protected forest from non-protected forest, and various land use categories which will affect tiger distribution in the future. This process put the H (for Habitat) into the PHVA acronym, and is a valuable analytical process, an indispensable training tool, and permits interactive development of management scenarios at the workshop.

Regional Captive Management Programs. Before populations of wild tigers fall to crisis levels, which precludes developing management strategies except in panic, captive populations of tigers need to be secured while there are still sufficient numbers of wild tigers left. These captive populations will provide a genetic and demographic reserve to reestablish or revitalize wild populations when the need and opportunity arises. The first stage in developing a regional captive management program for tigers in range countries is to establish a regional studbook, train a tiger management group in concepts of tiger management, husbandry and health, plan the breeding facility, and initiate the regional tiger masterplan. This process allows range countries to develop their own management programs for their endemic subspecies as recommended by the Tiger GCS. Tiger subspecies with high priority in need of program development include the Indochinese tiger in Malaysia, Thailand, Laos and Vietnam, and the South China tiger in China.

This second-stage development of regional captive management programs provides hands-on training sessions at each zoo that focuses on animal health procedures for medical treatment, immobilizations, immunizations, evaluations, health maintenance and diets, and the use of ARKS record keeping software program. This is culminated with a masterplan meeting where the masterplan with institution-by-institution breeding recommendations are drafted, translated into range country language, and distributed to participating zoos. At the same

time, biological material (usually sperm, blood, and tissue) are collected and cryopreserved as part of the IUCN/SSC CBSG Tiger Genome Resource Banking Action Plan (see below).

A Case Study—Indonesian Program for the Sumatran Tiger

The first Regional Captive Breeding Workshop for Sumatran tigers was held in November 1992 at Taman Safari Indonesia. Nine of 11 Indonesian zoos sent 39 staff to the workshop. Javan zoos included Taman Safari Indonesia, Ragunan Zoo (Jakarta), Yogyakarta Zoo, Solo Zoo, Semarang Zoo, Surabaya Zoo, Bandung Zoo, and from West Sumatra, the Jambi Zoo. The products of this Sumatran Tiger Workshop include:

1. Preventive Medical Procedures: Veterinary staff attended tiger immobilization training sessions focusing on proper animal health procedures for medical treatment, immobilizations, immunizations, evaluations, and health maintenance. Animal physical examinations (four males, one female) included permanent tattooing of each animal with a temporary studbook number and placement of a transponder as a backup identification system.
2. Tiger Facility: A tiger captive breeding facility was designed and constructed at Taman Safari Indonesia (see below);
3. Husbandry: Animal management staff received training in proper animal husbandry procedures for maintaining captive tigers on a day-to-day basis;
4. Reproductive Evaluation Procedures: Training was also conducted regarding semen collection, evaluation and storage techniques necessary for the establishment of a genome resource banking program. Semen was collected and frozen from three adult male founders for permanent storage in Indonesia.
5. Husbandry Manual: The Tiger Husbandry Manual was evaluated for its use in Indonesia and translated into Bahasa Indonesia;
6. Studbook: A Regional Sumatran Tiger Studbook was established and an Indonesian Tiger Studbook Keeper was trained in the use of SPARKS (see below);
7. Masterplan: An Indonesian Captive Breeding Masterplan for Sumatran tigers was drafted; and a PKBSI Tiger Management Committee was formed.

The Indonesian Sumatran Tiger Regional Captive Breeding Program will serve as the heart of the global Sumatran tiger population by preserving sufficient genetic diversity to provide animals for reinforcement of world captive and wild populations as recommended in the Tiger GCS. The establishment of this Regional Program will also serve as a model for other regional endangered species captive breeding programs in Asia. By acting now while Sumatran tigers are still present

in sizeable numbers in the wild, we have the potential and the resources to act effectively to prevent Sumatran tigers from extinction.

Regional Captive Breeding Facilities. With few exceptions, tiger facilities in Asian zoos are too overcrowded, reproduction occurs but neonatal mortality is high, diets are poorly balanced, and medical immobilizations, immunizations and examinations are rarely performed because of lack of drugs, equipment and experience. The net result is that wild tigers frequently die as soon as they are placed in such zoos, and if they do live, they seldom raise viable young. This is a regrettable waste of a valuable resource. These issues can be remedied by constructing a modern captive breeding facility in range countries as part of a regional masterplan. As a model, a breeding facility was designed and constructed for Sumatran tigers at Taman Safari Indonesia in November 1992 (see below). Five similar facilities need to be constructed for Indochinese tigers (in Malaysia, Thailand, Laos, and Vietnam) and South China tigers (in China).

Indonesian Tiger Breeding Facility

A captive breeding facility for Sumatran tigers was constructed at Taman Safari Indonesia and was dedicated on 17 November 1992. It was funded by Taman Safari Indonesia and 18 North American zoos through the Tiger SSP. This facility measures 15m x 21m and is large enough to maintain four or more adult breeding pairs of tigers. The facility includes two separate mixing and breeding areas, two separate maternity dens with outside runs, holding space with outside runs for tiger progeny, and a service kitchen. Currently, four male and one female Sumatran tigers (all wild-caught founders) are housed in the facility.

Regional Tiger Studbooks. All species management programs in captivity are predicated on the creation of a studbook, which establishes the identity and origin of each individual animal, and tracks each animal from birth to death. Thus, it will be necessary to establish Regional Studbooks for each regional captive tiger program. Costs include computer hardware, training in studbook software programs (SPARKS), and studbook publication and distribution. The Indonesian Sumatran Tiger Studbook will be completed in January 1994; others needed are the Indochinese (four countries) and South China Tiger Studbooks.

Genome Resource Bank. A successful cryobiology program for tigers will have a significant impact on conserving genetic diversity. A resource of frozen tiger semen will be used interactively with living tiger populations to periodically infuse genetic material from captive or wild populations and to instill captive populations with preserved genes from previous generations. The options cryobiology brings to long-term tiger conservation strategies are limited only by our imagination, but only as long as this program proceeds in concert with

protection of wild populations. The Tiger GCS strongly recommends that a systematic Genome Resource Bank (GRB) for tigers be initiated, which includes the collection, storage, use, exchange, and further research of genetic material from founders and selected free ranging and captive individuals. Elements of this GRB are being developed for Sumatran tigers, which will serve as the model for all Asian tigers (see Genome Resource Banking Action Plan). The Sumatran tiger in Indonesia needs to be completed, the Indochinese tiger needs to be collectively banked from wild-caught tigers in Malaysia, Thailand, Laos, and Vietnam, as well as the South China tiger from wild-caught tigers in Chinese zoos.

Indonesian Studbook for the Sumatran Tiger
Information regarding all Sumatran tigers in Indonesian zoos was compiled and verified for entry into the Indonesian Regional Sumatran Tiger Studbook using the Single Population and Analysis Record Keeping System (SPARKS). Temporary studbook numbers were assigned to those animals which could not be linked to the International Tiger Studbook. At the completion of the workshop, information regarding 76 Sumatran tigers (38 male, 38 female) comprised the Regional Studbook. Of the 42 Sumatran tigers (25.17) currently living in Indonesian zoos, 11 (7.4) are wild-caught founders (only three of which have produced offspring). These preliminary analyses were used by workshop participants to evaluate tentative management strategies for the Regional Captive Breeding Program.

Dr. Ligaya Tumbelaka, Taman Safari Indonesia, was appointed as the Indonesian Regional Studbook Keeper. She will work directly with animal management staff at the Indonesian zoos as well as the Regional Sumatran Tiger Coordinator to rectify remaining inconsistencies in the database. She is also responsible for submitting an annual report to the International Tiger Studbook, kept by P. Muller, Leipzig Zoo.

Tiger International Newsletter. Accurate information is vital to making good decisions. In the case of the tiger, situations can change rapidly and this information needs to be widely circulated to maintain a coherent conservation program for all tigers. For example, the Siberian tiger population for decades has been considered safe; with the recent breakup of the Soviet Union, chaos has reigned. In recent months poaching has proliferated and the wild Siberian tiger is nearly gone. This is just one example; we need to be able to respond to other such crises. This can only be achieved by having a centralized database of field research, public policy, and anecdotal reports on trends affecting tigers throughout Asia. To this end, the Tiger GCS recommends publishing and distributing three issues per year of Tiger Beat, the international newsletter of the Tiger GCS to all tiger constituents. This includes field researchers, managers of tiger protected areas in Asia, key forestry and conservation agency staff in range countries, appropriate NGOs, politicians and the world zoo community. The Minnesota Zoo has published this newsletter since 1987 and distributes it to a membership of over 500 individuals globally.

Tiger Husbandry Manual. In Asian zoos, medical and management records for tigers are poorly kept, if at all, and no captive management plan exists for any zoo population except for Indonesia. This is directly attributable to lack of knowledge that is easily remedied by the production, publication and translation into the language of the range countries of a tiger husbandry manual for use in tiger regional captive management programs. Indonesian and Thai versions are already complete.

Overview of Zoo-Based Conservation Programs

1982: First Species Survival Plan initiated by the AAZPA was for the Siberian tiger by Ulysses Seal.

1986: International Symposium, World Conservation Strategies for Tigers, coordinated by the IUCN/SSC CBSG, Cat Specialist Group and Minnesota Zoo.

1987: Tigers of the World: The Biology, Biopolitics, Management, and Conservation of an Endangered Species, edited by R. Tilson and U. Seal, published.

1988: AAZPA Tiger SSP Masterplan recommended that SSP programs be developed in North America for: 175-200 Siberian (P. tigris *altaica*), 175 Sumatran (P. tigris *sumatrae*) and 75-80 each of Bengal (P. tigris *tigris*) and Indochinese (P. tigris *corbetti*). South China (P. tigris *amoyensis*) tiger program to be based at Chinese zoos.

1990: First live tiger births through in vitro fertilization and embryo transfer occurred at the Henry Doorly Zoo in collaboration with the National and Minnesota Zoos.

1991: EEP Sumatran Tiger Program established.

1991: First live tiger birth through artificial insemination occurred at the Henry Doorly Zoo with the National and Minnesota Zoos.

1992: EEP Amur Tiger Program established.

1992: First meeting of the AAZPA Felid Taxon Advisory Group, during which the first Felid Action Plan was developed, classifying *P. tigris amoyensis* and P. tigris *sumatrae* as critical, and recommending that PVAs and captive breeding programs be developed. Other tiger subspecies: PVA required, captive programs desirable.

1992: First IUCN/SSC CBSG Tiger Global Animal Survival Plan, linking *in situ* and *ex situ* conservation programs for tigers on a global level, developed at the Edinburgh Zoo with participation from the AAZPA, EEP and Indian Zoo Authority.

1992: First Population and Habitat Viability Analysis (PHVA) conducted for tigers (Sumatran subspecies) at Padang, West Sumatra in collaboration with the

Indonesian Department of Forest Protection and Nature Conservation (PHPA).

1992: First Regional Captive Management Program for tigers in Asia (Sumatran subspecies) by the Indonesian Zoological Parks Association (PKBSI).

1993: First IUCN/SSC CBSG Genome Resource Bank (GRB) for Tigers review draft by D. Wildt et al. developed in Antwerp, Belgium.

1994: Indonesian Sumatran Tiger GRB established at Taman Safari Indonesia among CBSG, PKBSI and PHPA.

1995: South China Tiger Studbook and Masterplan of the Chinese Association of Zoological Gardens established.

1995: Indochinese Tiger Masterplan for Thailand of the Zoological Parks Organization of Thailand established.

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Captive Management contents