

แผนแม่บทของการจัดการเสือโคร่งอินโดจีนในประเทศไทย

Indochinese Tiger Masterplan for Thailand

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Edited by

Ronald Tilson

IUCN/SSC Tiger Global Animal Survival Plan (GASP) Coordinator

Sophon Dumnui

Director, Khao Kheow Open Zoo, Thailand

Kathy Traylor-Holzer

IUCN/SSC Tiger GASP Studbook Advisor

Douglas Armstrong

AZA Tiger Species Survival Plan Veterinary Advisor

Sumate Kamolnorrarath

Veterinarian, Khao Kheow Open Zoo, Thailand

Wisid Wichasilpa

Assistant Director, Dusit Zoo, Thailand

Visit Arsaithamkul

Curator of Mammals, Dusit Zoo, Thailand

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Cover photo courtesy of K. Traylor-Holzer, a wild-caught Indochinese tiger at the Cincinnati Zoo.

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Thai editions of the *Indochinese Tiger Masterplan for Thailand* can be requested through the Zoological Park Organization, 71 Rama V Road, Dusit District, Bangkok 10300, Thailand (fax: +66-2-2826125).

English editions of the *Indochinese Tiger Masterplan for Thailand* can be ordered through the International Tiger Information Center, c/o Minnesota Zoo, 13000 Zoo Blvd., Apple Valley, MN 55124 (fax: 1-612-431-9327). Send checks for US \$35.00 (for printing and shipping costs) payable to the Asian Tiger Fund.

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Executive Summary

Ronald Tilson, Kathy Traylor-Holzer and Sophon Dumnui

The status of wild populations of the Indochinese tiger (*Panthera tigris corbetti*) is relatively unknown. This is mostly due to its very broad distribution across most of Indochina, which includes southern China, Vietnam, Cambodia, Lao PDR, Thailand, Malaysia and eastern Myanmar. In these countries, tigers live in remote forests in hilly to mountainous terrain, most of which is defined as common boundaries of neighboring countries. Access to these areas is often restricted, and biologists have only recently been granted limited permits for field surveys.

In Thailand, which is the center of the Indochinese tiger's range, earlier estimates of this subspecies' status suggested a range of 400 to 600 individuals. In the early 1990s Rabinowitz surveyed a number of sites and suggested about 248 tigers were still left in Thailand's protected areas. His estimates were based on an assumed population density of one tiger/100 km², which was modified by a correction factor based on degree of human-caused disturbance to the area.

According to the Thai Royal Forest Department (RFD), tigers are present in 42 protected areas in Thailand, distributed in 17 separate populations. The largest of these forest complexes includes the Huai Kha Khaeng/Thung Yai World Heritage Site and ten other contiguous national parks and wildlife sanctuaries. Together these protected areas, at 14,000 km², form the largest single conservation unit in mainland Asia. Using population density estimates of one tiger/74 km² to one/100 km² (based on field observations in Huai Kha Khaeng Wildlife Sanctuary), the RFD suggests at least 359-486 tigers can be found in eight forest complexes, and another 80-109 tigers in nine discrete forest reserves, giving a potential total population of 439-595 tigers distributed across 44,295 km² of habitat in Thailand.

The RFD is currently making a country-wide tiger assessment of all of their protected areas using Geographic Information System technology and intend to conduct, in conjunction with the CBSG Tiger GASP and other conservation organizations, a regional PHVA workshop in January 1996. The status of Thai tigers will then be clearer, permitting discussions with neighboring countries -- Malaysia, Myanmar, and Lao PDR -- on how to organize trans-border tiger protection programs. Because so many important tiger populations live on both sides of these countries' borders, cooperative programs will be vital to the tiger's survival.

Like most tiger range countries, Thailand has similar problems affecting the long-term survival of wild populations, including hunting (or poaching), human encroachment, loss of habitat and loss of common tiger prey. For the most part, responsible forestry and wildlife departments are too understaffed and underbudgeted to be effective against this onslaught. The reality of ever-

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decreasing tiger numbers, ever-increasing human utilization of remaining habitat and continuing demand for tiger body parts for Chinese folk medicine continue to decimate wild populations. Current conservation management guidelines for large felids like tigers that emphasize increased protection measures have failed across all of Asia. Simply put, tigers are disappearing in the wild. If we continue to maintain the *status quo*, then we run the risk of losing all wild tigers.

In 1986, an international symposium of the IUCN/SSC Cat Specialist and Conservation Breeding Specialist Groups concerned with *World Conservation Strategies for Tigers* recommended that captive breeding programs based upon long-term conservation goals should be encouraged in the regions where the subspecies naturally occurs. The idea was to develop captive management programs to serve as genetic reservoirs to support the recovery or reinforcement of wild populations. This recommendation was strengthened in the 1993 IUCN/SSC/CBSG *Tiger Global Animal Survival Plan (GASP)*, which is a strategy for the management of tigers at the international level that links *in situ* (in the habitat) and *ex situ* (captive management) conservation activities. One component of the plan is to develop globally-linked captive tiger programs in each Asian tiger country while there is still time.

This meeting is in response to an invitation from the Zoological Parks Organization of Thailand (ZPO) made to the IUCN/SSC Conservation Breeding Specialist Group (CBSG) to fulfill recommendations in its 1993 *Thai Zoo Masterplan for Conservation* to assist in the development of an Indochinese tiger captive management program. There are currently about 43 Indochinese tigers in 10 zoos of Indochina and North America. Zoos in the ZPO of Thailand possess possibly three known wild-caught Indochinese tigers; a brother-sister pair at Khao Kheow Open Zoo and one male at Dusit (Bangkok) Zoo. None have produced non-hybridized offspring. Other reputedly wild-caught Indochinese tigers may reside in privately held collections in Thailand, but are not part of any official organized management program.

The objectives of this masterplan meeting were to initiate an analysis of origin of their Indochinese tigers for inclusion in the *Indochinese Tiger Regional Studbook*, and to evaluate the role that the ZPO's captive tiger program, in conjunction with neighboring range countries of Malaysia, Vietnam, Lao PDR, Cambodia and Myanmar, will have in preserving genetic diversity and possibly for support of wild populations. This included recommending tiger management procedures and policies for maintaining tigers in captivity, as well as animal health procedures for medical treatment and health maintenance. These recommendations comprise the *Indochinese Tiger Masterplan for Thailand*.

During the meeting, three working groups were established. One, facilitated by Visit Arsaithamkul and Ronald Tilson, addressed tiger management and staff training issues; the second, facilitated by Sumate Kamolnorrnarath and Douglas Armstrong, addressed animal health issues; and the third, facilitated by Wisid Wichasilpa and Kathy Traylor-Holzer, addressed animal identification, institutional records and population management. A subsequent plenary session integrated results of these discussions that formed the basis for developing the masterplan and its recommendations.

The working groups on **Tiger Management** and **Animal Health** noted that some zoos need more training in tiger management and tiger health programs than other zoos. In order to develop standardized techniques in all aspects of managing tigers, which includes husbandry procedures, immobilizations, physical examinations, disease analysis, vaccinations, parasites, dental problems, pathology, nutritional analysis and record keeping, it was decided that protocols addressing these issues that are contained in the American Zoo and Aquarium Association's (AZA) Tiger Husbandry Manual (*Management and Conservation of Captive Tigers*, 1994) be adoptable for use in ZPO zoos. Policies concerning tiger escapes, carcass disposition, and management of surplus tigers need to be developed.

Issues discussed by the working group on **Population Management** were individual animal identification, standardized records in the zoos, an accurate studbook, a studbook numbering system, a studbook record keeping system, and tiger pedigree verification. Because of the uncertain origin regarding the subspecies of the majority of captive tigers in Thailand, and because of the small Indochinese tiger captive population and relative value of each individual, they recommended the collection of biomaterials (blood, fur and tissue) from these animals for a Genome Resource Bank for use in diagnostic DNA testing (this includes tigers at ZPO zoos and also at the Royal Forest Department and Wild Animal Rescue Center if possible). There is also a need to expand the capacity for tigers at ZPO zoos to 15-20 animals as outlined in the *Thai Zoo Masterplan for Conservation*. The small number of Indochinese tigers currently living in ZPO zoos and low tiger capacity precluded the setting of program goals at the workshop.

Three significant developments were the recommendations that a Genome Resource Bank (GRB) for Indochinese tigers within the ZPO should be established, a Population and Habitat Viability Assessment (PHVA) for wild tiger populations should be initiated in collaboration with the Royal Forest Department, and that current Thai law regarding importation and exportation of tigers and tiger parts needs to be revised so that the ZPO can integrate its captive tiger program with other regional and global tiger programs.

Discussions during the third day yielded a set of priorities and recommendations, which was revised and supported by all workshop participants. On the fourth day a Timetable for Action for 1995-1996 was also developed. These documents comprise the *Indochinese Tiger Masterplan for Thailand*, which will be submitted to ZPO for final approval and translation into Thai.

This workshop marks the initiation of the ZPO Indochinese tiger program, a cooperative effort among Thai zoos designed to preserve genetic diversity for possible reinforcement of wild populations within Thailand and for captive tiger populations worldwide. The bringing to maturity of this regional captive management program may also serve as a model for other captive management programs for endangered species in Thailand. By acting now while tigers are still present in the wild, the ZPO has the potential and the resources to help the Royal Forest Department of Thailand prevent possible extinction of the Indochinese tiger. ■

Opening Address

Lerdrat Rattanavanich, Chairman of the ZPO Board of Directors

On behalf of the Thai Zoological Park Organization, I cordially welcome everyone here to the workshops which are hosted by the Conservation Breeding Specialist Group of the World Conservation Union, the Royal Forest Department of Thailand and the Zoological Park Organization of Thailand.

We are pleased and excited to recognize our friends from several nations -- Malaysia, Singapore, Cambodia, Laos PDR, Vietnam, China, Myanmar, India, Nepal, Sri Lanka, Philippines, Australia, Switzerland, Netherlands, United Kingdom and the United States of America. Again, welcome to Thailand and Khao Kheow Open Zoo.

It is recognizable that across the globe, we are currently facing enormous problems of environmental degradation, wildlife habitat loss, and species extinction. There are a number of reasons to explain these losses, but we are here not to look for more reasons, but to offer solutions on where we need to go, and what we need to do to preserve what is left of Thailand's and the region's biological diversity.

The major goals of these workshops over the next two weeks are to assess many aspects concerning population survival and habitat analysis for Indochinese tigers, wild cattle, and storks, ibises and spoonbills, and to encourage the development of long-term conservation management plans in Thailand and Southeast Asia.

Biological conservation is one of the global solutions to these problems. Thus, your participation here today will be of great importance to us, as I am sure your discussions will be very fruitful in helping preserve Thailand's and the region's flora and fauna in the future.

One of the most significant species for the people of Thailand is the tiger. Thailand is the center of the Indochinese tiger's range, with only about 500 still remaining in our protected forest system managed by the Royal Forest Department. Thus, it is important that the Zoological Park Organization develop an *Indochinese Tiger Masterplan* as part of its Masterplan for Conservation. This will serve as a preventive measure and insurance policy against extinction and can help support the Royal Forest Department in its efforts to save this species for our children in the future.

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I would like to take this opportunity to express our sincere appreciation to CBSG, Dr. Ulysses Seal and Dr. Ronald Tilson in particular, and to thank the Director General of the Thai Zoological Park Organization - Khun Usum Nimmanheminda, the Director of Khao Kheow Open Zoo, - Khun Sophon Dumnui, and Dr. Schwann Tunhikorn of the Royal Forest Department for their contribution and efforts to make these sessions possible. I would also like to thank all of you for your interest in helping us with our problems and for your valuable time in attending these workshops.

I now officially declare the opening of the workshops. Thank you. ■

Indochinese Tiger Masterplan Recommendations

INTRODUCTION

The five national zoos of Thailand are organized under the aegis of the Zoological Park Organization of Thailand (ZPO). The Director General of the ZPO is Usum Nimmanheminda, and his office is located at the Dusit Zoo in Bangkok. The ZPO is managed by a Board of Directors representing the Thai Government, the Royal Forest Department, and Bangkok-based conservation agencies and corporate executives. The Chairman of the Board of Directors is appointed by the Minister of the Prime Minister's Office.

The five national zoos of Thailand are:

- 1) **Dusit Zoo** is located in the capital city of Bangkok, which has a metro population of about 7.9 million people in a country of about 58 million people. The zoo, established in 1938, was previously the private garden of the King of Thailand, and is situated across the street from the Royal Palace. It is 20 ha in size, holding over 1,500 animals of over 200 species. There are 150 employees and approximately 2.5 million visitors per year.
- 2) **Khao Kheow Open Zoo** is located about 100 km southeast of Bangkok, and about 20 km north of the city of Chonburi (with a population of 0.9 million). The zoo, established in 1974, is adjacent to the 25,000 ha Khao Kheow Wildlife Sanctuary, 800 ha of which are owned by the zoo. The zoo is 480 ha in size and holds 5,240 animals of 212 species. There are about 140 employees and currently 100,000 visitors per year (projected attendance is 2.5 million annually). The Khao Kheow Conservation and Research Center, which will link *ex situ* (zoo) with *in situ* (wildlife and forest agencies) conservation programs will be sited here.
- 3) **Chiangmai Zoo** is located in Chiangmai in northern Thailand, which has a population of 1.5 million. The zoo was established in 1954 as a private zoo, and became a municipal zoo in 1975. It is 80 ha in size, holding 1,165 animals of 194 species, and is situated adjacent to Doi Suthep National Park. There are about 75 employees and approximately 500,000 visitors per year.
- 4) **Nakorn Ratchasima Zoo** is situated about 15 km south of the city of Nakorn Ratchasima (previously Korat, population of 2.5 million) in northeast Thailand. The zoo was established in 1989 and is still under construction. It will feature a Crane and Stork Breeding Center. Several million visitors per year are expected.

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- 5) **Songkla Zoo** is located between Songkla (population of 1.1 million) and Hat Yai (population of 125,000) in south Thailand near the Malaysian border. It was established in 1989 and is still under construction.

In 1991 H.E. Minister Mechai Viravaidya of the Office of the Prime Minister requested an assessment of the Zoological Park Organization (ZPO) of Thailand and its five zoos. The objective was to assess the administration, management and function of the existing zoo system in Thailand, make recommendations for improving the zoos to meet international standards, and suggest how to achieve these standards. The assessment led the ZPO Board of Directors to commission the Conservation Breeding Specialist Group of the World Conservation Union (IUCN) to develop a comprehensive masterplan that would touch on all phases of zoo planning. The goal was to transform the national zoos of Thailand into a modern zoo system that could make significant contributions to the conservation of Thailand's endangered wildlife.

One year later, the *Thai Zoo Masterplan for Conservation* was presented to the Office of the Prime Minister and Chairman of the Board of Directors of the ZPO. Several features of this document was the creation of comprehensive collection plans for each zoo that were guided by three conservation priorities:

- 1) The first conservation priority was to focus on developing conservation action for the endangered endemic species of Thailand;
- 2) The second priority, on a broader regional scale, was to focus on developing conservation action for the threatened species of Southeast Asia; and
- 3) The third priority was to develop quality captive breeding programs with the view that these species would provide the linkage between the captive breeding community and the wildlife agencies and conservation organizations of Thailand.

All of these conservation priorities were guided by the process termed **CON-LINK** -- the linking of *ex situ* and *in situ* conservation programs -- which will lead to the long-term viability of wild populations within Thailand. Essentially CON-LINK combines the knowledge gained through captive management programs and associated research and applies the results through a series of phases to the implementation of recovery programs.

As CON-LINK progresses, the role of captive breeding in the development of conservation management strategies should be seen as an attempt to maximize the options and minimize the risks for the recovery of wild populations. This philosophy recognizes that captive populations are a support, not a substitute, for wild populations. One of the species identified in the collection plans for each zoo was the Indochinese tiger. It was also a species identified in need of conservation action both by the *Thai Zoo Masterplan for Conservation* and by the *IUCN/SSC CBSG Tiger Global Animal Survival Plan*.

At the Indochinese Tiger Masterplan Workshop for Thailand, hosted by Khao Kheow Open Zoo and the ZPO, a comprehensive list of issues regarding tigers and tiger management were discussed, and from these discussions, a set of recommendations were made and approved by consensus of all participants. These recommendations for Indochinese tigers in ZPO zoos comprise the ZPO *Indochinese Tiger Masterplan for Thailand*, which follow.

MASTERPLAN RECOMMENDATIONS

Animal Identification and Studbook

1. All ZPO institutions must be members of the International Species Information System (ISIS) and use the Animal Records Keeping System (ARKS) software package for management of their collections. ZPO institutions should ensure that accurate records are kept regarding identification, origin, parentage, breeding, health, transfer, and mortality data for tigers.
2. All ZPO institutions should report all births, deaths (including neonatal deaths), and transfers of studbook managed tigers to the International Tiger Studbook Keeper.
3. All potential Indochinese tigers should be permanently identified with tattoos (temporary or permanent studbook numbers) and with transponders (using the Avid system for the time being, and placed interscapularly).
4. Because of the uncertain origin regarding the subspecies of the majority of captive tigers in Thailand, and because of the small Indochinese tiger captive population and relative value of each individual, we recommend the collection of biomaterials (blood, fur and tissue) from these animals for a Genome Resource Bank for use in diagnostic DNA testing (this includes tigers at ZPO zoos and also at the Royal Forest Department and Wild Animal Rescue Center if possible).
5. The ZPO should appoint a studbook keeper in Thailand to maintain their Indochinese tiger studbook in the SPARKS software system. A veterinary advisor should be assigned either to the ZPO tiger management committee or to the studbook keeper to collect and distribute information on diseases, pathology and clinical chemistry values in the tiger population (see AZA guidelines).

Population Management

6. Because of the low number of verified Indochinese tigers in ZPO zoos, there is a need to either bring more animals into the program and/or use genetic DNA analysis to verify tigers of unknown origin for possible inclusion in the program.
7. Efforts should be made to identify any verifiable Indochinese tigers in non-government facilities or owned by private individuals and pursue incorporation of these animals into the ZPO Indochinese tiger program.

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8. ZPO institutions should not hybridize Indochinese tigers with other subspecies.
9. ZPO institutions should not breed additional tigers outside of the *ZPO Indochinese Tiger Masterplan*.
10. ZPO institutions holding Indochinese tigers with no potential mates should work with the regional Indochinese tiger program to find suitable mates for this individual. Specifically, the 10-year-old wild-caught male Indochinese tiger (T903) at the Dusit Zoo needs to be paired with a female Indochinese tiger, and sperm should be collected and stored.
11. ZPO should designate an Indochinese Tiger Coordinator (perhaps from KKOZ because of the tiger breeding center) and an Indochinese Tiger Management Committee.

ZPO Tiger Capacity

12. There is a need to expand the capacity for tigers at ZPO zoos to 15-20 animals as outlined in the *Thai Zoo Masterplan for Conservation*. Tiger space should be expanded by building a tiger breeding facility as planned at KKOZ. Pairs of tigers could be transferred from the KKOZ tiger breeding facility to other ZPO zoos for breeding or exhibition.
13. Tiger spaces in ZPO zoos should be given priority for Indochinese tigers rather than for other tiger subspecies.

Regional Integration

14. The ZPO Indochinese tiger program should cooperate with other Indochinese tiger range countries (Malaysia, Laos, Vietnam, Myanmar, Cambodia, and Singapore) in the regional management, and other countries (USA) in the global management, of captive Indochinese tigers, and pursue exchanges of animals when possible.
15. Current new Thai law prohibits the importation and exportation of tigers or tiger parts in and out of Thailand, posing a major problem both for needed transfer of animals among regions and export of tiger samples for DNA analysis. Importation and exportation is permitted under this law for conservation, breeding and research purposes, but the guidelines and regulations involved have not yet been outlined. Such imports and exports will need the approval of the Minister of Agriculture and cooperatives as approved by the National Wildlife Reserved and Protected Committee. A strong recommendation should be made from this workshop regarding the importance of these importations and exportations to the conservation of the global captive population of the Indochinese tiger, with endorsement from CBSG and the Tiger GASP.

Genome Resource Bank

16. A Genome Resource Bank (GRB) for Indochinese tigers within the ZPO should be established, by the policy of ZPO, a primary and secondary storage site should be identified, and a GRB coordinator should be appointed.
17. The ZPO should consider developing their Indochinese tiger GRB with CBSG. This can be facilitated by drafting a letter of intent or Memorandum of Cooperation to initiate this relationship.
18. All wild-caught tigers brought into captivity should have biomaterials and semen collected and stored in the GRB as soon as possible.

Tiger Health Programs

19. The ZPO should require that all Indochinese tigers receive an annual physical examination, following standard immobilization guidelines. The exam should include vaccinations, dental examination, health monitoring and blood collection for CBCs and chemistry, and for long-term serum storage (see ZPO tiger husbandry manual for protocols).
20. Before an animal is moved between institutions, the following items are required: permanent identification with studbook number, complete medical history, and parasite testing. If possible, tigers should be quarantined and disease testing should be done.
21. The Thai Zoo Vet Association should collect all available information on tiger diseases in this region, and make prevention and treatment recommendations in the tiger husbandry manual. They also need to determine standard methods for disease testing by July 1996.
22. ZPO should require the development of quarantine facilities at each of their institutions.
23. The Thai version of the tiger husbandry manual should include standard procedures for immobilization, parasite exam and de-worming program, vaccination protocol and schedule, quarantine, hematology and chemistry health monitoring tests, post-mortem procedures and sample collection and toxicology test, hand-rearing protocols, and neonatal management recommendations. Also included should be a list of common diseases, list of common parasites, list of hematology and serum chemistry tests, and a basic list of tissues to be fixed in formalin or preserved fresh or frozen.
24. A method should be developed to provide additional training and experience in health management procedures for the zoo veterinarians in Thailand.
25. A complete post-mortem should be performed on every tiger upon death (sample protocols are contained in the AZA tiger husbandry manual).

26. Contraception should be used to control breeding of surplus tigers (sample protocols are contained in the AZA tiger husbandry manual).

Wild Tiger Programs

27. The ZPO encourages the initiation of a Population and Habitat Viability Assessment (PHVA) in collaboration with the Royal Forest Department to characterize the best known information on wild tiger distribution, status and threats. This information should be provided to ZPO staff to develop public education and conservation programs in their zoos.

28. The ZPO encourages close collaboration between the ZPO and the Royal Forest Department in tiger conservation programs, and for the capture and transport of problem tigers or captive tigers under their jurisdiction.

29. The Thai Zoo Vet Association should provide advice when a wild tiger is immobilized for radiocollaring or for field studies concerning samples collected for hematology, chemistries, parasites, diet, DNA banking and analysis, semen collection and banking (develop prioritized list).

30. Transport of tigers, both within and outside of Thailand, should follow guidelines in the AZA tiger husbandry manual and adhere to domestic and international regulations (e.g., CITES).

Tiger Husbandry and Management

31. The AZA tiger husbandry manual (*Management and Conservation of Captive Tigers*) should be adapted to Thai conditions, translated into Thai and distributed to all concerned parties.

32. All ZPO staff involved in tiger staff should receive training based on information in the Thai version of the tiger husbandry manual.

Tiger Nutrition

33. The Thai Zoo Vet Association should investigate and determine recommended nutrition levels and minimum quality standards for tiger diets.

34. Each ZPO zoo should provide the veterinary advisor with a complete lists of foods and quantities fed to tigers for nutritional analysis and recommendations on diets. These nutritional recommendations should consider seasonal and local variations in availability and costs in Thailand.

35. Veterinary staff will advise their central commissary about quality, handling, storage and prevention of contamination of tiger diets.

36. A set feeding routine should be established for ease of management (shifting between indoor and outdoor enclosures) and night-time security. Accurate daily records of tiger food consumption should be kept.

37. A program for behavioral enrichment in feeding methods for tigers should be developed in ZPO zoos. Some ideas are presented in the AZA tiger husbandry manual.

Tiger Exhibit Design

38. Future tiger exhibits should follow specifications outlined in the AZA tiger husbandry manual and adapted to the Thai environment, available materials, available space and needs of each zoo. Contemporary and future information on captive tiger behavior should be utilized in exhibit design.

Administration and Tiger Policies

39. ZPO staff working with tigers should be educated in tiger reproductive behavior to be more effective in breeding and rearing tigers. This includes the development of a ZPO policy on cub rearing and management of pregnant females (see the AZA tiger husbandry manual).

40. Each ZPO zoo should establish a tiger escape policy and train relevant staff in its implementation.

41. The ZPO should establish a tiger carcass disposition policy.

42. The ZPO should develop, in collaboration with the Royal Forest Department and other conservation organizations in Thailand (e.g., WWF-Thailand), an education and public awareness program regarding tiger conservation in Thailand.

43. The ZPO should develop funding opportunities from public, corporate and government agencies to support the implementation of the *ZPO Indochinese Tiger Masterplan*.

44. The ZPO should establish a policy on issues related to the management of surplus tigers.

45. As the Indochinese tiger management program in Thailand fulfills the goals of the *Indochinese Tiger Masterplan*, the ZPO should develop a collaborative effort with the RFD for possible reintroduction programs for returning Indochinese tigers back to the wild. ■

ZPO Indochinese Tiger Program Timetable for Action

<u>Action</u>	<u>Responsible party</u>	<u>Date</u>
Indochinese Tiger Masterplan Workshop	ZPO/CBSG	17-20 July 95
Masterplan draft report (to Usum)	CBSG	1 Sept 95
Review by ZPO	ZPO	1 Oct 95
Distribution of report and Publication/translation of Thai version	CBSG/ZPO	1 Dec 95
Studbook keeper	ZPO	1 Sept 95
Tiger Management Committee	ZPO-Usum	1 Sept 95
Draft GRB document	ZPO/CBSG/NGO University	Aug 95 (review)
Report to International Tiger Studbook Keeper	ZPO	Sept 95
Report to CBSG in Dublin	Usum	29 Sept 95
Report to SEAZA in Taipei	Usum	Oct 95
Thai version of tiger husbandry manual (translation and publication)	ZPO/CBSG	1 Dec 95

INDOCHINESE TIGER Studbook (Historical)
(Panthera tigris corbetti)

Stud #	Sex	Birth Date	Sire	Dam	Location	Date	Local ID	Event	Country	Name	Breeder #
1	M	~ 1979	WILD	WILD	ASIA MELAKA SARAWAK	~ 1980 15 Jun 1980 7 Nov 1989	UNK UNK UNK	Capture Transfer Loan to	ASIA MALAYSIA MALAYSIA	SYED IBAM	
2	F	~ 1979	WILD	WILD	ASIA MELAKA	~ 1980 15 Jul 1980	UNK UNK	Capture Transfer	ASIA MALAYSIA	SHARIFAH D	
3	M	~ 1979	WILD	WILD	ASIA MELAKA	~ 1981 15 Jun 1981	UNK UNK	Capture Transfer	ASIA MALAYSIA	JANTAN	
4	F	~ 1981	WILD	WILD	ASIA MELAKA	~ 1983 6 Apr 1983 31 Dec 1986	UNK UNK UNK	Capture Transfer Death	ASIA MALAYSIA MALAYSIA	PUTRI	
5	M	17 Jan 1985	3	2	MELAKA	17 Jan 1985 15 Aug 1988	UNK	Birth Death	MALAYSIA	ALONG	MEL 1
6	F	17 Jan 1985	3	2	MELAKA KUALA LUM CINCINNAT	17 Jan 1985 23 Nov 1988 13 Jan 1990	UNK UNK 190014	Birth Loan to Loan to	MALAYSIA MALAYSIA U.S.A.	CANTIK	MEL 2
7	M	4 Sep 1986	3	2	MELAKA	4 Sep 1986 21 Mar 1987	UNK	Birth Death	MALAYSIA	RIANG	MEL 3
8	F	4 Sep 1986	3	2	MELAKA	4 Sep 1986	UNK	Birth	MALAYSIA	SERI	MEL 4
9	F	4 Sep 1986	3	2	MELAKA	4 Sep 1986	UNK	Birth	MALAYSIA	DEWI	MEL 5
10	M	~ 1979	WILD	WILD	ASIA MELAKA	~ 1986 6 Nov 1986 9 Nov 1986	UNK UNK UNK	Capture Transfer Death	ASIA MALAYSIA MALAYSIA	IBAM	
11	F	~ 1986	WILD	WILD	ASIA MELAKA	~ 1987 3 Jan 1987 15 May 1987	UNK UNK UNK	Capture Transfer Death	ASIA MALAYSIA MALAYSIA	PERMAI	
12	M	~ 1974	WILD	WILD	ASIA MELAKA	~ 1987 5 Feb 1987	UNK UNK	Capture Transfer	ASIA MALAYSIA	PUCHONG	
13	M	~ 1987	WILD	WILD	ASIA MELAKA	~ 1987 5 Sep 1987 5 May 1988	UNK UNK UNK	Capture Transfer Death	ASIA MALAYSIA MALAYSIA	KALA	
14	M	~ 1987	WILD	WILD	ASIA MELAKA CINCINNAT	~ 1987 3 Jan 1987 13 Jan 1990	UNK UNK 190013	Capture Transfer Transfer	ASIA MALAYSIA U.S.A.	TENGGU	
15	M	29 Jan 1988	3	2	MELAKA	29 Jan 1988 15 Dec 1988	UNK	Birth Death	MALAYSIA	WIDURI	MEL 6
16	F	29 Jan 1988	3	2	MELAKA	29 Jan 1988 15 Aug 1989	UNK	Birth Death	MALAYSIA	WATI	MEL 7
17	F	24 Nov 1988	3	2	MELAKA SARAWAK	24 Nov 1988 7 Nov 1989	UNK UNK	Birth Loan to	MALAYSIA MALAYSIA	ILA	MEL 8
18	F	24 Nov 1988	3	2	MELAKA CINCINNAT	24 Nov 1988 13 Jan 1990	UNK 190015	Birth Loan to	MALAYSIA U.S.A.	INA	MEL 9
19	M	23 Mar 1990	3	2	MELAKA TAIPING SINGAPORE	23 Mar 1990 15 Jun 1990 1 Dec 1993	UNK UNK UNK	Birth Loan to Transfer	MALAYSIA MALAYSIA SINGAPORE	SYAABAN	MEL 10
20	F	23 Mar 1990	3	2	MELAKA	23 Mar 1990	UNK	Birth	MALAYSIA	TUN TEJA	MEL 11
21	F	23 Mar 1990	3	2	MELAKA TAIPING	23 Mar 1990 15 Jun 1990	UNK UNK	Birth Loan to	MALAYSIA MALAYSIA	MELOR	MEL 12
22	F	~ 1988	WILD	WILD	ASIA MELAKA	~ 1990 26 Jul 1990 26 Jul 1990	UNK UNK UNK	Capture Transfer Death	ASIA MALAYSIA MALAYSIA		
23	M	~ 1988	WILD	WILD	ASIA MELAKA TAIPING	~ 1990 26 Jul 1990 30 Apr 1992	UNK UNK UNK	Capture Transfer Loan to	ASIA MALAYSIA MALAYSIA	CERUL	
24	M	20 Aug 1990	3	9	MELAKA	20 Aug 1990 21 Aug 1990	UNK	Birth Death	MALAYSIA		MEL 13
25	M	20 Aug 1990	3	9	MELAKA	20 Aug 1990 21 Aug 1990	UNK	Birth Death	MALAYSIA		MEL 14

INDOCHINESE TIGER Studbook (Historical)
(Panthera tigris corbetti)

Page

Stud #	Sex	Birth Date	Sire	Dam	Location	Date	Local ID	Event	Country	Name	Breeder #
26	F	20 Aug 1990	3	9	MELAKA	20 Aug 1990 21 Aug 1990	UNK	Birth Death	MALAYSIA		MEL 15
27	F	17 Apr 1991	3	2	MELAKA SANDIEGOZ	17 Apr 1991 19 Feb 1992 19 Feb 1992	UNK 592047	Birth Transfer Death	MALAYSIA U.S.A.	ANUM	MEL 16
28	F	17 Apr 1991	3	2	MELAKA SANDIEGOZ	17 Apr 1991 19 Feb 1992	UNK 592048	Birth Transfer	MALAYSIA U.S.A.	ANIS	MEL 17
29	F	17 Apr 1991	3	2	MELAKA	17 Apr 1991	UNK	Birth	MALAYSIA	ALICE	MEL 18
30	M	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHEMAS	MEL 19
31	F	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHEKAL	MEL 20
32	F	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHERAH	MEL 21
33	F	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHEKAK	MEL 22
34	M	29 Jul 1992	14	18	CINCINNAT	29 Jul 1992 9 Aug 1992	192158	Birth Death	U.S.A.		CIN 1
35	M	29 Jul 1992	14	18	CINCINNAT	29 Jul 1992 15 Aug 1992	192159	Birth Death	U.S.A.		CIN 2
36	M	22 Jun 1993	14	18	CINCINNAT SANDIEGOZ	22 Jun 1993 9 Dec 1993	193128 593427	Birth Transfer	U.S.A. U.S.A.		CIN 3
37	M	22 Jun 1993	14	18	CINCINNAT SANDIEGOZ	22 Jun 1993 9 Dec 1993	193129 593428	Birth Transfer	U.S.A. U.S.A.		CIN 4
38	M	22 Jun 1993	14	18	CINCINNAT	22 Jun 1993	193130	Birth	U.S.A.		CIN 5
39	F	26 Oct 1993	14	18	CINCINNAT OMAHA	26 Oct 1993 9 Feb 1995	193235 8226	Birth Loan to	U.S.A. U.S.A.	TEJA	CIN 6
40	F	26 Oct 1993	14	18	CINCINNAT SANDIEGOZ	26 Oct 1993 8 Apr 1994	193236 594141	Birth Loan to	U.S.A. U.S.A.		CIN 7
41	F	26 Oct 1993	14	18	CINCINNAT OMAHA	26 Oct 1993 9 Feb 1995	193237 8227	Birth Loan to	U.S.A. U.S.A.	SARI	CIN 8
42	M	6 Jun 1993	23	21	TAIPING	6 Jun 1993	UNK	Birth	MALAYSIA	SURESH	TAIP 1
43	F	6 Jun 1993	23	21	TAIPING	6 Jun 1993	UNK	Birth	MALAYSIA	ASHA	TAIP 2
44	F	6 Jun 1993	23	21	TAIPING	6 Jun 1993	UNK	Birth	MALAYSIA	USHA	TAIP 3
45	M	9 Oct 1994	23	21	TAIPING	9 Oct 1994	UNK	Birth	MALAYSIA	SIVA	TAIP 4
46	M	9 Oct 1994	23	21	TAIPING	9 Oct 1994 9 Jul 1995	UNK	Birth Death	MALAYSIA	WIRA	TAIP 5
47	F	9 Oct 1994	23	21	TAIPING	9 Oct 1994	UNK	Birth	MALAYSIA	MELATI	TAIP 6
T901	M	~ Aug 1993	WILD1	WILD2	CAMBODIA KHAOKHEOW	~ Dec 1993 7 Dec 1993	UNK T901	Capture Transfer	ASIA THAILAND		
T902	F	~ Aug 1993	WILD1	WILD2	CAMBODIA KHAOKHEOW	~ Dec 1993 7 Dec 1993	UNK T902	Capture Transfer	ASIA THAILAND		
T903	M	~ 1985	WILD	WILD	THAILAND BANGKOK	~ Jul 1985 ~ Jul 1985	UNK T903	Capture Transfer	THAILAND THAILAND		
T904	M	~ Dec 1992	WILD3	WILD4	MYANMAR WARC	~ 1 Feb 1993 ~ Aug 1993	UNK UNK	Capture Transfer	ASIA		
T905	F	~ Dec 1992	WILD3	WILD4	MYANMAR WARC	~ 1 Feb 1993 ~ Aug 1993	UNK UNK	Capture Transfer	ASIA THAILAND		
T906	M	~ 1992	WILD	WILD	LAOS TULAKOM	???? ????	UNK UNK	Capture Transfer	LAOS		
T907	F	~ 1994	WILD	WILD	LAOS TULAKOM	???? ????	UNK UNK	Capture Transfer	LAOS LAOS		

TOTALS: 26.28.0 (54)

INDOCHINESE TIGER Studbook (Living)
(Panthera tigris corbetti)

Restricted to:
Status: Living by 14 Aug 1995

Stud #	Sex	Birth Date	Sire	Dam	Location	Date	Local ID	Event	Country	Name	Breeder #
1	M	~ 1979	WILD	WILD	ASIA MELAKA SARAWAK	~ 1980 15 Jun 1980 7 Nov 1989	UNK UNK UNK	Capture Transfer Loan to	ASIA MALAYSIA MALAYSIA	SYED IBAM	
2	F	~ 1979	WILD	WILD	ASIA MELAKA	~ 1980 15 Jul 1980	UNK UNK	Capture Transfer	ASIA MALAYSIA	SHARIFAH D	
3	M	~ 1979	WILD	WILD	ASIA MELAKA	~ 1981 15 Jun 1981	UNK UNK	Capture Transfer	ASIA MALAYSIA	JANTAN	
6	F	17 Jan 1985	3	2	MELAKA KUALA LUM CINCINNAT	17 Jan 1985 23 Nov 1988 13 Jan 1990	UNK UNK 190014	Birth Loan to Loan to	MALAYSIA MALAYSIA U.S.A.	CANTIK	MEL 2
8	F	4 Sep 1986	3	2	MELAKA	4 Sep 1986	UNK	Birth	MALAYSIA	SERI	MEL 4
9	F	4 Sep 1986	3	2	MELAKA	4 Sep 1986	UNK	Birth	MALAYSIA	DEWI	MEL 5
12	M	~ 1974	WILD	WILD	ASIA MELAKA	~ 1987 5 Feb 1987	UNK UNK	Capture Transfer	ASIA MALAYSIA	PUCHONG	
14	M	~ 1987	WILD	WILD	ASIA MELAKA CINCINNAT	~ 1987 3 Jan 1987 13 Jan 1990	UNK UNK 190013	Capture Transfer Transfer	ASIA MALAYSIA U.S.A.	TENGGU	
17	F	24 Nov 1988	3	2	MELAKA SARAWAK	24 Nov 1988 7 Nov 1989	UNK UNK	Birth Loan to	MALAYSIA MALAYSIA	ILA	MEL 8
18	F	24 Nov 1988	3	2	MELAKA CINCINNAT	24 Nov 1988 13 Jan 1990	UNK 190015	Birth Loan to	MALAYSIA U.S.A.	INA	MEL 9
19	M	23 Mar 1990	3	2	MELAKA TAIPING SINGAPORE	23 Mar 1990 15 Jun 1990 ~ 1 Dec 1993	UNK UNK UNK	Birth Loan to Transfer	MALAYSIA MALAYSIA SINGAPORR	SYAABAN	MEL 10
20	F	23 Mar 1990	3	2	MELAKA	23 Mar 1990	UNK	Birth	MALAYSIA	TUN TEJA	MEL 11
21	F	23 Mar 1990	3	2	MELAKA TAIPING	23 Mar 1990 15 Jun 1990	UNK UNK	Birth Loan to	MALAYSIA MALAYSIA	MELOR	MEL 12
23	M	~ 1988	WILD	WILD	ASIA MELAKA TAIPING	~ 1990 26 Jul 1990 30 Apr 1992	UNK UNK UNK	Capture Transfer Loan to	ASIA MALAYSIA MALAYSIA	CERUL	
28	F	17 Apr 1991	3	2	MELAKA SANDIEGOZ	17 Apr 1991 19 Feb 1992	UNK 592048	Birth Transfer	MALAYSIA U.S.A.	ANIS	MEL 17
29	F	17 Apr 1991	3	2	MELAKA	17 Apr 1991	UNK	Birth	MALAYSIA	ALICE	MEL 18
30	M	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHEMAS	MEL 19
31	F	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHEKAL	MEL 20
32	F	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHERAH	MEL 21
33	F	30 Jan 1992	23	20	MELAKA	30 Jan 1992	UNK	Birth	MALAYSIA	CHEKAK	MEL 22
36	M	22 Jun 1993	14	18	CINCINNAT SANDIEGOZ	22 Jun 1993 9 Dec 1993	193128 593427	Birth Transfer	U.S.A. U.S.A.		CIN 3
37	M	22 Jun 1993	14	18	CINCINNAT SANDIEGOZ	22 Jun 1993 9 Dec 1993	193129 593428	Birth Transfer	U.S.A. U.S.A.		CIN 4
38	M	22 Jun 1993	14	18	CINCINNAT	22 Jun 1993	193130	Birth	U.S.A.		CIN 5
39	F	26 Oct 1993	14	18	CINCINNAT OMAHA	26 Oct 1993 9 Feb 1995	193235 8226	Birth Loan to	U.S.A. U.S.A.	TEJA	CIN 6
40	F	26 Oct 1993	14	18	CINCINNAT SANDIEGOZ	26 Oct 1993 8 Apr 1994	193236 594141	Birth Loan to	U.S.A. U.S.A.		CIN 7
41	F	26 Oct 1993	14	18	CINCINNAT OMAHA	26 Oct 1993 9 Feb 1995	193237 8227	Birth Loan to	U.S.A. U.S.A.	SARI	CIN 8
42	M	6 Jun 1993	23	21	TAIPING	6 Jun 1993	UNK	Birth	MALAYSIA	SURESH	TAIP 1
43	F	6 Jun 1993	23	21	TAIPING	6 Jun 1993	UNK	Birth	MALAYSIA	ASHA	TAIP 2
44	F	6 Jun 1993	23	21	TAIPING	6 Jun 1993	UNK	Birth	MALAYSIA	USHA	TAIP 3

INDOCHINESE TIGER Studbook (Living)
(*Panthera tigris corbetti*)

Pa

Restricted to:

Status: Living by 14 Aug 1995

Stud #	Sex	Birth Date	Sire	Dam	Location	Date	Local ID	Event	Country	Name	Breeder
45	M	9 Oct 1994	23	21	TAIPING	9 Oct 1994	UNK	Birth	MALAYSIA	SIVA	TAIP
47	F	9 Oct 1994	23	21	TAIPING	9 Oct 1994	UNK	Birth	MALAYSIA	MELATI	TAIP
T901	M	~ Aug 1993	WILD1	WILD2	CAMBODIA KHAOKHEOW	~ Dec 1993 7 Dec 1993	UNK T901	Capture Transfer	ASIA THAILAND		
T902	F	~ Aug 1993	WILD1	WILD2	CAMBODIA KHAOKHEOW	~ Dec 1993 7 Dec 1993	UNK T902	Capture Transfer	ASIA THAILAND		
T903	M	~ 1985	WILD	WILD	THAILAND BANGKOK	~ Jul 1985 ~ Jul 1985	UNK T903	Capture Transfer	THAILAND THAILAND		
T904	M	~ Dec 1992	WILD3	WILD4	MYANMAR WARC	~ 1 Feb 1993 ~ Aug 1993	UNK UNK	Capture Transfer	ASIA		
T905	F	~ Dec 1992	WILD3	WILD4	MYANMAR WARC	~ 1 Feb 1993 ~ Aug 1993	UNK UNK	Capture Transfer	ASIA THAILAND		
T906	M	~ 1992	WILD	WILD	LAOS TULAKOM	???? ????	UNK UNK	Capture Transfer	LAOS		
T907	F	~ 1994	WILD	WILD	LAOS TULAKOM	???? ????	UNK UNK	Capture Transfer	LAOS LAOS		

TOTALS: 16.22.0 (38)

Captive Population Analysis

Kathy Traylor-Holzer

Current Inventory

The current estimated inventory of captive Indochinese tigers in Asia is 44-58 individuals (Table 1). Only 19 of these animals are registered in the *International Tiger Studbook*. Many of these tigers have been donated by private individuals and are of uncertain origin. At least 12 tigers are proposed to be wild-caught Indochinese tigers (only 4 of these are registered in the *International Tiger Studbook*), and most of these potential founders have not bred. The specific tiger inventory given at the workshop is detailed below by country.

Thailand

Khao Kheow Open Zoo has 4.2 tigers: 3.0 are captive-born Bengal tigers from Chiangmai Zoo that came originally from Japan; 0.1 tiger was donated from a private individual to the Dusit Zoo and was transferred to KKOZ one year ago; and 1.1 tigers are believed to be wild-caught Indochinese tigers from Cambodia. These two animals arrived at KKOZ about two years ago at 3-4 months of age and may be siblings. Although KKOZ currently has 6 tigers, carrying capacity for tigers is 4 (2 are being held in bear enclosures).

Chiangmai Zoo has 2.2 Bengal tigers and are at capacity.

Dusit Zoo has 5.3 tigers: 2.0 are from the RFD and could possibly be Indochinese tigers (unknown origin); 1.1 are Bengal tigers from Japan; 1.0 is a possible wild-caught Indochinese tiger originally from the RFD but donated by a private individual; 1.1 are possible Indochinese tigers donated by individuals, and 0.1 is a possible Bengal tiger also donated by a private individual.

Songkla and Nakorn Ratchasima Zoos currently do not hold tigers.

The *Royal Forest Department* has 4.2 tigers which could possibly be Indochinese: 2.1 tigers are 4.5 years old and were confiscated from illegal trade; 1.0 was captive-born at RFD and is almost 2 years old (offspring of above female and another male); 0.1 is a captive-born 4.5-year-old of unknown origin donated from a private owner in northern Thailand; and 1.0 is a 4-year-old tiger which was a private donation. RFD would be interested in holding and breeding tigers, and has enclosures to maintain 5 pairs of big cats (leopards as well as tigers).

Wild Animal Rescue Center has 1.1 possible Indochinese tigers believed to be wild-caught siblings captured in Myanmar near the Thailand border and donated to a temple at 3 weeks of age. These animals are now 2.5 years old and are maintained together (female is not yet showing signs of estrus).

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A 1993-94 survey of wildlife facilities in Thailand by T. Redford reported another 143 tigers held by municipal zoos, game farms, private owners or at other facilities, most of which are of unknown origin.

Summary of status of tiger population at ZPO zoos

Currently in Thailand in ZPO zoos there are 18 tigers (all subspecies), 7 of which may be Indochinese tigers. Dusit and KKOZ are currently over preferred carrying capacity. The current tiger carrying capacity of ZPO zoos is closer to 10 animals.

KKOZ has 1.1 wild-caught Indochinese tigers, 2 year-old siblings believed to be captured in Cambodia (studbook # T901♂ and T902♀). Dusit Zoo has 1 male wild-caught Indochinese tiger (SB# T903) caught at 6 months of age in a wildlife sanctuary in Thailand during a forest fire about 10 years ago. This male needs to be paired with a female Indochinese tiger, and sperm should be collected and stored from this male. Dusit Zoo also has 3.1 tigers donated from the private sector which may be Indochinese but need verification through DNA analysis. Therefore, ZPO institutions currently have 2.1 confirmed Indochinese tigers, all of which are wild-caught and none of which have bred or have been genome banked.

Singapore

Singapore Zoo has 4.6.2 Indochinese tigers at the "day" zoo and 3 Sumatran tigers at the "night" zoo. The original animals were 1.3 from Zoo Melaka (three sisters and their uncle); the male subsequently bred with all three females. All of these animals are captive-born and from the Zoo Melaka line. The Sumatran tigers are related to the Zoo Negara line, and Singapore would like to replace them with Indochinese tigers.

Malaysia

Zoo Melaka has 3.9 Indochinese tigers, most of which are registered in the *International Tiger Studbook*. As all studbook-registered captive Indochinese tigers have passed through Melaka or are descendants of Zoo Melaka animals, the institutional records for Melaka's tigers are very important and need to be examined to complete the revision of the studbook database.

Taiping Zoo has 2.3.3 Indochinese tigers, a wild-caught male and captive-born female from Melaka and their offspring (two litters).

Zoo Negara has 3.2 Indochinese tigers, all believed to be captive-born and from the Zoo Melaka line.

Myanmar

Yangon Zoological Gardens, Rangoon, has 1.2 Bengal tigers and 1.0 possible Indochinese tiger about 12 years old and believed to be wild-caught in Myanmar. The zoo has a carrying capacity of 7-8 tigers.

Laos

Tulakom Inter Zoo has 1.1 possible Indochinese tigers, a 3 year-old male and a 1 year-old female believed to be captured in southern Laos and donated to the zoo by private individuals.

Vietnam

Saigon Zoo has 4 tigers; 2 are believed to be Indochinese. Their carrying capacity is 4 tigers, with plans to expand to 8.

Hanoi Zoo has 3 tigers; 2 are believed to be Indochinese. No data are available on carrying capacity.

United States

Ten studbook-registered Indochinese tigers are held outside of Asia, all in U.S. zoos: 2.2 at *Cincinnati Zoo*; 2.2 at *San Diego Zoo*; and 0.2 at the *Omaha Zoo*.

Two major issues identified during the workshop were the lack of information on the origin, and therefore subspecies, of many of the captive tigers in Asia, and the need for accurate records and a tiger identification system within zoos. The captive global population is currently based upon 4 founders which have living descendants in the population (SB# 2♀, 3♂, 14♂ and 23♂). Additional founders may be available in Thailand as well as in Cambodia, Laos, Vietnam and Myanmar. These potential founders would form the basis of the ZPO Indochinese tiger program in Thailand and also would be of great value to the global captive population. Therefore, priority should be given to identifying new founders, through official documents or molecular DNA analysis, and incorporating these individuals into the ZPO Indochinese tiger program.

Given that the ZPO Indochinese tiger population only has 3 founders and a carrying capacity of 10 tigers, no program goals for retention of genetic heterozygosity were set at the workshop. With 3 founders and 10 tiger spaces, only 30-35% of the original genetic heterozygosity could be retained over 100 years (Table 2). Given the best case scenario of 7 founders and expanding the carrying capacity to 25, only 60-65% of the genetic heterozygosity could be retained for 100 years in the ZPO population. This punctuates the desperate need for the ZPO to increase its carrying capacity and to incorporate new founders into its program. Carrying capacity and founders can be further expanded by integrating the ZPO Indochinese tiger program with other regional and global programs. Approximately 109 tiger spaces are projected to be available in Southeast Asia (Table 1), with additional spaces available in North America. Such integration would make it possible to preserve 90% of the genetic heterozygosity over the next 100 years (Table 2). ■

Table 1. Current tiger inventory and tiger carrying capacity in institutions in Asia.

Institution	# of Tigers				
	Current # of Indochinese	Current # of other subsp.	Total # of tigers	Current capacity	Projected capacity
Thailand					20-25
KKOZ	2	4	6	4	
Dusit	1 (+4?)	3?	8	2	
Chiangmai	0	4	4	4	
Songkla	0	0	0	0	
Nakorn Rat	0	0	0	0	
RFD	6?	0?	6	10	10
WAR	2	0	2	2	2
Singapore	12	3	15	12-15	12-15
Malaysia					
Melaka	12	0	12	12	12
Taiping	7	0	7	7?	7?
Negara	5	12	17	17?	17?
Myanmar	1	3	4	7-8	7-8
Laos	2	0	2	2	2
Vietnam					
Saigon	2?	2?	4	4	8
Hanoi	2?	1?	3	3	3
TOTAL	44-58	32-46	90	90	109

Table 2. Carrying capacities required to maintain various levels of heterozygosity for 100 years with various numbers of founders (from CAPACITY 2.11 program by Ballou).

No. Effective Founders	PERCENT HETEROZYGOSITY RETAINED					Table Parameters
	30.0	40.0	50.0	60.0	65.0	
	3	10	16	36	****	
4	9	13	20	50	****	
5	9	11	17	30	49	
6	9	11	16	26	34	
7	9	11	16	23	30	

**** = Not Possible with these parameters

No. Effective Founders	PERCENT HETEROZYGOSITY RETAINED					Table Parameters
	35.0	45.0	55.0	65.0	75.0	
	3	10	17	****	****	
4	9	12	22	****	****	
5	8	11	17	38	****	
6	8	10	16	27	****	
7	8	10	14	23	68	

**** = Not Possible with these parameters

No. Effective Founders	PERCENT HETEROZYGOSITY RETAINED					Table Parameters
	75.0	80.0	85.0	90.0	95.0	
	10	36	63	****	****	
15	29	41	74	****	****	
20	28	38	58	151	****	
25	28	36	52	104	****	
30	28	36	50	90	****	

**** = Not Possible with these parameters

Physical and Medical Evaluation Report

Douglas Armstrong

Summary

Physical examinations and routine medical procedures were performed on 1.1 Indochinese tigers. No significant clinical abnormalities were found in either cat. Immobilizations of the tigers was accomplished with an average dose of 0.48 mg/kg xylazine given intramuscularly by blow dart. After 10 minutes an average dose of 4.72 mg/kg ketamine was administered intramuscularly by blow dart. Anesthesia was maintained with supplemental doses of either ketamine intramuscularly at 1.0-1.6 mg/kg or midazolam intravenously at 0.006 mg/kg. The average interval between supplemental drug doses was 10 minutes, with a range of 2-28 minutes. Anesthesia was maintained for 81 minutes in the male tiger and 29 minutes in the female.

Each animal was subsequently given a complete physical examination including examinations of the eyes, ears, teeth, and claws as well as general physical condition. No significant abnormalities were found in either cat. The male had minor pad abrasions and the female had a minor abrasion on the inside surface of the lower left rear leg. The teeth of both cats were clean with no significant calculus present.

A blood sample was collected from each animal for hematology, serum chemistries and serum banking. Three 6 mm full thickness biopsies of the skin were collected from each animal and placed in liquid nitrogen for later genetic analysis. Hair was also collected for this purpose. Semen was collected from the male by electroejaculation.

Permanent identification was placed in each animal by tattooing the temporary studbook number in the inside left rear leg. Two transponders were placed interscapularly in each cat. Each cat has the following permanent identification.

Male: Tattoo: "T901", medial left rear leg
 Transponder: Trovan - 0001DB66BF; AVID - 000836276
 Both transponders are located interscapularly.

Female: Tattoo: "T902", medial left rear leg
 Transponder: Trovan - 000132F2DD; AVID - 000849008

Each tiger received a single dose of trimethoprim and sulfadiazine antibiotic to help prevent secondary infections.~

Semen Collection and Genome Resource Banking Report

Onnie Byers

One of the objectives of the *Indochinese Tiger Masterplan for Thailand* was to collect and freeze semen from the genetically valuable wild-caught tiger at Kheo Kheow Open Zoo (KKOZ).

Two tigers were immobilized and the male (temporary studbook number T901) was electroejaculated using the standard semen collection protocol. Seminal fluid (3.713 ml) was obtained but this ejaculate contained very few sperm cells (too few to determine an accurate concentration). The motility and status of the few observed sperm cells were estimated to be <5% and 2.0 respectively. The seminal fluid pH was 8.7. He is a young animal and, although spines were present on his penis, he has most likely not yet reached full sexual maturity. It is recommended that this animal be electroejaculated again in approximately six months and that those results be compared with the results of this collection. A demonstration of semen analysis and the pellet freezing procedure was presented.

It had been hoped that the semen collected from tiger T901 would be the first deposit into Thailand's potential Indochinese tiger Genome Resource Bank. A Tiger GRB Action Plan for North America has recently been written but it will not be functional until it becomes a truly global program. A Genome Resource Bank could be used as insurance against the loss of more genetic variation from the population, and, in the future, with the use of assisted reproduction techniques such as artificial insemination, gene diversity could be spread more effectively and efficiently among populations by shipping germ plasm (frozen sperm) rather than living animals.

A Genome Resource Bank includes not only sperm, but also other biomaterial such as animal tissue, plasma, WBCs and RBCs, that can be used to establish cell lines and produce DNA that is necessary for answering questions about subspecies genetic variation and even offspring parentage. Blood serum is useful for studying and solving disease problems.

We collected these useful samples from the two Indochinese tigers immobilized at KKOZ. Tissue, hair, serum and whole blood were collected from each tiger. These samples are currently being stored at Dusit Zoo in Bangkok.

I gratefully acknowledge the Conservation Breeding Specialist Group, NOAHS Center and British Air for travel expenses and the Save the Tiger Fund, a special project of the National Fish and Wildlife Foundation created in partnership with Exxon Corporation, for workshop expenses. ■

Workshop Agenda

Indochinese Tiger Masterplan Workshop for Thailand Khao Kheow Open Zoo, Chonburi, Thailand, 17 - 20 July 1995

Monday, 17 July

- AM Opening addresses and presentations of tiger programs
Overview of CBSG organization and programs
Overview of Indonesian PKBSI Sumatran Tiger Program
- PM Masterplan process: Establish working groups
- 1) Medical issues
 - 2) Husbandry and management issues
 - 3) Animal identification and studbook verification
- Working group reports

Tuesday, 18 July

- AM Overview of small population biology
Overview of genome resource banking
Working groups continue
- 1) Medical issues
 - 2) Husbandry and management issues
 - 3) Population management
- PM Working group reports

Wednesday, 19 July

- AM Tiger training session: immobilization, evaluation, identification, genome banking
- PM Draft *Indochinese Tiger Masterplan for Thailand* and recommendations

Thursday, 20 July

- AM Revise *Indochinese Tiger Masterplan for Thailand*
Formation of short-term timetable for action
Workshop wrap-up and closing

Workshop Participants

Participants from Thailand

Usum Nimmanheminda, DG of ZPO
Kayoon Srimung, Deputy Director ZPO
Channarong Sukthon, Technical Officer
Nipat Rattanapan, Technical Officer
Zoological Park Organization
71 Rama V Road, Dusit
Bangkok 10300
THAILAND
Tel: 66-2-281-2000, 1904
Fax: 66-2-282-6125

Alongkorn Mahannop, Director
Wisid Wichasilpa, Asst. Dir./Gen. Cur.
Visit Arsaithamkul, Vet/Mam. Curator
Chaichana Satrulee, Education Curator
Butawan Pamoke, Nutritionist
Yongchai Utara, Veterinarian
Dusit Zoo
71 Rama V Road, Dusit
Bangkok 10300
THAILAND
Tel: 66-2-281-3832, 1039, 2000
Fax: 66-2-282-6125

Thaworn Orasoon, Technical Officer
Wichit Kongkham, Veterinarian
Prayuth Navacharoen
Nakornratchasima Zoo
111 M.1, Chaimongkol Muang
Nakornratchasima 30000
THAILAND
Tel: 66-44-216352, 216353
Fax: 66-44-216352

Sophon Dumnui, Director
Sumate Kamolnorrnanarth, Veterinarian
Prayuth Intarapanich, Nutritionist
Apidet Singhaseni, Zoo Educator
Naris Kaewsalabnil, Anim. Feed Curator
Wanchai Tunwattana, Mammal Curator
Rattapan Pattanarangsarn, Veterinarian
Khao Kheow Open Zoo
P.O. Box 6, Bangphra
Chonburi 20210
THAILAND
Tel: 66-38-311561, 321525
Fax: 66-38-311561, 321525

Chatri Khoohathapharak, Veterinarian
Kanchai Sanwong
Chiangmai Zoo
100 A. Muang
Chiangmai
THAILAND
Tel: 66-53-222479

Wivake Sukead, Technical Officer
Songkhla Zoo
Songkhla
THAILAND
Tel: 66-74-323649
Fax: 66-74-323649

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Vulilert Klahan, Veterinarian
Padet Siridumrong, Veterinarian
Sriracha Zool. & Wildlife Research Ctr.
P.O. Box 16
Sriracha, Chonburi 20110
THAILAND
Tel: 66-38-338101, 338300
Fax: 66-38-338106

Tim Redford
Project Manager
Wild Animal Rescue Fdn of Thailand
29/2 Sukhumwit 33
Bangkok 10110
THAILAND
Tel: 66-2-258-5560
Fax: 66-2-261-0925

Sanan Liangpaiboon
Wildlife Conservation Division
Royal Forest Department
61 Paholyothin Rd.
Jatujak, Bangkok 10900
THAILAND
Tel: 66-2-561-4292, 4293 x713
Fax: 66-2-561-4236

International Participants

Sun Hean
Technical Officer
Wildlife Protection Office
Forestry Department
40, Norodom Bd.
Phnom Penh
CAMBODIA
Fax: 855-23-62383, 26011

Apichart Tirawatana
Chief, Bangpra Breeding Station
Royal Forest Department
P.O. Box 5, Bangpra
Sriracha, Chonburi
THAILAND
Tel: 66-1-931-7431

Ma Yiqing
Institute of National Resources
103 Haping Road
Harbin 150040
CHINA
Tel: 86-451-6664562

Pornchai Patumrattanathan
Forest Technician
Royal Forest Department
Khao Pratubchang Wildlife Breeding Ctr.
147 Moo 8, Tumboon Chomboong
Amper Chomboong, Rachaburi 70150
THAILAND
Tel: 66-1-931-7434
Fax: 66-1-561-4836

Anwaruddin Choudhury
Chief Executive
Rhino Foundation for Nature in NE India
The Assam Co. Ltd.
Girish Bamunimaidam
Guwahati 781007
ASSAM, INDIA
Tel: 91-361-550257
Fax: 91-361-550902

Parntep Ratanakorn
Wildlife Research Laboratory
Department of Zoology
Kasetsart University
Bangkhen, Bangkok 10900
THAILAND
Tel: 66-2-5791022
Fax: 66-2-5611645

Nuan Thong Xavongxay
Veterinarian
Tulakhom Inter Zoo
Vientiane
LAO P.D.R.
Tel: 856-21-130389

Bounchanh Liphoung
Manager
Tulakhom Inter Zoo
Vientienne
LAO P.D.R.
Tel: 856-21-130389

Zainuddin Bin Awang Lela
Game Ranger
DWNP Malaysia
Jabatan Perhilitan N. Pahang
Temerloh 28000
MALAYSIA
Tel: 60-3-2961267

Razeem Mazlan Abdullah
Zoo Melaka
Ayer Keroh
Melaka 75450
MALAYSIA
Tel: 60-6-324053, 324054

Khin Than Win
Veterinary Officer
Nature & Wildlife Conservation Division
Forest Department
West Gyogone, Inseir Yangon
MYANMAR
Tel: 95-1-63490
Fax: 95-1-64336, 65592

Su Su Oung
Veterinary Officer
Yangon Zoological Gardens
40 Kaba Aye Pagoda Road
Sheve-Gon-Daing P.O. Yangon
MYANMAR
Tel: 95-1-53688, 50772

Ruben Callo
Research Specialist
Ecosystems Research & Dev. Bureau
Dept. of Envir. & Natural Resources
UPLB Campus, College, Laguna 4031
PHILIPPINES
Tel: 63-94-3481, 2269, 2229
Fax: 63-94-2850, 51115

Kumar Pillai
Curator
Singapore Zoological Gardens
Mandai laile Rd.
Singapore 2512
SINGAPORE
Tel: 65-2693411
Fax: 65-3672974

Sarah Christie
Conservation Programmes Coordinator
London Zoo
Regent's Park
London NW1 4RY
UK
Tel: 44-171-722-3333 x455
Fax: 44-171-722-2852

Douglas Armstrong
Staff Veterinarian
Henry Doorly Zoo
3701 South 10th St.
Omaha, NE 68107
USA
Tel: 1-402-733-8401 x244
Fax: 1-402-733-4415

Onnie Byers
Program Officer
Conservation Breeding Specialist Group
12101 Johnny Cake Ridge Road
Apple Valley, MN 55124
USA
Tel: 1-612-431-9453
Fax: 1-612-432-2757

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Eric Miller
Director of Animal Health & Research
St. Louis Zoo
1 Government Dune
St. Louis, MO 63110-1396
USA
Tel: 1-314-781-0900 x483
Fax: 1-314-768-5454

Ulysses Seal
CBSG Chair
Conservation Breeding Specialist Group
12101 Johnny Cake Ridge Road
Apple Valley, MN 55124
USA
Tel: 1-612-431-9325
Fax: 1-612-432-2757

Ronald Tilson
Director of Conservation
Minnesota Zoo/CBSG
13000 Zoo Blvd.
Apple Valley, MN 55124
USA
Tel: 1-612-431-9267
Fax: 1-612-431-9452

Kathy Traylor-Holzer
Conservation Biologist
Minnesota Zoo
13000 Zoo Blvd.
Apple Valley, MN 55124
USA
Tel: 1-612-431-9206
Fax: 1-612-431-9452

Le Vu Khoi
Department of Zoology
Hanoi University
90 Nguyen Trai St.
Hanoi
VIETNAM
Tel: 84-4-340564
Fax: 84-4-583061