CBSG News

Inside...

- PHVA Overview
- Recent PHVAs
- Recent CAMPs
- Giant Panda Survey
- South China Tiger Evaluation
- Confiscation Meeting
- Saigon Zoo
- Book review
- CBSG updates

Volume 9
Number 1
September 1998

Newsletter of the Conservation Breeding Specialist Group, Species Survival Commission, World Conservation Union

Growth of CBSG Processes and Network

This newsletter contains reports from a selection of recent CBSG workshops and projects. The scope of conservation issues and problems that can be analyzed with the production of useful management outcomes using the CBSG workshop processes and tools now ranges from single populations to groups of species and ecosystems. Organizational conservation planning needs are an extension of these processes designed to make use of the information gathered in CBSG workshop reports, SSC Action Plans, and other sources. CBSG is a value-added knowledge organization whose vitality depends upon our ability to constantly anticipate and respond to change, to lead through innovation of new products and processes, and to rapidly transfer our knowledge and skills. Every workshop experience provides us with new information and unexpected events. This stimulates us to constantly re-examine our work. Through all of this uncertainty and change our values remain at the core of our organizational vitality.

We have recently drafted a statement of these values, which we wish to share with you, our friends and supporters:

"CBSG cares about saving endangered species and habitat. It bases its mission and activities on the development and implementation of scientifically sound processes. CBSG takes a leadership position in the conservation community based on cross-cultural, interdisciplinary and inter-sector partnerships. It champions openness, inclusiveness, morality, ethics and risk-taking. It constantly evolves in response to the needs of all those concerned with conserving the planet's biodiversity. It depends on the warmth, support, acceptance and vitality of its extended community."

One of our challenges and goals is to improve and enhance the PHVA workshop process in terms of quality, depth and scope. We have re-examined and reaffirmed our mutual definition of the goals and objectives of a PHVA workshop: Exactly what are we trying to accomplish through such an exercise? The general goal is to assist the process of species recovery. Objectives include:

- Quantitative risk assessment of species/ habitat endangerment
- Development of a set of management plans to address species recovery
- Consensus agreement on said management plans
- Facilitation of an increased level of trust and collaboration among relevant stakeholders
- To provide a broader foundation of information upon which planning and subsequent recovery action may proceed
- Distribute the CBSG tools and mindset to the conservation community — training

Overall, the recognition remains that expanding the content through the rigorous scientific basis of the PHVA increases the likelihood of successful species recovery. This occurs because new information is constantly being collected and assessed (i.e., information is converted to knowledge), and because with increased trust new collaborations and partnerships are formed that enhance recovery efforts.

Ulysses S. Seal, CBSG Chairman

The CBSG Conservation Council

These generous contributors make the work of CBSG possible

Conservators ($10,000 and above)

Australasian Species Mgmt. (ASMP)
Chicago Zoological Society
Columbus Zoological Gardens
IUDZG – The World Zoo Organization
Metropolitan Toronto Zoo
Minnesota Zoological Garden
Omaha's Henry Doorly Zoo
Saint Louis Zoo
Walt Disney's Animal Kingdom
White Oak Conservation Center
Wildlife Conservation Society - NYZS
Zoological Society of London
Zoological Society of San Diego

Guardians ($5,000-$9,999)

Cleveland Zoological Society
Denver Zoological Gardens
Fossil Rim Wildlife Center
Loro Parque
Lubee Foundation
Taronga Zoological Park NSW
Toledo Zoological Society

Protectors ($1,000-$4,999)

Albuquerque Biological Park
Allwetter Zoo Munster
Audubon Zoological Gardens
Bristol Zoo
Caldwell Zoo
Calgary Zoo
Chester Zoo
Copenhagen Zoo
Detroit Zoological Park
El Paso Zoo
Federation of Zoological Gardens of Great Britain and Ireland
Fort Wayne Zoological Society
Fort Worth Zoo
Gladys Porter Zoo
Greater Los Angeles Zoo Association
Houston Zoological Garden
International Aviculturists Society
Jacksonville Zoological Park
Jersey Wildlife Preservation Trust
Living Desert
Marwell Zoological Park
Metro Washington Park Zoo
Milwaukee County Zoo
North Carolina Zoological Park
Oklahoma City Zoo
Paignton Zool. & Botanical Gardens
Parco Natura Viva Garda Zool. Park
Philadelphia Zoological Garden
Phoenix Zoo
Pittsburgh Zoo
Royal Zoological Society of Antwerp
Royal Zoological Society of Scotland
Royal Zoological Society of S.Australia
San Antonio Zoo
San Francisco Zoo
Schonbrunner Tiergarten
Sedgwick County Zoo
Sunset Zoo (10 year commitment)
Taipei Zoo
The WILDS
Twycross Zoo
Union of German Zoo Directors
Urban Services Dept. of Hong Kong
Wassenaar Wildlife Breeding Centre
Wilhelma Zoological Garden
Woodland Park Zoo
Yong-In Farmland
Zoo Atlanta
Zoologischer Garten Koln
Zoologischer Garten Zurich

Stewards ($500-$999)

Aalborg Zoo
Arizona-Sonora Desert Museum
Banham Zoo & Sanctuary
Dickerson Park Zoo
Dutch Federation of Zoological Gardens
Fota Wildlife Park
Givskud Zoo
Granby Zoo
Great Plains Zoo
Knoxville Zoo
Lowry Park
National Aviary in Pittsburgh
National Zoological Gardens of Pretoria
Odense Zoo
Ouwehands Dierenpark
Perth Zoological Gardens
Riverbanks Zoological Park
Rolling Hills Refuge Conservation Center
Rotterdam Zoo
The Zoo
Thrigby Hall Wildlife Gardens
Tierpark Rheine
Wellington Zoo
Welsh Mountain Zoo
World Parrot Trust
Zoologischer Garten Rostock

Curators ($250-$499)

Douglass, Elaine
Emporia Zoo
Lincoln Park Zoo
Racine Zoological Society
Roger Williams Park Zoo
Topeka Zoo, Friends of
Zoo de la Casa de Campo

Sponsors ($50-$249)

African Safari
Alameda Park Zoo
Alice Springs Desert Park
Apenheul Zoo
Arbeitskreis Natur-u Artenschutz in den
Belize Zoo
Brandywine Zoo
Chen, Richard
Darmstadt Zoo
Jones, Marvin
Kew Royal Botanic Gardens
Lisbon Zoo
Memphis Zoo
Miller Park Zoo
National Birds of Prey Centre
PAAZAB
Palm Beach Zoo at Dreher Park
Potter Park Zoo
Safari Parc de Peaugres
Shimizu, Teruko
Steinhart Aquarium
Tautphaus Park Zoo
Tokyo Zoological Park Society
Touro Parc-France

Supporters ($25-$49)

Folsom Children's Zoo & Botanical Garden
Jardin aux Oiseaux
Lee Richardson Zoo
Moore, Don
Oglebay's Good Children's Zoo

September 9 , 1998

Thank You!!!

CBSG News

The *CBSG News* is published by the Conservation Breeding Specialist Group, Species Survival Commission, World Conservation Union. *CBSG News* is intended to inform CBSG members and other individuals and organizations concerned with the conservation of plants and animals of the activities of CBSG in particular and the conservation community in general. We are interested in exchanging newsletters and receiving notices of your meetings. Contributions of US $25 to help defray cost of publication would be most appreciated. Please send contributions or news items to:

CBSG News
12101 Johnny Cake Ridge Road
Apple Valley, MN 55124-8151 USA
Phone: 01-612-431-9325
Fax: 01-612-432-2757
E-Mail: office@cbsg.org

Staff

Contents...

PHVA Workshops 4
Western Prairie Fringed Orchid PHVA 6
Lion Tamarin PHVA 8
Goblin Fern PHVA 10
African Wild Dog PHVA 12
Mountain Gorilla PHVA 14
Winged Mapleleaf Mussel PHVA 17
Peary Caribou PHVA 18
Iberian Lynx PHVA 20
Evaluation of South China Tiger 21
Giant Panda Biomedical Survey 22
Indian CAMPs 24
Mexican Cactus CAMP 26
El Salvador Confiscation Workshop 27
Saigon Zoo Masterplan 29
World Conservation Strategy Review 31
Primate Conservation: Book Review 32
Announcements 33
CBSG Update 34
CBSG Upcoming Meetings/Travel 35

CBSG Mission Statement

The mission of the Conservation Breeding Specialist Group is the conservation or establishment of viable populations of threatened species.

The goals of CBSG are to:

1. Organize a global network of people and resources.
2. Collect, analyze and distribute information.
3. Develop global conservation breeding programs.
4. Integrate management programs for captive and wild populations.

Population and Habitat Viability Assessment Workshops

The first Population Viability Assessment (PVA) workshop facilitated by CBSG was the Florida Panther PVA held in Naples, Florida in February 1989. Since that time, CBSG has assisted with 77 PVA or PHVA (Population and Habitat Viability Assessment) workshops in 31 countries on six continents. Diverse taxonomic groups have been assessed, including mammals, birds, reptiles, amphibians, invertebrates and plants. Modelling used in these workshops has evolved to incorporate habitat status (hence the development from PVAs to PHVAs) and aspects of human demography. Across the broad spectrum of these taxonomic groups and conservation scenarios, the basic workshop format, guidelines and objectives essentially are the same.

The PHVA Process

Effective conservation action is best built upon critical examination and use of available biological information, but also very much depends upon the actions of humans living within the range of the threatened species. Motivation for organizing and participating in a PHVA comes from fear of loss as well as a hope for the recovery of a particular species.

At the beginning of each PHVA workshop, there is agreement among the participants that the general desired outcome is to prevent the extinction of the species. The workshop process takes an in-depth look at the species' life history, population history, status, and dynamics, and assesses the threats putting the species at risk.

One crucial by-product of a PHVA workshop is that an enormous amount of previously unpublished information can be gathered from a variety sources and stakeholders. This information is then discussed by the workshop participants with the aim of first reaching agreement on the state of current information. These data then are incorporated into a computer simulation model to determine: 1) risk of extinction under current conditions; 2) those factors that make the species vulnerable to extinction; and 3) which factors, if changed or manipulated, may have the greatest effect on preventing extinction. In essence, these computer-modelling activities provide a neutral way to examine the current situation and what needs to be changed to prevent extinction.

Complimentary to the modelling process is a communication process, or deliberation, that takes place during a PHVA. Workshop participants work together to identify the key issues affecting the conservation of the species. Participants then divide into smaller working groups to discuss key identified issues, whether management, disease, translocation, or other emerging topics. Each working group produces a brief report on their topic, and recommendations are discussed in plenary sessions to reach workshop consensus. A successful PHVA workshop depends on determining an outcome where all participants, coming to the workshop with different interests and needs, "win" in developing a management strategy for the species in question. Workshop recommendations are developed by, and are the property of, the local participants.

Recent PHVA Workshops

In this issue of *CBSG News* we summarize the findings and recommendations of eight recent PHVA workshops, which demonstrate the breadth of taxa, issues and stakeholders involved in these processes. Complete reports are available for these workshops from the CBSG Office.■

One of the first CBSG-facilitated PVA workshops was the Javan Rhino PVA held in Bogor, Indonesia in June 1989.

Year	Workshop	Location	Date
1989	Florida Panther PVA	Naples, FL, USA	January 1989
	Javan Rhino PVA	Bogor, West Java, Indonesia	June 1989
	Puerto Rican Parrot PVA	San Juan, Puerto Rico	June 1989
	Puerto Rican Crested Toad PVA	Puerto Rico	1989
	Florida Panther PVA	Gainesville, FL, USA	November 1989
1990	Bali Mynah PVA	Bogor, West Java, Indonesia	March 1990
	Florida Key Deer PHVA	Key West, FL, USA	May 1990
	Leontopithecus PVA	Belo Horizonte, Brazil	June 1990
1991	Pink Pigeon PVA	Jersey, Channel Islands	April 1991
	Whooping Crane PVA	Glen Rose, TX, USA	August 1991
	Caribbean Parrot PVA	St. Vincent Island	October 1991
	Tanu River Primate Reserve PHVA	Kenya	October 1991
	New Zealand Kea PHVA	Christchurch, New Zealand	December 1991
	New Zealand Kaka PHVA	Christchurch, New Zealand	December 1991
1992	Kirtland's Warbler PHVA	Bloomington, MN, USA	January 1992
	Cotton-Top Tamarin PHVA	Caracas, Venezuela	February 1992
	Aruba Island Rattlesnake PHVA	Palm Beach, Aruba Island	February 1992
	Karner Blue Butterfly PHVA	Zanesville, OH, USA	April 1992
	Waldrapp Ibis PHVA	Rabat, Morocco	April 1992
	Mississippi Sandhill Crane PHVA	Pascagoula, MS, USA	September 1992
	Sangai PHVA	Coimbatore, India	October 1992
	Spix's Macaw PHVA	Belo Horizonte, Brazil	October 1992
	Sumatran Tiger PHVA	Padang, West Sumatra, Indonesia	November 1992
	Alala, Akohekohe, and Palila PHVA	Hilo, HI, USA	December 1992
1993	Orangutan PHVA	Medan, North Sumatra, Indonesia	January 1993
	Jamaican Iguana PHVA	Kingston, Jamaica	February 1993
	St. Helena Island PHVA	London, UK	May 1993
	Baiji Dolphin PHVA	Nanjing, China	June 1993
	Sandplain Gerardia PHVA	Shelter Island, NY, USA	July 1993
	Lion-Tailed Macaque PHVA	Madras, India	October 1993
	Asiatic Lion PHVA	Gujurat, India	October 1993
	Pampas Deer PHVA	La Paloma, Rocha, Uruguay	October 1993
	Asian Elephant PHVA	Bandar Lampung, Indonesia	November 1993
	Sumatran Rhino PHVA	Bandar Lampung, Indonesia	November 1993
	White-Winged Wood Duck PHVA	Bandar Lampung, Indonesia	November 1993
	Indian Rhino PHVA	Jaldaparas, West Bengal, India	December 1993
1994	Attwater's Prairie Chicken PHVA	Glen Rose, TX, USA	January 1994
	Mediterranean Monk Seal PHVA	Athens, Greece	April 1994
	Thai Gibbon PHVA	Khao Yai NP, Thailand	April 1994
	Javan Gibbon and Langur PHVA	Cisarua, West Java, Indonesia	May 1994
	Houston Toad PHVA	Austin, TX, USA	May 1994
	Asiatic Black Bear PHVA	Taipei, Taiwan	June 1994
	Marsh Deer PHVA	Sao Paulo, Brazil	September 1994
	Peninsular Pronghorn PHVA	La Paz, Baja California Sur, Mexico	November 1994
	Bairds Tapir PHVA	Panama City, Panama	December 1994
1995	Gharial PHVA	Gwalior, Madhya Pradesh, India	January 1995
	Mantled Howler Monkey PHVA	Puebla, Mexico	March 1995
	Masked Bobwhite Quail PHVA	Sasabe, AZ, USA	April 1995
	Squirrel Monkey PHVA	Manuel Antonio NP, Costa Rica	June 1995
	European Bison PHVA	Miedzyzdroje, Poland	June 1995
	Barasingha PHVA	Dehra Dun, India	July 1995
	Clouded Leopard PHVA	Taipei, Taiwan	October 1995
	Komodo Monitor PHVA	Cisarua, West Java, Indonesia	December 1995
	Indonesian Sea Turtle PHVA	Cisarua, West Java, Indonesia	December 1995
1996	Volcano Rabbit PHVA	Mexico City, Mexico	January 1996
	Cheetah PHVA	Otjiwarango, Namibia	February 1996
	Namibian Lion PHVA	Otjiwarango, Namibia	February 1996
	Javan Hawk-Eagle PHVA	Cisarua, West Java, Indonesia	May 1996
	Tamaraw PHVA	Laguna, Philippines	May 1996
	Anoa PHVA	Cisarua, West Java, Indonesia	July 1996
	Babirusa PHVA	Cisarua, West Java, Indonesia	July 1996
	Spotted Tree Frog PHVA	Melbourne, Australia	August 1996
1997	Chimpanzee PHVA	Entebbe, Uganda	January 1997
	Sarus Crane PHVA	Thailand	January 1997
	Western Prairie Fringed Orchid PHVA	Ashland, NE, USA	April 1997
	Lion Tamarin PHVA	Belo Horizonte, Brazil	May 1997
	Goblin Fern PHVA	Leech Lake, MN, USA	October 1997
	African Wild Dog PHVA	Pretoria, South Africa	October 1997
	Mountain Gorilla PHVA	Kampala, Uganda	December 1997
1998	Winged Mapleleaf Mussel PHVA	Monticello, MN, USA	January 1998
	Iberian Lynx PHVA	Parque Cabakeros, Spain	February 1998
	Sangai PHVA	Manipur, India	February 1998
	Peary Caribou PHVA	Yellowknife, NWT, Canada	February 1998
	Muriqui PHVA	Belo Horizonte, Brazil	May 1998
	Tree Kangaroo PHVA	Lae, Papua New Guinea	September 1998
	Humboldt Penguin PHVA	Olmue, Chile	September 1998

Western Prairie Fringed Orchid PHVA

Nebraska, April 1997

The western prairie fringed orchid (*Platanthera praeclara*) was listed as a threatened species under the Federal Endangered Species Act in 1989 as a result of a decline in the species' range over the past 100 years, the reduced size of the remaining populations, and an increasingly fragmented distribution. Approximately 74 sites are known in 38 counties over seven states, including 14 known populations in Nebraska. Historically, the species was more widely distributed and was locally common. The species is endemic to the North American tall grass prairie community and the Nebraska Sandhills but also occurs naturally in disturbed sites associated with this habitat. Major threats are the loss of habitat through conversion to agriculture, fragmentation, incompatible land use practices, hydrologic changes induced by human activity, and invasion of exotic plant species. A revised federal recovery plan for the species was distributed in early 1997.

In October 1996, the Nebraska Game and Parks Commission invited CBSG to conduct a PHVA workshop for the western prairie fringed orchid. Omaha's Henry Doorly Zoo agreed to provide personnel, organizational, financial and logistical support. The PHVA was held at Eugene T. Mahoney State Park in Ashland, Nebraska on 27-30 April 1997. Forty- five participants were present, representing nearly the entire range of the species and a diversity of interests, including private land owners, non-governmental organizations, universities, state and federal agencies, habitat managers, field researchers, and other specialists.

After plenary presentations on small population biology and orchid conservation, working groups were formed to address the primary areas of concern: distribution and field survey of Nebraska populations; life history; *ex situ* propagation; land use and habitat management; and population dynamics and modeling. Several issues became clear in the course of the discussions. For example, virtually no specific life history information is available for the species. These small populations could be highly vulnerable to extinction, and life history variables can profoundly influence growth dynamics. These factors are also crucial in determining the management methods that will enable the populations to survive. In addition, it was apparent that there are significant differences among populations located in various climatic and geologic conditions, which can profoundly affect the population's survivability. The absence of distribution information was considered to be an important issue affecting the preservation of the species. Translocation and reintroduction into habitats where the orchid occurred historically were recognized as complex programs requiring consideration and participation of a wide range of groups. Participants agreed that there is no need or intention to undertake these programs immediately in Nebraska, but recognized the importance of initiating discussion now in order to facilitate the best possible planning for such possibilities in the future.

Detailed recommendations from each working group are presented below. In general, the consensus was that a great deal of work is needed for this species in Nebraska and throughout its range. Research on the species' life history and habitat in Nebraska should be conducted as well as studies of various land use management methods and their effect on orchid populations. It is essential that these studies be done collaboratively and cooperatively with other groups studying populations in other regions, using standardized methodology. This will enhance funding opportunities, significantly increase the value and applicability of the data, and enable the most efficient use of resources to produce the maximum beneficial result. *Ex situ* work such as genetics and *in vitro* culture may also contribute significantly to our understanding of the biology of the species and to other issues critical to its survival.

Summary of Recommendations

Life History Working Group

1. Identify mycorrhizal species associated with the orchid at different sites and different life stages.
2. Determine number of seeds per capsule, seed viability, and germination rates in the field and laboratory.
3. Identify mechanisms and extent of seed dispersal in specific populations; correlate environmental factors with seed germination in the field.
4. Develop non-destructive methods to allow the following of below-ground stages.
5. Conduct research to determine whether or not dormancy exists and, if so, what the trigger factors are and how long a plant can persist in this stage.
6. Encourage comparable data collection by developing a standardized protocol for demographic monitoring.
7. Gather comparable quantitative data on the number of flowering plants in current year that become absent, vegetative or reflower in the following year, seed production, number of leaves and plant height.

8. Conduct studies to identify the specific species of pollinators which are successful in a given area. General estimates of pollinator abundance and diversity would be useful management information.
9. Determine how environmental influences affect growth and reproduction in the following year.
10. Maintain and continue established databases and develop new ones to answer the above questions.

Distribution Working Group
1. Select orchid sites in Nebraska for conservation actions based on the recommendations of the ecoregional planning documents being developed by The Nature Conservancy and the Orchid Recovery Plan. Preserving these known, and currently unprotected populations, is the number one priority.
2. Document threats at individual orchid sites and incorporate this information into conservation planning and management documents.
3. Conduct county-based natural area inventories in Nebraska to identify potential orchid habitats.
4. Standardize orchid survey methods.
5. Train biologist to conduct orchid surveys and develop a pool of capable surveyors.
6. Utilize/train volunteers to conduct orchid surveys.
7. Conduct initial orchid surveys in priority habitats.
8. Document site characteristics including soil texture and chemistry, associated vegetation, slope position, land use history, and ground water hydrology.
9. Secure funding to conduct orchid and county-based natural area inventories in Nebraska.

Population Biology and Modeling Working Group
1. Initiate a seed bank study to determine the residence time of seeds in the soil.
2. Initiate a study to determine if a protocorm can directly become a flowering plant, bypassing a vegetative, above-ground stage.
3. Obtain estimate of number of seeds per mature capsule and determine whether "not so plump" capsules have any (viable) seeds.
4. Begin plot studies of marked plants at several sites, especially upland prairie sites, to determine whether or not dormancy exists in this species.
5. Begin plot studies of marked plants at several sites, especially upland prairie sites, to study recruitment.
6. Collect demographic data for upland prairie sites and populations outside of the northern part of the species' range. Data from small sites, upland prairie populations and wet meadow populations in the sandhills would be most helpful in furthering our understanding.
7. Compare Cheyenne and Minnesota data sets while continuing data collection on the impact of environmental variables and management treatment.
8. Modify the model to accommodate autocorrelations across years and across transition probabilities within years to examine cumulative effects.

Ex Situ Conservation Working Group
1. Develop effective means of plant propagation including protocols for germination and growth to maturity.
2. Develop protocols for short- and long-term germplasm storage, such as seeds and protocorms.
3. Utilize *ex situ* germination and culture studies to document developmental biology and to provide additional material for further research studies of genetics, morphology and longevity.
4. Undertake field studies of *in situ* populations to compare developmental responses to *ex situ* studies and to provide information that may facilitate *ex situ* cultivation.
5. Develop reintroduction techniques through controlled field research.
6. Develop public display gardens, without disrupting wild populations, for public education.
7. Produce and distribute public educational materials.
8. Develop education materials for school curricula introducing Great Plains rare and endangered species.
9. Recruit local nursery and garden centers and involve cooperative extension programs as an educational outlet to reach the general public.

Management Working Group
1. Determine the effects of hydrologic factors on management practices and address sources of hydrologic modifications.
2. Conduct research on current prairie management practices and variables to determine their effects.
3. Determine effects of management practices on seasonal growth stages of the orchid.
4. Determine effects of climatic conditions in conjunction with management practices.
5. Integrate management and life history research.
6. Develop and implement management plans using a short-term and long-term approach.
7. Use documented annual land use histories to structure and direct management research and devise short-term management.
8. Identify and address factors that may influence and limit the type and level of conservation and management practices that can be implemented, including land ownership and land use priority. ■

Submitted by Douglas Armstrong, Henry Doorly Zoo and Onnie Byers, CBSG.

Lion Tamarin PHVA

Brazil, May 1997

The four endangered species of lion tamarins, (*Leontopithecus rosalia*, golden lion tamarin; *L. chrysomelas*, golden-headed lion tamarin; *L. chrysopygus*, black-lion tamarin; and *L. caissara*, black-faced lion tamarin) are endemic to the Atlantic forest in eastern and southeastern Brazil. Deforestation, hunting and commerce have caused their populations to decline drastically over the last 50 years. Current population estimates are about 630 for the golden lion tamarin (GLT), 6,000 to 15,500 for the golden-headed lion tamarin (GHLT), 1000 for the black lion tamarin (BLT) and as few as 400 for the black-faced lion tamarin (BFLT). Populations of the GLT and BLT are highly fragmented with the majority of animals in protected areas. Less fragmented is the population of GHLTs. The distribution and status of the BFLT are less well known as they were only discovered in 1990.

All four species are currently the subject of intensive conservation programs that, depending on the species, include scientific global management of captive populations (GLT, GHLT, BLT), studies on the ecology and behavior of wild populations (all species), translocation of threatened wild groups (GLT, BLT), habitat restoration (GLT), local conservation education programs (all species) and reintroduction of captive-born individuals to natural forest (GLT). Four International Research and Management Committees (IRMC) advise the Brazilian government (IBAMA) on the research and conservation activities for these species.

The first Population and Habitat Viability Assessment workshop for lion tamarins was held in 1990, and led to the development of integrated conservation strategies and the establishment of IRMCs for all four species. The second *Leontopithecus* PHVA was held in May 1997 in conjunction with the 25th Anniversary *Leontopithecus* symposium, designed to synthesize the current state of knowledge of the four lion tamarin species in preparation for the PHVA. The objectives of this second PHVA were to evaluate the current status and threats facing the lion tamarin species and to recommend priorities for conservation strategies to address problems. At the forefront of these threats and perceived needs were: 1) recognition that lion tamarin populations are extremely fragmented, with many small areas completely isolated from each other and therefore highly susceptible to the risks associated with small populations; and 2) acknowledgment that expansion of conservation education and community programs will be vital to lion tamarin conservation.

More than 50 managers, scientists, governmental officials, and educators participated in the workshop. After a general open discussion identifying the various factors that needed to be addressed during the workshop, the following four working groups were identified: metapopulation management issues, habitat and research issues, social and communication issues, and population modeling.

The recommendations presented by the four working groups focus on three fundamental issues. The first major issue is that conservation of lion tamarins must proceed within a metapopulation context to maximize both the viability of populations and the conservation of habitat. Management of all fragmented populations, including captive populations, must be considered within a single "global" conservation objective, with goals set for separate populations. This approach acknowledges that movement, possibly frequent, of animals among populations is a necessary component of the management plan.

The second fundamental issue is the recognition that existing protected areas need to be maximally utilized, managed and safeguarded, with threats removed where they exist. For GLTs, GHLTs, and probably BFLTs as well, a significant proportion of the existing populations exist in unprotected areas. Where possible, protected areas need to be expanded to incorporate existing populations.

The effect of human-related factors (political, socio-economic, legislative, demographic and educational) was identified as the preeminent challenge to the successful conservation of lion tamarins. The needs of viable lion tamarin populations must be reconciled with the needs of the people sharing the Atlantic forests of Brazil and the resource limitations of those involved with the conservation of these species and habitat. These issues are likely to be the primary foci of conservation action in the years to come.

Summary of Recommendations

Metapopulation Management Working Group

1. Set as the objective of the metapopulation management plan to ensure the survival of the species, and preferentially, the survival of a population (or metapopulation) in its native habitat of sufficient size to undergo natural adaptive evolution. Quantitatively, the objective is a metapopulation of sufficient composition, size, and geographic distribution to survive for 100 years with a probability of at least 98%, with an overall effective size sufficient to retain at least 98% gene diversity for 100 years.
2. For each species, define the populations (including captive populations) and habitats that will constitute the metapopulation, as well as the objectives, research and management needed for each population to ensure its contribution to the overall metapopulation viability.
3. Continue to develop and refine techniques for translocation/reintroduction so that animals can be successfully and efficiently moved among populations;
4. Define and implement methods to increase the levels of communication between *in situ* conservation efforts and zoos to strengthen the link between public education, public support and *in situ* conservation programs.

Habitat and Research Working Group

GLT: The only officially designated protected area for this species is the 5,500 ha Poço das Antas Biological Reserve (of which only 51% is forested). Increase protected areas for GLTs by: 1) Creating an official protected area of the 2,400 ha Fazenda União; and 2) annexing the 340 ha Fazenda Cambucais as part of the Poço das Antas Reserve.

GHLT: The Una Biological Reserve is the only protected area for the species; only 5,522 ha of the 11,400 ha established in the decree creating the Reserve is covered by forest. Provide indemnities for the removal of the 24 families of squatters within the Una Biological Reserve, and intensify the current efforts to register and incorporate into the Reserve the remaining 4,378 ha to fulfill the original mandate in the decree for the Reserve.

BLT: The Morro do Diabo State Park (35,000 ha) and the Caitetus State Ecological Station (2,178 ha) are the only two protected areas containing populations of BLTs. Establish an institutional agreement between the Secretary of the Environment of the State of São Paulo, INCRA, MST and rural landowners to guarantee the permanence of the remaining forest fragments in the region of the Pontal do Paranapanema, incorporating forests into the Morro do Diabo State Park where possible ; and 2) provide incentives and accelerate the procedures involved in creating private reserves (RPPNs) in areas where there are populations of black lion tamarins.

BFLT: The only officially protected area for the black-faced lion tamarin, Superagüi National Park, is threatened by the construction of the BR-101 highway, and the island of Superagüi is under considerable threat from deforestation, development and conflict of interests with Indians resident in the Park. Establish protected areas based on recommendations arising from population studies. Include recommendations arising from the PHVA Workshop and the International Committee for the species, and IBAMA in the highway environment impact study.

Social and Communications Working Group

1. Reduce the pressure of human occupation in and around existing conservation units as well as reduce the negative impact of human practices in the region surrounding conservation units. Using a Participatory process, develop a regional plan for human occupation and land use for each region, and implement environmental education programs with the communities pressuring the conservation units.
2. Develop incentives for private landowners to preserve natural areas and improve law enforcement.
3. Develop new and innovative economic alternatives for communities around conservation units;
4. Improve communication and collaboration among institutions involved at all levels in land use and policy in the areas within the ranges of the lion tamarins.

Population Modeling Working Group

1. If populations of each species were not fragmented and there were no further loss of habitat, we could marginally meet objectives defined by the metapopulation management plan. As this is not the case, any degree of fragmentation or loss of habitat endangers these populations.
2. Effects of fragmentation can be reduced by movement of animals. There needs to be enough movement to ensure that small populations contribute to overall metapopulation viability.
3. Models should continue to be refined and used to guide management as needed. ■

Submitted by Jon Ballou, National Zoological Park; Anthony Rylands, Conservation International; Ilmar Santos, IBAMA; and Susie Ellis, CBSG.

Goblin Fern PHVA

Minnesota, October 1997

Found in only three states, the goblin fern (*Botrychium mormo*) is listed as Endangered in Wisconsin and as a species of special concern in Minnesota and Michigan. In addition, *B. mormo* is listed as a 'species of concern' by the U.S. Fish and Wildlife Service (USFWS), a G3 species by The Nature Conservancy, and a Sensitive Species by the U.S. Forest Service.

The preferred habitat of this small plant is under the shaded leaf litter of forests with a maple-basswood component. The goblin fern has a strong fungal (mycorrhizal) association that permits it to survive even when covered by dense leaf litter, and can remain underground for years under poor conditions. Although extensive surveys have been conducted in some areas in each of the three states, there has been no range-wide effort to inventory the species.

The USFWS recognized a need to assess the viability of this species on a range-wide basis. A Goblin Fern PHVA was held at Leech Lake, near Walker, Minnesota from 6-9 October 1997. The workshop was sponsored by the Chippewa National Forest, Minnesota Department of Natural Resources and the University of Minnesota Institute of Sustainable Resource Management Education. Twenty-eight participants were present, representing the entire range of the species. Representatives of the timber and mining industries were unable to attend.

Following presentations on *Botrychium* taxonomy, genetics and life history, working groups were formed to address the primary areas of concern for the participants: life history and modeling; distribution; threats and risks; and management and social issues. Several issues became clear in the course of the discussions:
a) very little specific life history information is available for the species. The effects of dispersal and disturbance and the importance of mycorrhizal associations and photosynthesis were identified as crucial aspects to be investigated;
b) the apparent impact of exotic earthworms on *B. mormo* habitat;
c) the fact that conflict or risk comes in mixed stands of maple, basswood, and aspen, where aspen is represented well enough to harvest; and
d) the need for increased stakeholder involvement, particularly by the timber industry.

Distribution data were collected during the workshop and 191 populations were identified. A follow-up meeting of the *Distribution Working Group* was held on 20 November to compile and analyze the available data. Using the life history modeling assumption that populations with at least five above-ground stems were sustainable, and considering potential threats of documented exotic earthworm infestation and potential harvest of aspen sites, the *Distribution Working Group* concluded that 51 of the 191 goblin fern populations are stable. With this knowledge in hand, the need for an overall metapopulation analysis becomes an important component of a broad species management plan, based at least in part on an assessment of occupancy of suitable microhabitats across the species range.

Summary of Recommendations

Population Life History and Viability Working Group
1. Maintain sufficient northern hardwood habitat.
2. Preserve significant *B. mormo* sites.
3. Monitor the demographics of disturbed populations through permanent plots.
4. Search for additional occurrences in all habitats.
5. Study and compare the underground biology of *B. mormo* in normal and disturbed communities.
6. Study spore dispersal strategy, including the distance dispersed and agents of dispersal.
7. Conduct *B. mormo* transplant experiments.
8. Study mycorrhizal aspects of population dynamics.
9. Study ecophysiology, including contribution of photosynthesis to overall energy budget.
10. Examine the potential importance of *B. mormo* to the entire community.

Threats and Risks Working Group
1a. In areas affected by exotic earthworms, institute a minimum 24-month moratorium from other impacts on *B. mormo* sites in order to assess the earthworm risk; these sites should be protected by ecological Land Type Association phase-level buffer zones.
1b. Study the impact of earthworms on the viability of *B. mormo* and its habitat, survey all sites (and control sites) for worm presence, and develop methods to prevent the spread of worms and control them.
2. Investigate feasibility of timber harvest methods that do not impact factors critical to *B. mormo* viability.
3. Conduct research on the life cycle and function of the mycorrhizae associated with *B. mormo*.
4. Survey historic, current and potential sites to determine abundance, distribution and limiting factors.
5. Federal/state licensing/permitting agencies should conduct/require pre-project site surveys and include conservation conditions in any permit/license issued.
6. Provide public/landowner information on *B. mormo*; assist landowners in developing voluntary site protection plans; provide information on threats.

Management and Social Issues Working Group

Stakeholder Participation

1. Add stakeholders to PHVA mailing list.
2. Establish personal contacts with critical stakeholders who did not attend the PHVA.
3. Host a one-day overview in neutral location aimed at bringing critical participants "to the table."
4. Provide general letter/overview to updated mailing list within two weeks following the workshop.
5. Include goblin fern information on the Chippewa National Forest Homepage, including range-wide status, life history and ongoing research/monitoring.
6. Publish popular articles on goblin fern.
7. Provide copies of Goblin Fern PHVA Workshop Report to all participants, critical stakeholders and all other interested parties.

Information and Monitoring

1. Update and share all information range-wide across all agencies and interested parties annually.
2. Continue project level Forest Service inventories and encourage other landowners to do the same.
3. Seek grants and partnerships to support proactive range-wide inventories and associated habitat research.
4. Summarize all existing monitoring studies range-wide and share this information with all agencies and interested parties.
5. Seek grants and partnerships to evaluate the effects of clear-cutting and intermediate harvesting.
6. Conduct studies to thoroughly research site and plant characteristics in specified locations.
7. Conduct studies on *B. mormo* life history.
8. Monitor and control earthworms.

Range-wide Management

1. Plot geomorphic region equivalents across the entire range of *B. mormo*.
2. Designate those LTAs that hold the largest number of known *B. mormo* occurrences and/or have the greatest potential for *B. mormo* occurrence.
3. Based upon known occurrences and habitat conditions, determine the number of populations needed to provide long-term viability of *B. mormo* within designated LTAs throughout its range.
4. Develop a range-wide communication network to track status, distribution, new technology, biology, research findings, data collection and monitoring.

Landscape Level Management

1. Within the selected LTAs, further identify and designate the landscapes that are, or recently were dominated by maple-basswood-beech forests as *B. mormo* habitat management areas (BMHMAs).
2. Implement landscape-level forest management strategies on these BMHMAs designed to promote the composition, structure and historic disturbance regime associated with these forest habitats.
3. Encourage multi-agency management compatible with habitat objectives within designated BMHMAs.
4. In areas of *B. mormo* concentrations within the BMHMAs (10,000+ acres), designate large areas (300-3000 acres) for a high level of protection.

Site/Stand Level Management

1. Within BMHMAs, for stands without *B. mormo* occurrences, defer harvest or implement uneven-aged silvicultural practices (single-tree or group selection).
2. Within the BMHMAs, for stands with *B. mormo* occurrences, defer harvest in the stand or permit single tree or group selection beyond 300 feet of known occurrence in the remainder of the stand.
3. For known *B. mormo* occurrences outside the BMHMAs and within the selected LTAs, defer from harvest land-type phase or stand or allow any harvest greater than 300 feet from an occurrence.
4. For known *B. mormo* occurrences outside the selected LTAs, defer the stand from harvest or allow harvest beyond 300 feet of known occurrence.

Distribution and Status Working Group

Using the criteria for risk and security outlined in this working group report, 51 of the 191 element occurrences documented throughout the species range are considered secure. It may, therefore, seem appropriate for The Nature Conservancy global rank of the species to be changed to G4. However, more conservative and widely accepted guidelines for viability in plant populations generally assume a MVP of 100 plants. According to this more conservative guideline for viability, only two of five populations known to be as large or larger than 100 above-ground plants are free of threat.

Recommendation: The G rank for *B. mormo* should not be modified until there is better documentation of the actual size of non-threatened populations, the geographic extent and intensity of earthworm threat has been evaluated, and managing agencies have developed guidelines that assure avoidance of impacts to large known populations as a result of timber harvest. ■

Submitted by Nancy Berlin, U.S. Forest Service; Onnie Byers, CBSG; and Phil Miller, CBSG.

African Wild Dog PHVA

South Africa, October 1997

There can be no doubt that African wild dogs (*Lycaon pictus*) have declined over the last century, especially in the last 30 years. Once distributed through much of sub-Saharan Africa, today's population numbers 3,000 to 5,000 animals, with most populations, both outside and inside of protected areas, still possibly declining.

Wild dogs have enormous home ranges and live at extremely low population densities, even in well protected habitats with abundant prey. This makes them unusually susceptible to habitat fragmentation. As large tracts of land have been converted to livestock grazing and cultivation, growing human populations have caused wild dog populations and habitat to become fragmented. With more colonization of land, wild dogs have been persecuted and their prey has been depleted, even in national parks and game reserves. This combination of habitat fragmentation, persecution and prey loss explains wild dogs' dramatic decline across most of Africa. Today, wild dogs persist only in countries with relatively low human population densities – even in these areas, direct contact with humans accounts for over 50% of recorded adult mortality.

Persecution remains the most serious threat to wild dog populations. Wild dogs are persecuted where they are perceived as a pest that kills livestock, or compete with people for wild ungulates in hunting areas. Unintentional or purposeful capture in snares is another important cause of mortality. Disease also is a serious threat – in particular, rabies and canine distemper.

Although wild dog populations have declined markedly throughout their range, viable populations remain in several countries in southern and eastern Africa, with the last viable wild dog populations living in Kruger and Hwange National Parks (South Africa), Selous National Park (Tanzania), Zambezi National Park (Zimbabwe) and Okavango region (Botswana). With adequate protection and management, there is no reason why these populations should not endure.

To address these and other problems facing the African wild dog, a PHVA workshop was held at the National Zoological Gardens in Pretoria, South Africa from 14-17 October 1997. Thirty-five people attended the workshop, which was a collaborative effort between the IUCN Canid Specialist Group and the Carnivore Conservation Group of the Endangered Wildlife Trust. The primary aim of the workshop was to develop a conservation action plan to improve the status of wild dogs in southern Africa. Of particular interest was the investigation of a metapopulation approach to manage the species. A second priority was the identification of suitable conservation areas that could support an introduction program to establish additional populations of wild dogs, and the development of criteria for selecting such sites.

Workshop participants worked together to identify the key issues affecting the conservation of the species and then dispersed into small, self-selected groups to discuss components of key issues. which included: management; reintroduction; disease; human interactions; and modelling/life history.

The *Reintroduction Working Group* focused on reintroduction, keeping in mind that many of the items discussed also would pertain to translocation. The group identified three main issues affecting reintroduction: site selection; animal selection; and criteria for reintroduction.

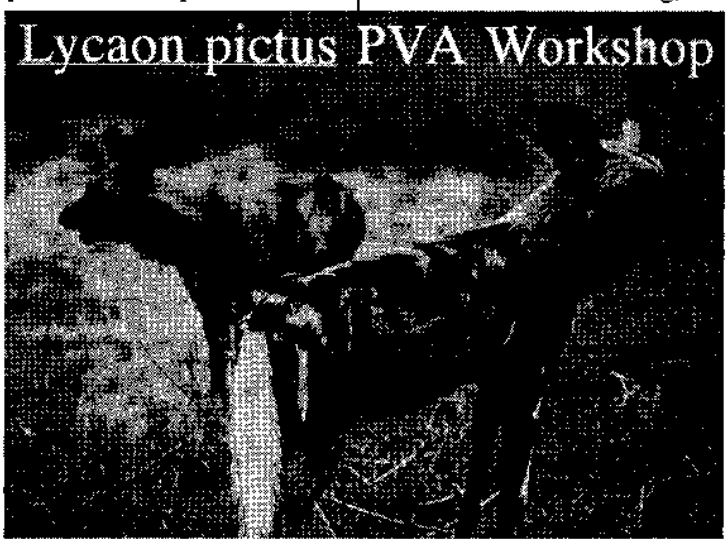
The working group developed 29 site selection criteria, which were subsequently used by the *Management Working Group* to compile information on various potential reintroduction sites and eventually will be used to evaluate sites for suitability. The following strategies were also recommended:

1. Initiate a communication awareness campaign utilizing the media and targeting the local community.
2. Set up a working group to evaluate reintroductions and requests for reintroductions.
3. Develop a national and international strategy to lobby for legislative support for reintroductions.
4. Evaluate/model the prey base to ensure a high probability of a sustained adequate food supply for dogs.

The working group defined animal selection as the selection of the most suitable and available individuals to develop a founder population, in order to achieve specified reintroduction goals. The most important factor in animal selection concerns the founder population. Selection criteria need to be develop based on factors such as: age; immune status; genetic status; established hunting skills; and exposure to litters.

A plenary discussion was held to discuss the wild population of African wild dogs as a source for the proposed reintroduction program. The reintroduction program planned for South Africa is aimed at establishing a metapopulation, with packs to be distributed across southern Africa. It was estimated that 50-100 founders will be needed over a 10-year period. Given the desire to have the potential wild founder source represent the southern African genetic "ecotype," founder stock could come from Kruger National Park, Zimbabwe, or Namibia. Workshop participants agreed that there are enough source animals available from the wild to implement the reintroduction program without compromising the wild population. Consideration was

also given to use of the captive population as a potential source for reintroductions, but participants agreed that lower heterozygosity and uncertain provenance limits the usefulness of captive animals as a source for introductions. It was recommended that the reintroduction program for next five years use wild animals as the source for founders, and that the captive community clarify provenance and genetic status of its animals and consider developing a research program to address questions identified by this workshop.



The *Management Working Group* identified five primary factors affecting the management of wild dogs and prioritized them as follows: fragmentation; problem animals; monitoring; need for a meta-database; and need for a uniform national policy. High priority management issues include the need to:

1. Map distribution, protection status and size of existing wild dog populations. The working group used data from the *Canid Action Plan* combined with updated information to develop a table of information on wild dog and pack numbers.
2. Determine protection status of an area, considering both the level of security and level of legal protection.
3. Identify suitable areas for wild dog re-introduction.

The working group also identified the need to develop a set of guidelines to reduce the probability of extinction of extant or introduced populations. High priorities for research include genetics, disease and metapopulation management. The group developed draft guidelines for managing small populations of wild dogs, with the overall goal that within the next ten years, a second viable population will be established.

To begin an evaluation of the 29 potential reintroduction sites identified by the working group, the sites were cross-plotted on a matrix against the 29 criteria for site selection prepared by the *Reintroduction Working Group*. A paired ranking test was used to identify the highest-ranking selection criteria. The working group recommended that this paired ranking approach (using the seven high priority criteria) be used for all relevant countries as a potential approach for selecting the highest priority reintroduction sites. It also was recommended that a high priority for the *Lycaon* Working Party will be to use this approach on the 18 potential reintroduction sites in South Africa.

The aim of the *Modeling/Life History Working Group* was to develop a model to underpin practical recommendations for a managed metapopulation in southern Africa. To develop and validate the model, the working group selected Kruger National Park (KNP), with supplementary data from Moremi in Botswana to model eight packs as a metapopulation. Based on the modeling, the group made the following recommendations for the managed metapopulation:

1. A research priority should be the quantification of mortality factors.
2. Metapopulations comprising only few packs are likely to require management. Model simulations emphasize the risk of metapopulation extinction as a consequence of even low frequencies of catastrophes.
3. The metapopulation analysis suggests that metapopulations as large as eight packs will require management to secure an acceptable level of persistence. This conclusion is in accord with the judgement of field biologists in the working group.
4. Consistent, periodic managed gene flow (through tranlocations) is recommended to reduce damaging levels of inbreeding and the resulting risks of meta- and sub-population extinction.
5. Any proposed creation of sub-populations should include a feasibility study to confirm that the necessary level of management is practical.
6. Annual anti-rabies vaccination is likely to increase the probability of persistence. Vaccination programs should be contingent upon further research, using captive animals, to establish vaccination protocols that are both safe and effective.
7. The model also demonstrated that any founding group size from two to seven could persist but that a founding pack of six or more reduces the probability of extinction to acceptable levels.
8. Based on the initial eight-pack model, an offtake (for the purposes of reintroduction) of six animals per year for the next eight years is sustainable, and that an additional six per year may be sustainable under relaxed mortality conditions.

The *Threats and Diseases Working Group* defined two types of threats to wild dogs: anthropogenic mortalities and those caused by disease. Threats associated with anthropogenic mortalities included: direct persecution; road mortalities; snares; and researcher effect. Primary disease threats, in decreasing order of importance, included: rabies; canine distemper; anthrax; Parvovirus-enteritis; Babesiosis; Ehrlichiosis; internal parasite infections; external parasites; sarcoptic mange; and tuberculosis.

The working group addressed each threat in turn, developing solutions and strategies which might be used to lessen its effects. Primary recommendations to lessen the identified threats included:

1. Conduct basic research into vaccination of wild dogs against rabies and canine distemper.
2. Compile guidelines for crises handling of wild dogs.
3. Establish a national/international strategy on education.
4. Establish a resource information network.
5. Insist on legislation granting special protection to wild dogs throughout the Southern African region.

The *Human Factors Working Group* defined factors which are important for the development of an effective management program, including: habitat; ownership and legal issues; education, participation and interaction; funding and NGOs; and ecotourism and sustainable utilization. The most important actions and strategies to address the identified factors include:

1. Involve community land owners and game farmers in the early stages of the development of a management plan for the wild dog in their region.
2. Seek all potential contributors to take the lead in fund-raising activities.
3. Prepare a user-friendly version of the PHVA report for distribution to land owners and game farms to encourage their participation in management programs.
4. Develop pamphlets on the biology and conservation of the wild dog for general distribution.
5. Encourage the formation of larger land areas with the state and conservancies by private landowners and game farmers with removal of fencing.

At the end of the workshop, the IUCN Canid Specialist Group (CSG) Chair proposed that CSG's *Lycaon* Working Party be restructured into a nested structure, with both geographical and topical responsibilities. The initial intention is to appoint national and regional representatives. Within the CSG web site, a *Lycaon* page also will be developed (currently via http://users.ox.ac.uk/~wcruinfo). ■

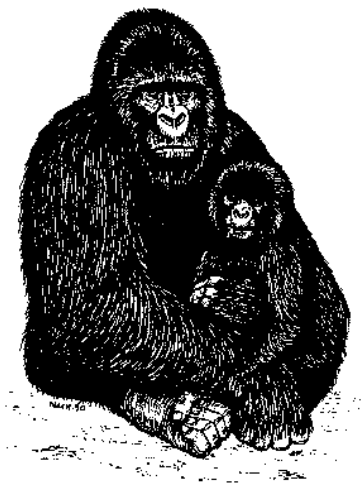
Submitted by M.G.L. Mills, National Parks Service, South Africa, and Susie Ellis, CBSG.

Mountain Gorilla PHVA

Uganda, December 1997

The mountain gorilla (*Gorilla gorilla beringei*) is restricted in its distribution to two small populations: one of about 300 individuals in the Bwindi Impenetrable National Park in Uganda, and the other of about 320 animals in the Virunga Volcanoes region of Uganda, Rwanda and the Democratic Republic of Congo (formerly Zaire). Although the distribution of the mountain gorilla is entirely within National Parks, there are serious threats to these ecologically vital afro-montane and medium altitude forest habitats.

Historically, hunting and poaching resulted in a rapid decline of the Virungas population from which it has not yet recovered. The continuing civil unrest and armed conflict in Rwanda and the Democratic Republic of Congo produces thousands of refugees who are encroaching into the National Parks. Current rates of deforestation for firewood collection and building materials along with unsustainable land-use practices are likely to cause permanent habitat damage in the very near future. Moreover, the dangerous situation in Rwanda has prevented any protection, conservation, or research efforts since August 1997, the longest period in recent history that the Virunga gorillas have been unmonitored and unprotected (i.e., no anti-poaching patrols). The potentially rapid rate of habitat destruction in the National Parks resulting from this crisis situation will result in a decline in mountain gorilla population size and a long-term reduction in the viability of the subspecies, emphasizing the need for a systematic evaluation of mountain gorilla population viability and development of a regional management plan that incorporates the needs of all relevant governmental, non-governmental agencies, public and private stakeholders.



CBSG, in collaboration with the IUCN Primate Specialist Group, was invited by the Director of Uganda Wildlife Authority, the Office Rwandais de Tourisme et Parcs Nationaux, and the Institut Congolais pour la Conservation de la Nature to conduct a PHVA for the mountain gorilla in December 1997 in Kampala, Uganda. Participants included biologists, researchers, and wildlife managers from Uganda, Congo and Rwanda, and international experts on mountain gorilla population biology and ecology. The workshop received generous sponsorship from the Columbus Zoo, the International Gorilla Conservation Programme, the Dian Fossey Gorilla Fund Europe, the Dian Fossey Gorilla Fund International, the Wildlife Conservation Society, Jersey Wildlife Preservation Trust, and Abercrombie and Kent.

Perhaps the most general conclusion of the workshop was the need for recognition that the mountain gorilla is now limited to two small populations of about 300 individuals that may be very vulnerable to pressures from surrounding human populations. The current turmoil in these human populations has made the process of monitoring, managing, and protecting the Virungas population difficult if not impossible. It is possible that this population could be rapidly reduced in numbers in the short term and that its habitat could be greatly reduced with longer term negative effects. There is a risk of significant population decline and eventual extinction. The current political/civil situation in the region, if it persists, poses the very threats (namely, war and disease) that simulation modeling at the workshop identifies as the primary agents of this risk. It will therefore be essential for the survival of the mountain gorilla to develop mechanisms for regional collaboration for their protection and management.

Summary of Recommendations

Health and Disease Working Group

1. Develop a sustainable wildlife veterinary unit in each of the range countries.
2. Identify and support potential local/regional diagnostic facilities to process mountain gorilla samples for rapid diagnosis of disease and routine health monitoring. Standardized protocols for sample collection, handling, identification, processing and reporting should be developed and distributed.
3. Secure funding for veterinary equipment, clinical, diagnostic and research support, and training of local personnel, with input from government agencies, NGOs and other relevant agencies.
4. Establish an interactive, international computerized database and an organized tissue/serum bank.
5. Develop a comprehensive epidemiologically-based plan and appropriate research for safeguarding gorilla health. This plan should be based on scientifically sound disease surveillance and control practices, taking into account both human and animal populations.

Human Population Issues Working Group

1. Work with humanitarian agencies to ensure their emergency plans fully address conservation concerns. In addition, conservation agencies (governmental and non-governmental) must prepare their own emergency plans which address identified critical interactions of humans with gorillas and their habitat.
2. Promote community participation in conservation through institutional mechanisms that enable consultation with the local population on all aspects of the park that concern these populations and with decisional power on areas that particularly affect them.
3. Guarantee a consistent, reliable source of funds dedicated for sharing with local communities. The most effective, practical mechanism would be to guarantee a proportion of total park revenue for this purpose; an alternative would be to charge an additional fee for each gorilla permit.
4. Establish a trust fund(s) for Parc National des Volcans and Parc National des Virungas with full collaboration of governmental and non-governmental agencies active in gorilla conservation. Increase the existing Mgahinga and Bwindi trust finds.
5. Conduct a study to consider the possible sustainable utilization of minor forest products (e.g. medicinal herbs, honey, vines, water) in the Virungas.
6. Because park boundaries represent the most acute pressure points of conflict between local people and the park, boundaries must be clearly marked and their integrity enforced, and measures must be taken to address problems caused by crop-raiding wildlife.

Population Biology Working Group

1. Recognize that during times of relatively minimal human-gorilla conflicts, there is potential for resilient gorilla population growth. However, when human population pressures result in severe loss of gorilla habitat and population growth potential, recognition of the acute risks this subspecies faces is required so that extinction risk is minimized.
2. Collect more accurate information regarding impact of disease on gorilla mortality rates and reduced fecundity, thereby increasing the predictive value of the modeling process.
3. Assess more accurately how human disturbance affects mortality and fecundity in non-habituated gorillas.

4. Use population modeling as an evaluation tool for contingency plans developed as part of a broader long-term mountain gorilla conservation plan.
5. Evaluate and monitor the amount and quality of habitat for the Virunga and Bwindi populations.
6. Accurately assess demographic parameters for the Bwindi population to determine population growth rate.
7. Recognize that the reduced carrying capacity for this subspecies, which exists in only two small and isolated populations, increases the probability of population extinction, and that complacency is inappropriate.

Management and Research Working Group
1. Initiate research focused on areas which are of critical importance for management: poaching of plant and animal forest products; crop raiding by animals from the park; impacts of tourism and habituation of gorillas; and impacts of resource sharing.
2. Develop standardized ranger-based monitoring for the Virunga Volcanoes and Bwindi regions focusing on monitoring trends in critical management areas.
3. Develop procedures to enhance collaboration between the park and all stakeholders to raise awareness, enforce and update environmental legislation, strengthen enforcement procedures, and develop policies and systems for problem animal control.
4. Support the protected area management authorities to increase the effectiveness of conservation by implementing planning, researching options for sustainable funding, furthering the decentralization of the protected area authorities, and strengthening tourism programs.
5. Implement sensitization programs targeted at all levels to raise government awareness and to develop strategies and programs for interpretation, for both national and international tourism.
6. Develop a framework for regional collaboration and tourism, including improved mechanisms for communication and collaboration.

Governance Working Group
1. Encourage countries to give greater priority to nature conservation and related tourism through contact with political leaders, dissemination of information, translation of legislation into guidelines and regulations, and other mechanisms, and to form a monitoring group for each country.
2. Promote, through communication with appropriate governmental authorities, the harmonizing of conservation legislation and its implementation and enforcement within the range states.
3. Sensitize all stakeholders about the importance of 'ownership', or shared responsibility in the joint protection of the mountain gorilla. In the long-term, investigate the use of the Migratory Species Convention to strengthen joint protection measures, the possibility of a World Heritage Site for Uganda and Rwanda, and the management of the Virunga Range as a Peace Park.
4. Request cooperation of military authorities in the coordination of protective conservation measures through range countries and strengthen awareness programs for the military authorities as to the critically endangered status of the mountain gorilla.
5. Improve regional and institutional collaboration by establishing NGO coordination offices in the range countries and through informal meetings of stakeholders to develop Codes of Practice.
6. Require that any research samples remain the property of state and that samples and data should be shared with the host country institution and made available to researchers.

Finance, Revenue and Economics Working Group
1. Stakeholders (governments, NGOs and donors, private sector) should meet to discuss appropriate revenue sources and revenue sourcing mechanisms.
2. Promote the mountain gorilla as a symbol of ecotourism and develop an education program through existing Africa-based formal and informal education networks on the values of gorilla conservation.
3. Conduct a cost-benefit analysis for mountain gorilla conservation and explore promising revenue generating activities such as biodiversity prospecting, carbon trading initiatives and other financing mechanisms.
4. Make concerted efforts to overcome existing and future threats to revenues that support mountain gorilla conservation.
5. Stakeholder groups in each range state should meet internationally to share information and to develop mechanisms for promoting a collaborative, regional perspective, with diversification of funding mechanisms and sources.
6. Integrate mountain gorilla tourism into the whole tourism sector at both national and regional level.
7. Use the mountain gorilla as a special case study to demonstrate the broadest values of species and habitat conservation, including an analysis of all costs and benefits to the community [financial and non-financial] of gorilla conservation. ■

Submitted by Samson Werikhe, International Gorilla Conservation Program, Uganda, and Phil Miller, CBSG.

Winged Mapleleaf Mussel PHVA

Minnesota, January 1998

The winged mapleleaf mussel (*Quadrula fragosa*) is listed as Endangered under the Federal Endangered Species Act of 1973 and under Minnesota and Wisconsin endangered species laws. One of only two known populations is in one segment of the lower St. Croix River between Minnesota and Wisconsin, while the other population is found in the Ouachita River. According to the U.S. Fish and Wildlife Service's *Winged Mapleleaf Mussel Recovery Plan* (1997), the major factors of concern for the St. Croix River population are: 1) low reproduction; 2) low stream flow episodes; 3) high variation in stream flows caused by hydroelectric dam peaking operation during certain seasons; 4) toxic spills; 5) potential zebra mussel infestation; 6) habitat disturbance due to recreational or commercial activities; 7) human and non-human predation and disturbance; 8) water quality deterioration; 9) land-use changes in the watershed; and 10) lack of life history information.

To address these and other problems facing the mussel, a Population and Habitat Viability Assessment (PHVA) Workshop was held in Monticello, Minnesota from 5-8 January 1998. Seventeen people attended the workshop, which was a collaborative effort among the U.S. Fish and Wildlife Service, U.S. National Park Service, Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources and CBSG. The goals of the PHVA were to investigate the viability of the species and to develop practical conservation measures that public and private riverway stakeholders can support.

At the beginning of the workshop, the participants worked together in plenary to identify the major issues and concerns affecting the conservation of the winged mapleleaf mussel. These identified issues centered around three main topics, which then became the focus of the working groups: species biology; threats, habitat and management; and simulation modelling.

Recommendations from the working groups are presented below and are listed according to priority.

Summary of Recommendations

Species Biology Working Group

1. Determine quantitative and qualitative sample sizes needed to estimate changes in population density and species richness at various precision levels. From this analysis modify the existing long-term monitoring strategy such that results can be used to trigger management action.
2. Identify fish host and determine if the availability of fish host or its habitat is limiting; if increasing fish abundance is prudent, manage for host fish enhancement.
3. Examine adults every two weeks to find gravid females and determine the timing and duration of the brooding period.
4. Since fertilization may be dependent on the proximity of males and females, determine the density and spatial relationship of individuals to each other in existing populations.
5. Develop molecular reference standard for identification of glochidia. Collect fish in areas of existing *Q. fragosa* habitat, examine fish for glochidial infection, and identify glochidia by use of molecular genetics methodology.
6. Contact local unionid experts and review survey reports from each state with historical records of *Q. fragosa*, to determine sites that currently support unionid mussels and might support *Q. fragosa*. Conduct qualitative sampling at sites with species-rich unionid communities, emphasizing the St. Croix River.
7. Develop a non-lethal technique for determining sex of adult mussels and use methodology to determine sex of adults in extant populations.
8. Compile and analyze all available information on water quality, chemistry and water flow for streams with existing *Q. fragosa* populations.
9. Collect tissue using non-lethal techniques from extant populations of *Q. fragosa* and from other *Quadrula* species. Compare genetic structure of species using standard molecular genetic techniques to verify species status.
10. Model various hydrological scenarios to test lethal and sub-lethal effects on *Q. fragosa* and its hosts or a suitable surrogate species.

Threats Working Group

The five threats determined to be most significant to the survival of the winged mapleleaf mussel are listed below, followed by specific recommendations addressing these threats.

Zebra Mussels

1. Continue and expand existing aggressive zebra mussel encroachment prevention and education programs of St. Croix Zebra Mussel Task Force.
2. Continual findings of jeopardy under Section 7 Fish and Wildlife Service consultations for federal activities that will result in the introduction of zebra mussels.
3. Develop and implement a pro-active, contingency strategy to prevent extinction of winged mapleleaf

mussels in the St. Croix River from an infestation of zebra mussels.
4. Determine a threshold of zebra mussel demographics that triggers implementation of the contingency strategy.

Instream Flow

Increase the minimum flow from the Northern States Power dam during winter peaking operations from 800 cfs to 1,600 cfs; monitor the response of the mussel community and evaluate the need to adjust the minimum flow.

Point and Nonpoint Source Pollution

Establish a policy of no net increase in pollutant loading in the St. Croix watershed through programs designed to increase water quality monitoring, insuring compliance with existing regulations and adoption of voluntary Best Management Practices (BMPs).

Direct Human Disturbance

Develop creative, mutually satisfactory solutions to the problems of direct harm to the winged mapleleaf mussel and its habitat, particularly by boating, and the currently illegal use of mussels for fish bait and food.

Corridor Construction

1. Involve appropriate state and Federal agencies early in project planning prior to initiating the Environmental Impact Statement (EIS) process.
2. Develop off-site research and management in coordination with experts in the winged mapleleaf mussel and related areas.

Simulation Modeling Working Group

1. Develop more precise estimates of juvenile and subadult mortality.
2. Focus our understanding of the nature and extent of the interaction between *Q. fragosa* and the zebra mussel.
3. Improve estimates of annual rates of juvenile production per breeding female of *Q. fragosa*, primarily through more detailed analysis of literature on unionid mussels where available.
4a. Review and improve estimates of adult winged mapleleaf mussel mortality rates.
4b. Improve our understanding of the nature and extent of direct and indirect anthropogenic factors on mussel habitat and by extension, winged mapleleaf mussel demographic rates, particularly those involving juveniles and breeding adults.
5. Improve estimates of environmental variance associated with adult winged mapleleaf (or surrogate) mussel mortality rates. ■

Submitted by Chuck Kjos, U.S. Fish and Wildlife Service; Onnie Byers, CBSG; and Phil Miller, CBSG.

Peary Caribou PHVA

Canada, February 1998

To address declining populations, a PHVA Workshop for the Peary caribou and Arctic-island caribou was held from 27 February - 1 March 1998 in Yellowknife, Northwest Territories, Canada. The workshop was a collaborative endeavor of the Department of Resources, Wildlife and Economic Development (RWED) of the Government of Northwest Territories, Canada and CBSG. The 34 participants included people from co-management boards; regional hunter organizations; representatives from the hunters' and trappers' organizations for the seven communities within the range; Government of the Northwest Territories; the National Recovery Team; and the Devonian Wildlife Conservation Center.

This workshop was organized to provide a forum for open discussion and information-sharing and to assess information and support recommendations for recovery options to become part of a draft management plan for the Peary caribou and Arctic Islands caribou. Technical presentations on the first day summarized caribou status in the High Arctic and the mid-Arctic islands. An overview of the genetics of the populations indicated that they are closely related and that the Arctic island animals do not appear to be intergrades between Peary and barren-ground caribou. The two populations have almost disappeared and there has been a 90% decline in the Peary caribou population since the early 1960s. There is concern that this subspecies is at high risk of extinction.

The *Population Biology and Modeling Working Group* developed general and location-specific values for the input parameters of a baseline simulation model for these caribou populations. This model served as a baseline for adding the effects of severe weather events, harvesting, and variations in population size on the risk of extinction and fluctuations in population size in 100-year projections. Severe weather events with the same frequencies and severities experienced in the past 10 years are sufficient to increase the risk of extinction to 50-60% over 100 years and to account for the observed population declines. Harvest scenarios indicate that removal of a fixed number of males can also lead to increased risk of extinction in small populations. High priority recommendations were for specific information of calf mortality, adult female mortality, and age of first reproduction in years when a population is growing and when it is near carrying capacity, and information on migration rates between populations.

The *Factors Affecting Peary Caribou and Arctic-Island Caribou Working Group* classified the problems identified into human-induced factors and natural factors. The human-induced factors included contaminants, vegetation-habitat, migration, biologists, low recruitment, disturbances, harvesting, global climate, and shipping traffic. The natural factors included disease, vegetation-habitat, migration, predation, competition, birth and survival, and weather-climate. The impact of these factors in each of the management areas was evaluated. The group then moved to an analysis of four management options that might be used for short-term recovery options: wolf management, emergency feeding, translocation and captive breeding. Opinions varied on the usefulness of these management options, but all participants agreed on the need for information-sharing and improved access for the communities to technical information on these options. Recommendations were made to provide communities with information on the benefits and potential negative consequences of supplemental feeding, translocation of caribou, captive breeding, and wolf management. More information is needed on some of the problems associated with each option.

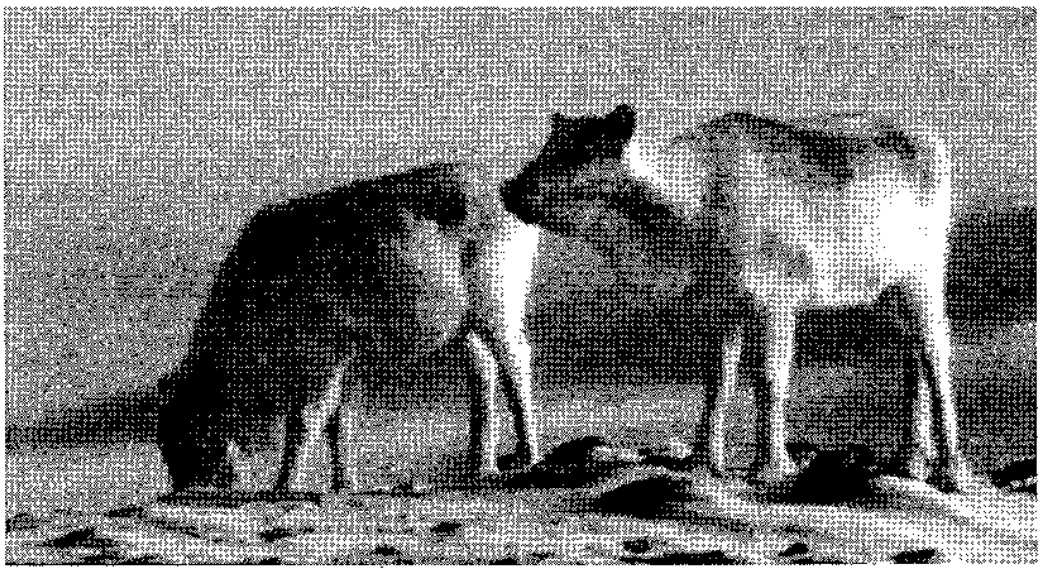
The *Information Needs Working Group* focused on the two major problem areas of surveys and climate. Identified survey needs were the need to conduct an Eastern Queen Elizabeth's Island Peary Caribou population survey, to establish management boundaries for each survey, to establish a schedule for future surveys, to collect and analyze harvest data, to monitor health, and to use careful survey design. Regarding climate and habitat, group members noted the need to establish the relationships between weather, range condition, and caribou population effects. They suggested studies of association between specific weather events and caribou and establishing the impact of weather fluctuations on the range of variation of caribou population dynamics. Other suggestions were to determine the impact of environmental contaminants, to do a retrospective assessment of impacts of human activities, and to initiate a program to utilize traditional knowledge in caribou management.

The *Co-management Working Group* chose two major problems for further analysis: communication and implications of inaction. In the area of communication they recommended active participation and involvement in the development of management options by the communities (with provision of funding) as well as the Regional Wildlife Organization (RWO) and RWED. The involvement of Renew (Recovery of Nationally Endangered Wildlife) and the Recovery Team needs to be clarified.

Consequences of inaction could be the result of either a deliberate decision or a failure to make a decision. Nine sub-problems, as possible effects of inaction, were identified and three chosen for further analysis: conservation of species, loss to co-management credibility, and community effects. Multiple needs and possible actions were identified and ranked for each of these sub-problems. The major theme in all recommended actions was active community involvement from the earliest stages of planning and decision-making.

The PHVA workshop report has been submitted to the communities for review and comments. This commentary and draft will then go to the management boards for their review and consideration in their decision-making process. ■

Submitted by Anne Gunn, RWED, and Ulysses Seal, CBSG.



Iberian Lynx PHVA

Spain, February 1998

The Iberian lynx *(Lynx pardinus)* is considered to possibly be the most endangered cat species in the world. Restricted to the Iberian Peninsula, its persistence is threatened by highly fragmented populations. Presently, there are fewer than 1,000 individuals in nine isolated populations, each also fragmented but with their patches connected by occasional dispersers to form metapopulations. The largest population, comprised of about 60 individuals, lives in Parque Doñana in Spain and surrounding areas.

A Population and Habitat Viability Assessment (PHVA) for the Iberian lynx, organized by the Spanish Ministry of the Environment, Office of the Director General of Nature Conservation, the IUCN/SSC Cat Specialist Group and CBSG, was held 21-23 February in Parque Cabañeros, Spain. The primary aim of the PHVA was to develop a conservation plan to improve the status of the Iberian lynx on the Iberian peninsula, which includes Spain and Portugal. Because there is no central governmental body in Spain charged with national coordination of lynx conservation efforts, developing a conservation plan which could be used as a model by local government bodies was a high priority. In Spain, each Autonomic Government (similar to state governments) is charged with developing its own plan and for the conservation and management of the lynx in their areas.

Fifty-two participants from four countries worked together to identify the key issues affecting the conservation of the Iberian lynx and then dispersed into small working groups to discuss components of key issues that included socio-political and legal issues, interactions with rabbits, habitat, research, mortality, captive breeding, and life history/modeling.

Among the most important challenges identified by several groups was the absence of a cohesive strategy for lynx conservation and also for the restoration of its habitat for future reintroductions. One of the priority recommendations was to develop an integrated management plan directly linked with a goal of recovery, and including populations both in Spain and Portugal. Another key challenge identified was the need for improved communication among the various sectors involved or interested in lynx conservation, including Autonomic Governments as well researchers, environmental organizations, and the general public. Many of the working groups also placed high emphasis on the development of education programs designed to sensitize local populations to the plight of the lynx.

Fragmented habitat has made the Iberian lynx especially susceptible to the risk of extinction. A high priority is to define the actual habitat of the lynx and minimal conditions necessary for survival. Workshop participants recommended that the precise distribution of the lynx must be determined, identifying each subpopulation's area and home range, potential and actual corridors that might allow genetic exchange, and adjacent zones that might be used for expansion. Presently, there are numerous political and socioeconomic factors that influence the composition and structure of habitat available to lynx. Within the mountainous habitat in which the Iberian lynx lives, for example, there are few incentives for private landowners either for habitat conservation or restoration. The recommendation was made to create incentives for landowners to conserve and/or restore habitat that is favorable for the species.

Development of research priorities, with creation of a central research committee and external review committee, also was recommended. High priority research might include: genetics; reproduction; population structure; causes of mortality; factors contributing to the abundance of rabbits; habitat regulation; translocation; migration corridor design; predator control; and interspecific interaction.

The development of an experimental captive population with clearly defined objectives and timelines for management activities also was recommended. It was suggested that an initial in-country program be developed with 12 founders, with a long-term goal of 2-3 populations of 30-50 animals total to serve as both a research population and for the development of techniques relevant to the conservation of the species. ■

Submitted by Susie Ellis, CBSG and Borja Heredia, Ministry of the Environment, Spain.

Evaluation of South China Tigers in Chinese Zoos

The South China tiger (*Panthera tigris amoyensis*) is the most critically endangered tiger subspecies, with possibly fewer than 20 tigers remaining in the wild and only 50 captive tigers maintained in Chinese zoos. The Chinese Association of Zoological Gardens (CAZG) recognized the need to develop a cooperative management program for the captive South China tiger population and, with the assistance of CBSG, held a studbook analysis and preliminary masterplan workshop in April 1995. A South China Tiger Coordinator, Studbook Keeper and Conservation Coordination Committee were formed to facilitate the management of the South China tiger among 19 Chinese zoos.

Funded by the *Save the Tiger Fund* and coordinated by the Minnesota Zoo, the CBSG South China Tiger Project Team visited China in November 1995 and again in November 1997 to evaluate the health, management and reproductive status of the captive South China tiger population. Team members included Ronald Tilson (Minnesota Zoo), Kathy Traylor-Holzer (Minnesota Zoo), Douglas Armstrong (Omaha Zoo), Onnie Byers (CBSG), Gerald Brady (Potter Park Zoo), Eric Miller (St. Louis Zoo), and Ellen Dierenfeld (Bronx Zoo). Working with CAZG, the project team traveled to four Chinese zoos (Shanghai Zoo, Suzhou Zoo, Chongqing Zoo and Guangzhou Zoo) and immobilized 22 tigers in 1995 and 13 tigers in 1997. Physical and dental examinations were conducted, blood samples were collected for laboratory analysis, and Chinese zoo staff were trained in immobilization and veterinary procedures. Tigers were permanently identified with tattoos and transponders. Semen was collected from adult male tigers for sperm evaluation and cryopreservation. Diets were analyzed for nutritional analysis, and tiger facilities and husbandry practices were evaluated. Reproductive histories were noted, and the studbook database was updated. After completing these evaluative procedures, the CBSG team attended the CAZG South China Tiger Conservation Committee workshop to report their findings and recommendations for future management.

The primary medical problem identified was fractured canine teeth. The results of blood sample analyses were compiled into a dataset to produce a range of baseline normal values for this population. A number of recommendations were made for diet improvement, including development and use of a standardized vitamin/mineral supplement designed for the South China tiger. Facilities and husbandry practices were generally good, and minor recommendations were made. Overall quality of the South China tiger semen samples was poor compared with semen from other tiger subspecies. Nine sperm samples from six of 14 males evaluated were banked in the South China tiger Genome Resource Bank, along with tissue, serum and hair samples from 28 South China tigers.

In early 1997 there was an outbreak of an infectious enteritis syndrome in tigers at the Shanghai Zoo suggestive of canine distemper. This outbreak underscores the vulnerability of this population to infectious disease, the need for vaccination, and the value of disease testing and quarantine.

Demographic and genetic analyses were performed for the current South China tiger population. There has been no net growth in the population for the past 10-15 years. As it is unlikely that any more tigers will be captured from the wild, it is essential that the captive population be self-sustaining and ideally should be expanded, as recommended in the 1995 masterplan. Demographic analysis suggests that population stagnation is primarily a product of low reproduction, which appears to be attributable to a variety of causes such as behavioral incompatibility, reduced fertility, small litter size and neonatal mortality. Improvements in nutrition, veterinary care and husbandry may help to promote reproductive success.

The captive South China tiger population is descended from only six wild-caught animals that were captured about 25 years ago and are now dead. Founder representation is unequal, with only 75% gene diversity left in the population. The average inbreeding coefficient is 0.25. Inbreeding does not appear to be strongly correlated with poor sperm quality, small litter size, high ratio of male cubs, or high cub mortality, but may certainly be a contributing factor.

The situation for the South China tiger is critical. Over the past two years CAZG zoos have taken steps to improve the management of their tigers. Further improvements will be needed, and cooperation among all of the zoos in the program will be necessary to face this challenge to preserve the South China tiger. ■

Submitted by Kathy Traylor-Holzer, Minnesota Zoo.

Biomedical Survey of the Giant Panda in Captivity in China

The endangered giant panda (*Ailuropoda melanoleuca*) is endemic to the mountains of China. Historically, the species was widely distributed and may have numbered 100,000 animals, but has declined to no more than 1,200 individuals. In the wild, giant pandas are fragmented into perhaps 32 subpopulations with no opportunity for large-scale genetic exchange. Giant pandas in captivity play a crucial role for educating the public about the plight of their wild counterparts, and are a critical "hedge" against extinction. They also serve as a potential resource for future reintroduction efforts. Captive giant pandas also are especially important for research and education and as a vehicle for attracting substantial public support for conservation of wild giant pandas as well as other endangered endemics.

Currently, there are about 117 giant pandas living in 33 zoos and breeding centers in China. The Chinese Association of Zoological Gardens (CAZG) has recognized the need for a management plan for giant pandas. As a neutral facilitator, catalyst and source of technical advice, CBSG was invited to facilitate a Captive Management Planning Workshop for the Giant Panda in Chengdu 10-13 December 1996 [see *CBSG News*, 8(1)]. The outcome of this first workshop was a "blueprint" for developing a practical and scientific management program that will result in a healthy, growing population of giant pandas in China. Workshop participants made more than 25 recommendations, one of the most important being for a biomedical assessment of adult giant pandas to:

- evaluate health, reproduction, and behavioral status.
- collect biomaterials for future genetic evaluations.
- ensure positive identification of all individuals.

This survey was carried out from 8 -22 March 1998, with a total of 18 animals evaluated at the Chengdu Zoo, Chengdu Research Base of Giant Panda Breeding, and the Beijing Zoo. Veterinarians, reproductive specialists, geneticists and animal behavior specialists combined their skills in the intensive collaboration, jointly organized by the CBSG and CAZG.

The teams worked together to assess which animals were prime breeders, which animals will have value as future breeders (when sexually mature) and which have problems that require further attention or make the animal unlikely to ever reproduce. Of the 18 giant pandas examined, all but five were found be good breeding prospects: seven animals were classed as prime breeders; six as potential breeders; and two as questionable breeders.

In addition to the health and reproductive assessments, each animal was implanted with a transponder and tattooed with its studbook number. These complementary marking systems allow easy identification and facilitate better record -keeping and management.

The teams examined six males and 12 females. In addition to physical and reproductive examinations, skin samples were collected for future genetic analysis. Because many of the older pandas in Chinese zoos are wild-born, these samples will be useful in determining the pedigree of animals living in the existing zoo populations. Blood samples were evaluated to begin to develop a crucial database on blood values from both healthy and unhealthy animals. Additional targets of the studies were reproductive history, diets and behavior. Semen was collected from four males, evaluated, used to test various sperm freezing methods and was then stored for future artificial insemination (AI) studies. Chinese zoos have used AI for many years to help breed giant pandas. The teams exchanged information on the latest techniques for semen freezing and thawing. Techniques developed in China were found to be as effective as those in use in the United States.

Female giant pandas usually come into estrus once a year for only three days. The need to perfectly time breeding, with a compatible mate, is essential. An analysis of breeding records revealed that some females at the Beijing Zoo were skipping years between estrus, unlike giant pandas in the Chengdu facilities. Adding to this finding is the fact that few males are available for breeding. Since all males examined were producing high numbers of motile sperm, the lack of reproduction may be related to behavioral incompatibility or perhaps to facility design that may hamper successful introductions or other factors.

Some institutions involved in the current giant panda breeding program often rely on a combination of natural and assisted breeding. Therefore, some females receive sperm from different males, generating many questions about parentage. To have an effective, long-range genetic management program, unambiguous pedigree information is needed. Genetic evaluations were recommended to establish provenance, to estimate how much wild heterozygosity remains in the captive population, and to provide independent evidence on effectiveness of artificial insemination. A high priority for the future will be to analyze all collected genetic samples, as well as to collect and

process samples from other giant pandas in the captive breeding program.

Even giant pandas classified as prime breeders were occasionally found to have medical questions that require further diagnosis. For example, a few animals showed blood values that may be indicative of poor liver or kidney function. This clearly illustrates how little we now know about this species and how much more needs to be done to ensure its future.

The Chinese team in Chengdu consisted of He Guangxin, Li Guanghan, Song Yunfang, Yu Jianqiu, Ye Zhiyong, Wang Qiang, Zhang Zhihe, Li Xuebing, Chen Hongwei, Niu LiLi, and Zhong Wei. The Chinese team in Beijing consisted of Zhang Jinguo, Peng Zheng Xin, Zhang Cheng Lin, Huang Shiqiang, Luo Yi, Yang Ming Hai, Pu Tian Chun, Peng Jiang Jun, Zhu Fei Bing and Hou Qiming.

The US-based team was comprised of scientists from the National Zoological Park (David Wildt and JoGayle Howard), CBSG (Susie Ellis), Zoological Society of San Diego (Don Janssen and Arlene Kumamoto), Columbus Zoo (Ray Wack), Zoo Atlanta (Rebecca Snyder) and University of California at Davis (Lyndsay Phillips).

Travel support for the project was provided by British Airways; generous financial support was provided by the American Zoo and Aquarium Association's (AZA) Giant Panda Group, Zoological Society of San Diego, the Columbus Zoo, and Zoo Atlanta; and equipment was donated by Nellcor Puritan Bennett, Air-Gas, the Zoological Society of San Diego, Sensor Devices, and CBSG.

Following the biomedical survey, results were presented and discussed in a two-day technical meeting held in Beijing on 24-25 March 1998. Working groups were formed on veterinary medicine, genetics and reproductive technology, and behavior. The groups identified key issues and developed recommendations for the development of the Captive Management Plan.

The highest priority recommendations were to:

1. Conduct a Record Keeping Workshop in China, utilizing ISIS software (MedARKS, ARKS, SPARKS).
2. Develop databases on diet and feeding practices, veterinary records, and behavior.
3. Conduct a veterinary workshop within the next two years to address diagnostic techniques, anesthesia, clinical pathology, nutrition, and gross pathology.
4. Carry out surveys on diet, animal introduction protocols, and exhibit design.
5. Conduct a behavioral workshop to discuss records and standardization of behavioral definitions and data collection techniques.
6. Establish the genetic profile of every giant panda in captivity, and develop a long-term strategy to achieve this goal. Paternity analyses need to be carried out as soon as possible on identified high-priority animals.
7. Establish a formal Genome Resource Bank (GRB) with sperm, blood, tissue and DNA.
8. Establish urinary hormone monitoring at zoos that have major breeding giant panda breeding programs.
9. Acquire a complete set of veterinary technical equipment at each facility.
10. Investigate variables that will allow developing a more consistent method of sperm cryopreservation using the pelleting technique.
11. Identify a captive diet similar to that eaten in the wild (food type and presentation).
12. Provide space and items that encourage behavior similar to that in the wild.
13. Provide giant pandas opportunities to socialize and interact with other pandas, especially young animals.
14. Compile and make available on the Internet a comprehensive, international list of publications about the behavior of giant pandas.

The results of the biomedical survey and the technical meeting will be formally presented to the Technical Committee on Giant Panda Breeding in December 1998 in Chengdu for discussion and for further implementation planning. ■

Submitted by He Guangxin, Chengdu Zoo; Li Guanghan, Chengdu Base of Giant Panda Breeding; Zhong Ying, Beijing Zoo; Xie Zhong, CAZG; Susie Ellis, CBSG; and David Wildt, Conservation and Research Center, National Zoo.

CBSG, India CAMPs

CBSG, India completed six CAMP workshops for the Biodiversity Conservation Prioritisation Project (BCPP) initiated last year (1997) under the auspices of the Biodiversity Support Program, a consortium of organizations including USAID, The Nature Conservancy, the World Resources Union and World Wide Fund for Nature, International and WWF, India. These workshops were part of the Endangered Species Component of the BCPP, which was coordinated by Dr. Ajith Kumar of the Salim Ali Centre for Ornithology and Natural History [see *CBSG News* 8(1), June 1997]. CBSG, India planned, organized and facilitated the workshops. Since July 1997, several CAMP workshops have been conducted, includingCAMPs for the Indian Mangrove Ecosystem, Indian Mammals, Indian Freshwater Fishes, Non-Timber Forest Products, and High Altitude Medicinal Plants.

Indian Mangroves CAMP

The Indian Mangrove Ecosystem CAMP was organized and hosted by the National Institute of Oceanography, Goa, which is the premier institute for marine studies in India. The Institute had conducted the most studies on mangroves for the longest period. The Mangrove Society of India was the other major collaborator. The workshop was conducted 21-25 July 1997 in Panjim, Goa. Forty-eight participants from 25 institutions with expertise ranging over field biology to forest management attended the workshop.

In addition to mangrove plants, mangrove associated fauna and algae were assessed. In total 176 taxa (including species and subspecies) were evaluated at the workshop: 60 mangrove plants, 23 algae, 51 marine fishes and 42 invertebrates. Twenty percent of mangrove plants were assessed as Critically Endangered, 66% as Endangered and 8% as Vulnerable. The high percentage of threatened mangrove species is attributable to a 50% decline in habitat along the Indian coast in the last few years. Participants identified lacunae areas that need prioritization. Survey, monitoring and habitat management were the most frequently recommended research and management tools for understanding distribution and trends of mangroves.

Indian Mammal CAMP

The CAMP for Mammals of India was held on 25-29 August 1997, hosted by the Centre for Ecological Sciences, Bangalore, which also provided generous sponsorship. Other local collaborators were the Jawaharlal Nehru Centre for Advanced Scientific Research and the Forest Department of Karnataka. Forty-five participants from 30 institutions with expertise ranging from field biology to forest management attended the workshop.

Three-fourths of all 430 Indian mammals were assessed at the workshop. Nearly 15% of the assessed mammals are endemic to India. One of the major outcomes of this workshop was the post-assessment research and management recommendations for every mammal taxon. Survey and monitoring are the most frequently recommended research and management tools for understanding distribution and trends of mammal populations.

Freshwater Fishes of India CAMP

The CAMP workshop on freshwater fishes of India was initiated under the BCPP but was ultimately sponsored by Sea World of Florida. Held on 22-26 September 1997, the workshop was organized and hosted by the National Bureau of Fish Genetic Resources, Lucknow, which is the premier research institute in India for freshwater fish and is responsible for listing and assessing their conservation status.

There are about 650 species of freshwater fish that occur in India. It was not possible to assess all of these at a single workshop, so 327 additional species remain to be assessed hopefully at a follow-up CAMP. Fish were assessed based on their distribution in India, which was divided into six broad zones or "drainages". A total of 227 Indian freshwater fishes were assessed as threatened based on the IUCN Red list Categories of 1994. The high percentage of restricted taxa being threatened is due to localized distribution of these taxa along with other man-induced threats. Freshwater fishes are a poorly studied group since information regarding distribution, population dynamics and threats is incomplete, and most of the information available is from a few well-studied locations only. Threats to Indian freshwater fishes are physical in nature, such as habitat destruction, fragmentation, poisoning, pollution, pesticides, destructive fishing, and other kinds of human interference. Trade is an important contributing factor in threatening some fish taxa. This is mainly because of unsustainable harvest, poor scientific practices in fishing and an ever-growing demand.

Non-Timber Forest Products CAMP

There is considerable interest in species of economic importance especially Non-Timber Forest Products (NTFPs). A wide variety of plant and plant parts are collected, processed and marketed by various official and private agencies. However, little is known about the impact of collection on the long-term viability of

these species. The sustainable management of these resources requires the collection of information and a program of regular monitoring.

A CAMP workshop was held 16–18 June 1998 for NTFPs in Madhya Pradesh State, one of the largest suppliers of NTFPs in India. The information yielded by the workshop will contribute to the effective and sustainable management of NTFPs in the future. This workshop was conducted by Development Alternatives, New Delhi and the Indian Institute for Forest Management, Bhopal in collaboration with the NTFP Federation of M. P. and the Madhya Pradesh Forest Department.

Forty species of NTFP's were assessed. The results of the workshop were surprising in that more than 50% of the species assessed were Threatened according to IUCN Red List criteria, based on the population reduction criterion only. Although drafts of the results are still being received, the tentative categories of the assessed 40 species are: CR - 2; EN - 9; VU - 14; LR-nt - 5; LR-lc - 9; NE - 1. The Indian Institute for Forest Management plans to conduct CAMP workshops for all NTFP species of their state in the near future.

High Altitude Medicinal Plants CAMPs

This workshop was held 16-18 April 1998 in Kullu Valley, Himachal Pradesh by the Foundation for Revitalixation of Local Health Traditions. It is significant for a variety of reasons, not the least of which is that it is the first time an offsping of CBSG and CBSG, India conducted a workshop independently. This workshop was for species occurring in the states of Jammu – Kashmir and Himachal Pradesh in the North Western Himalayas of India and was financially supported by the Royal Netherlands Embassy, New Delhi and Department for International Development-UK, New Delhi. There were 32 participants in the workshop comprising field botanists, forestry officials, university and wildlife researchers, and representatives from state and central research organizations and NGOs. Of the 42 taxa assessed, 21 had been earlier assessed at the Lucknow CAMP workshop in January 1997. The facilitators noted that only in the case of four species is there agreement in the threat categories assigned in the two workshops.

CAMP Training Workshop

A one-day training workshop on the IUCN Red List Criteria and the CAMP process was conducted at the international workshop, Medicinal Plants for Survival, which was held in Bangalore on 18 February 1998. The workshop was attended by about 50 participants.

Web Sites

Our web sites are all under development, but you are welcome to visit them. The species lists and executive summaries for all BCPP-initiated CAMPs are on the CBSG, India site. Other sites of interest are:

- CBSG, India: CAMP and PHVA Results -- http://members.xoom.com/ZOOIndia/
- ZOO, ZOOS' PRINT, ZOO ZEN -- http://www.geocities.com/rainforest/vines/6883
- History of Zoos and Natural History in India http://members.tripod.com/~SPHOZANHI

Submitted by Sally Walker, CBSG, India.

Table 1. Status of assessed mammal, freshwater fish and medicinal plant species in India.

Category	*Endemic mammals*	*Non-Endemic mammals*	*Freshwater fishes*	*Medicinal plants Jammu-Kashmir*	*Medicinal plants Himachal Pradesh*
Extinct (EX)	1	2	1	0	0
Extinct in the Wild (EW)	0	0	1	0	0
Critically Endangered (CR)	8	16	47	6	2
Endangered (EN)	10	22	98	11	11
Vulnerable (VU)	17	45	82	18	21
Lower Risk – near threatened (LR-nt)	3	89	67	2	2
Lower Risk – least concern (LR-lc)	5	57	13	1	2
Lower Risk – conservation dependent	0	0	0	0	0
Date Deficient (DD)	10	87	18	1	1
Total species evaluated	54	318	327	39	39

Mexican Cactus CAMP

Mexico, May 1997

The cacti of Mexico are some of the most notable and diverse in the Americas. Various geographic regions within Mexico represent important centers of diversity for cactus, including the Tehuacán-Cuicatlán Valley. This valley is located in the southeast part of the state of Puebla and the northeast portion of Oaxaca, in an area covering approximately 9,000 km^2. Recent botanical studies have shown evidence of botanic richness and endemism as well as a large number life forms in the area. The richness of cactus in the valley is reflected in 23 genera and 84 species. Approximately 22 species are endemic and found exclusively in the region.

The first CAMP workshop for Mexican cactus was held from 12-15 May 1997 in Puebla, Mexico. The workshop emphasized the endemic species of the Tehuacán-Cuicatlán Valley as well as a few selected species from northern Mexico. The workshop was organized by Africam Safari and the Mexican Society of Cactology, with the collaboration of diverse scientific and governmental institutions. Forty-five participants including researchers and governmental natural resources managers discussed the status/census, distribution, population trends, generation times and *ex situ* conservation efforts for these cactus species.

In all, 28 species of cactus endemic to the Tehuacán-Cuicatlán Valley and northern Mexico were evaluated. Each was evaluated taxon-by-taxon in terms of their actual and predicted status in the wild, with the objective of assigning priorities for conservation and/or research activities. Using the new IUCN Red List Categories of Threat, one taxon was listed as Critically Endangered, 8 as Endangered, 13 Vulnerable, 3 Lower Risk and 3 taxa were listed as Data Deficient. Identified threats and numbers of taxa affected by them were:

- Habitat loss (24 taxa)
- Interference or persecution by humans (23 taxa)
- Illegal trade (12 taxa)
- Predation (9 taxa)
- Habitat loss – fragmentation (7 taxa)
- Habitat loss because of exotic animals (6 taxa)
- Catastrophes (6 taxa)
- Habitat loss because of exotic plants (3 taxa)
- Predation by exotic animals (3 taxa)

For all taxa, recommendations were generated for the kinds of conservation action needed in terms of management and research. These included conducting PHVA workshops, the development of management and research for wild populations, and the development of education programs.

The participants focused on integrated management and research strategies needed for the conservation of the endemic cactus of the Tehuacán-Cuicatlán Valley. Recommendations for research and management based on the various threats affecting the taxon were:

- PHVA (9 taxa)
- PHVA Pending (18 taxa)
- Monitoring (27 taxa)
- Survey (24 taxa)
- Life history studies (19 taxa)
- Habitat management (15 taxa)
- Limiting factors research (14 taxa)
- Seed analysis (12 taxa)
- Management of limiting factors (7 taxa)
- Intensive cultivation (8 taxa)

The participants also discussed the themes, problems, topics and situations affecting the conservation of the cactus of the Tehuacán-Cuicatlán Valley, which organized into six basic areas: legislation; planning; need for a network; communication/education/ training; funding; and information on wild populations. The participants then worked in groups discussing some of these topics.

The *Legislation Working Group* defined problems of : 1) illegal collection and trade in seeds, plants, and plant parts internationally and nationally; and 2) lack of knowledge of existing legislation. The strategies developed by this group were:

1. Education and increased communication concerning environmental laws.
2. Development of "watch-groups" in communities
3. Inter-institutional coordination between those in charge of local communities and supervision and protection of natural resources.
4. International support for the regulation of trade in the germ plasm of Mexican cactus.

The *Planning Working Group* identified problems of: 1) unwillingness on various political levels to solve conservation problems; and 2) plans for development are poorly thought-out. The priority strategies for this group were:

1. Involvement of landowners and resource-holders
2. Involvement of the scientific community
3. Involvement of NGOs
4. Proposals of ecologically and economically viable programs

The *Working Group on the Need for a Network* identified as the primary problems: 1) the lack of coordination among specialists in the scientific community; and 2) the lack of dissemination of technical

information concerning the species. The priority strategies identified by the group were to:
1. Identify the cactus researchers of Mexico.
2. Make a directory of specialists.
3. Hold regional meetings to discuss the problems of the species of wild cactus in each region.
4. Beginning with the development of projects, propose a work plan.

The *Communication/Education/Training Working Group* identified as the most important problems: 1) the lack of environmental education programs in local communities and for the general public; and 2) a lack of training for appropriate government personnel. The strategies suggested were:
1. Implement and expand programs
2. Hold workshops on different topics
3. Give alternative solutions to problems
4. Expand legislation

The *Wild Populations Working Group* identified one general problem: the lack of scientific knowledge for conservation. This group recognized that this information might be gained by an inter-institutional and interdisciplinary scientific "megaproject". The components of this type of project should include research concerning:
1. Geographic distribution of populations for all threatened taxa
2. Demographic studies
3. Seed biology
4. Ecophysiology including abiotic limiting factors
5. Propagation
6. Reproductive biology
7. Complete systematics on all species
8. Reintroduction (at the experimental level)
9. Plant-animal relationships
10. Population genetics

Submitted by Amy Camacho, CBSG Mexico, and Susie Ellis, CBSG.

Other Recent CAMP Workshops

- Mesoamerican Primate CAMP, San Jose, Costa Rica, June 1997
- Orchid CAMP, San Jose, Costa Rica, April 1998
- Endemics of Cuba CAMP, Havana, Cuba, April 1998

Reports of these CAMP workshops are available in Spanish from the CBSG Office.

Confiscation Workshop in El Salvador

El Salvador, June 1997

A Confiscations Analysis and Planning Workshop, organized by the Zoological Foundation of El Salvador (FUNZEL) and the National Parks and Wildlife Service (PANAVIS) with support from the National Museum of Natural History, was held from 2–7 June 1997 in San Salvador. Twenty-two species of wildlife fauna, which are particularly susceptible to illegal commercialization and therefore confiscation, were analyzed, and suitability of releasing animals that have been rehabilitated was evaluated. Workshop participants represented 20 different governmental and non-governmental institutions.

After an overview of the CAMP process, working groups spent two days examining data on 22 different reptile, bird and mammal species to assess their population status and habitats. The third day was spent on presentations relevant to confiscation and reintroduction of wildlife, and were followed by two more days of working group sessions focusing on the problems and limitations in managing wild and rehabilitated fauna. Biological, institutional, legal and educational problems were discussed, and specific recommendations were made for each species (summarized below):

Reptiles

Iguana iguana: Endangered, with population of 2,500 adults. High risk of extinction due to human disturbance, pesticides, hunting, habitat fragmentation, contamination and commercialization. Only species that is legally produced for exportation. Captive program level 2 is recommended. Confiscated individuals of known wild origin should be released; otherwise, they may be donated (if healthy) or euthanized.

Ctenosaura similis: Vulnerable, with over 2,500 adults. High risk of extinction due to poaching and habitat loss. Husbandry and education programs are recommended. Confiscated individuals of known wild origin should be released immediately; otherwise, they may be donated (if healthy) or euthanized.

Boa constrictor: Vulnerable. Fewer than 2,500 adults. High risk of extinction due to illegal traffic for skin commerce, pets, meat, hunting, and habitat loss. Farming, population studies, education and reintroduction programs are recommended.

Caiman crocodilus: Critical. Protection depends upon adequate legal bases for protected natural areas where this species occurs. Need for a protected area management plan . Farms recommended for reintroduction. PHVA is recommended. Healthy animals that are confiscated should be released immediately; those that cannot be released should be used for education, research, or breeding.

Crocodylus acutus: Critical. Top recommendations include farming and registration of confiscated specimens for breeding stock. PHVA and population studies are recommended. Healthy confiscated animals should be released immediately if captured in local native habitat; those not releasable should be used for education, research or breeding.

Birds

Amazona auropaliata: In danger of extinction. Main threat is demand as pet. Population estimated as 100 pairs in 1994. Population studies and PHVA are recommended.

Amazona albifrons: Vulnerable, CITES Appendix II. Population of 1,000 adults in at least five localities. Used in pet trade. Research and management programs strongly recommended.

Aratinga canicularis: Endangered, CITES Appendix II. Wide distribution of 14 conservation sites. Population size unknown. Population studies are highly recommended.

Ara macao: Extinct. Last specimen registered in 1940s. Main causes of extinction were pet trade and habitat destruction. Captive population estimated at 67.

Strix virgata: Endangered. Wide distribution, including urban areas. Threatened by habitat loss. Population studies are highly recommended.

Glaucidium brasilianum: Common in El Salvador. Main threat is hunting (linked to witchcraft and superstitution). Captive breeding is recommended to enforce wild populations.

Aratinga strenua: Endangered, due to local commercialization and loss of nesting sites. Population studies, nesting site localizations, and community education program are highly recommended.

Brotogeris jugularis: Not endangered, but highly commercialized. Wide distribution. Population studies are recommended. Confiscated specimens captured from native areas should be released immediately.

Buteo nitidus: Endangered. Threats include use for falconry and habitat loss.

Crax rubra: Highly endangered. Restricted to one geographic site. Main threats are hunting and habitat loss. Research and wildfarming for captive reproduction is recommended for reintroduction.

Mammals

Potus flavus: Endangered. Population studies are recommended. Reintroduction is not recommended; confiscated specimens should be used in education and research programs.

Dasypus novemcinctus: Endangered. Biological studies are highly recommended for management programs. No specimens in captivity. Immediate release into habitat is highly recommended, since they are highly susceptible to die from stress.

Herpailurus yaguaroundi: Vulnerable, CITES Appendix I. Population studies are needed. Confiscated specimens of unknown origin must be kept in FUNZEL for biological studies. Those not in good health should be euthanized.

Ateles geofroyi: Critically endangered, CITES Appendix II. Priorities for management are habilitation of natural habitats for reintroduction, population studies and translocations. Confiscated specimens should go to zoos, research, translocation or education programs.

Tamandua mexicana: Endangered. Need for management programs is urgent since habitat loss in increasing and species biology is unknown. Population studies and protection of natural areas are recommended.

Procyon lotor: Abundant, with wide distribution. Population statistics for this species should be determined. Confiscated specimens should be placed in zoos, research and education programs.

Odocoyleus virginianus: Vulnerable. Not considered a priority species for conservation. Captive population estimated at 500. Inventory of captive population is recommended and handling management techniques, since they are very vulnerable to stress.

Agouti paca: Critical, CITES Appendix II. Biological and management studies recommended, as it is a food resource species. ■

Submitted by Yolanda Matamoros, Simón Bolivar Zoo, Costa Rica, and Ulysses Seal, CBSG.

Saigon Zoo Masterplan for Conservation

In late 1993 the Director of the Saigon Zoo and Botanical Gardens, Nguyen Quoc Thang, approached CBSG to request assistance in the development of a strategic masterplan for the Saigon Zoo and Botanical Gardens similar to the *Thai Zoo Masterplan for Conservation* developed for Thai zoos. The project was undertaken with the goal of developing a set of recommendations that would lead to the Saigon Zoo meeting international standards for exhibits, husbandry and management, as well as supporting the priorities of conservation and education. The completed document, the *Saigon Zoo Masterplan for Conservation*, is based on three visits of 7-10 days each, conducted over the course of two and one-half years (1994-97). During these visits there was an intensive evaluation of how the Saigon Zoo's animal collection plan and exhibits could contribute to the conservation of threatened species endemic to Vietnam. The team was led by the CBSG Chairman, Ulysses Seal, and programs were coordinated by Ronald Tilson (Minnesota Zoo), Chris Banks (Melbourne Zoo), and Douglas Richardson (Zoological Society of London). Other team members were Lee Simmons (Omaha's Henry Doorly Zoo) and Sian S. Waters (Bristol Zoo Gardens and the World Pheasant Association).

Saigon Zoo staff involved in producing the conservation masterplan included Nguyen Quoc Thang, Phan Viet Lam,, Vo Dinh Son, Tra Nhu Tu, Tran Dang Trung, Nguyen Anh Dung, Huynh Tuyet Mai, Huynh Thu Loan, Ngo Thanh Binh, and Truong Thi Minh. This document was improved immensely by the skillful concept drawings by Tran Van Dung (Design Architecture Company) and the Vietnamese language scientific reports by Dr. Lam.

The first visit of the CBSG team in November 1994 was spent training Saigon Zoo staff in the use of animal management software (ARKS and SPARKS). Planning sessions were also conducted on zoo concept design, animal program priorities and exhibit critiques, and groundwork was laid for preparing an animal collection plan. During the second visit in April 1995, emphasis was placed on developing animal collection plans and the design of exhibits that would contribute to the conservation of threatened Vietnamese species. This animal collection plan was completed in March 1997 and included evaluations of existing and developing exhibit designs, and recommendations for specific animal management procedures and species selection. Discussions were initiated with CARE International regarding a possible conservation partnership with Melbourne Zoo to assist Saigon Zoo in the development of a comprehensive education program.

The directions set forth in this *Saigon Zoo Masterplan for Conservation* focus on change that will lead to a new and improved modern zoo system for HCM City. The directions and priorities will help Saigon Zoo to make immediate and long-range decisions within the context of a comprehensive strategic conservation plan for endangered species of Vietnam.

Recommendations for Conservation Action

The *Saigon Zoo Masterplan for Conservation* lays the foundation for developing comprehensive zoo conservation programs, and gives direction on achieving these programs. This plan will need to be continually revised to meet changing agendas, as global and regional priorities are changed to reflect new recommendations for threatened species.

The CBSG Masterplan Team adopted three conservation priorities that served as guiding principles:

- The first conservation priority is to focus on conservation action for the threatened endemic species of Vietnam.
- The second priority, on a broader regional scale, is to focus on conservation action for the threatened species of Southeast Asia.
- The third priority is to develop quality captive breeding programs, with the view that these species provide the linkage between the captive breeding community and the wildlife agencies and conservation organizations of Vietnam.

As these conservation programs progress, 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.

Future Species Conservation Programs

There are a number of key species groups that are of conservation importance to Vietnam, and to Saigon Zoo in particular. To ensure that Saigon Zoo is capable of fulfilling its role in conservation education and breeding, the training requirements for these groups of animals are summarized here.

Elephants
The Asian elephant is an important species for the region and has special significance for the zoo, as it is depicted on its logo. Improvements in husbandry are needed for this species, and a new facility has been planned that will allow for breeding and safe management of an adult male. Staff training is needed in handling techniques and for health issues that affect this species, particular y foot and skin care.

Primates
The most important group of primates to be found in Vietnam are the leaf-eating monkeys, particularly douc langurs. The zoo should seek assistance and training from the Primate Rescue Center at Cuc Phuong National Park to acquire the necessary skills to maintain and breed these difficult primates.

Carnivores
The Rescue Center at Cuc Phuong also has a facility for Owston's palm civet, and the carnivore staff at Saigon Zoo would benefit from the center's experience with this endangered species. Once these management skills are obtained, Saigon Zoo could be a key player in a coordinated program with this species, both within Vietnam, SEAZA and other zoo regions of the world. Certain generalizations concerning the husbandry needs of Owston's palm civet are applicable to the care of all small carnivores, including the small felids.

Ungulates
The Saigon Zoo has had considerable success with many deer species, and regularly breed sambar, sika, hog deer and muntjac. What is needed is an understanding of modern ungulate management practices that will allow them to build on this success. Training by an experienced ungulate keeper/curator and veterinarian is recommended, particularly with respect to bovids. Some of the most exciting species of ungulate were only recently discovered in Vietnam, and are probably in danger of extinction . An expanded skills base with this group of animals would increase the zoo's conservation effectiveness, should programs be deemed necessary for the saola, spiral-horned antelope and giant muntjac.

Pheasants
This is a species group of which Saigon Zoo can be justly proud of their achievements to date. Their links with the World Pheasant Association should be strengthened, and full advantage taken of the support and training offered by that organization. If the success of the previous few years continues and maximum use is made of the available cage space, Saigon Zoo may quickly become a center of excellence internationally.

Crocodiles
The Siamese crocodiles are one of the most endangered crocodile species in the world. Saigon Zoo has the potential to contribute to the conservation of the Siamese crocodile through captive management and breeding, and working with Vietnamese wildlife agencies and research institutes to conserve the remaining wild populations. Saigon Zoo has bred crocodiles, but an experienced reptile keeper, with particular skills in crocodile management, should be brought in to advise on a management program for the Siamese crocodile.

Freshwater Turtles
Freshwater turtles comprise the group of highest conservation significance for reptiles in Vietnam. Many species are declining and some species are severely threatened. A new reptile facility is planned at the zoo, which will provide an excellent opportunity to establish breeding groups of several endemic species. An experienced zoo herpetologist, with particular skills in freshwater turtle management, should be brought in to assist in this development.

Conservation Policy and Action Plan

The status of the most endangered species of Vietnam must be conveyed to the visiting public through graphical interpretation of animals and exhibits, a proposed education center, printed brochures, and oral presentations by keepers and educators. By providing strong and active leadership, and by showing action and results, the Saigon Zoo will become a truly modern zoo organization.

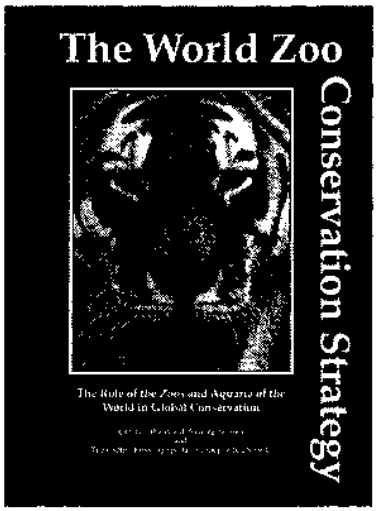
Animal Management and Education

The credibility of the Saigon Zoo will ultimately be determined by the standards set for animal management and animal health. After setting the collection plan, animal management staff can work toward its implementation. All modern zoos attach great importance to the scientific management of their animals, particularly endangered species.

Education should expand the visitor's awareness of historical, current and future environmental issues of Vietnam. It should also impart to visitors the value of species as well as suggest how we personally can effect change by becoming involved with conservation programs. ■

Submitted by Ronald Tilson, Minnesota Zoo/CBSG.

Review of the *World Zoo Conservation Strategy*



The most important document ever produced in the history of zoos is the *World Zoo Conservation Strategy* (WZCS), a joint effort of the World Zoo Organization (WZO) and IUCN/SSC's Conservation Breeding Specialist Group (CBSG).

The WZCS has gained much attention, both inside and outside the zoo community, and it has been translated in many of the world's languages. To guide the zoos around the world on their way to reach the goals expressed in the WZCS, in 1995 the WZO developed a strategic plan called "Zoo Future 2005". According to this plan, actions have to be taken in four areas:

1. Build up cooperative linkages between *in situ* and *ex situ* conservation programs.
2. Improve animal well-being in zoos.
3. Improve public perception, understanding and appreciation of zoo missions.
4. Build up a worldwide network.

The WZO has established committees to pursue these purposes:

1. CIRCC: Committee of Interregional Conservation Coordination
2. Committee on Ethics and Animal Welfare
3. Committee on Marketing, PR and Education

All these activities indicate that the zoo-community takes its conservation strategy very serious and is progressing to implement it.

From the beginning, however, the strategy has been considered to be a living document, which needs to be updated and adapted whenever new aspects or problems arise. Working groups, both at the annual CBSG meeting and the annual IUDZG conference in Berlin in 1997, undertook a review of the WZCS.

At first, we went through the Convention on Biological Diversity to see if we need better reference to it in the WZCS. We found that almost all aspects of the Convention are covered by the WZCS in one way or the other. Only the concept and vocabulary of sustainable development is not mentioned as such.

We then brainstormed to find out areas in the WZCS that need to be updated. These areas are:

1. The Strategy does not have a separate section on *in situ* research and conservation being accomplished by zoos, although much is said about conservation-related research within zoos and how conservation may benefit from the development of methods and tools to manage small populations. The "adopt-a-park" concept was not yet existent when the WZCS was written. It was emphasized that zoos need to build up a partnership in conservation to become true conservation centers – otherwise zoos will not survive.
2. It was also emphasized that collection planning on an institutional, regional and global scale is a key ingredient in the success of zoos and needs attention.
3. The problem of "roadside zoos" and zoo-like displays of animals at shopping centers and vacation centers was discussed. Zoos and zoo associations should be encouraged to influence legislation on minimum standards of care of wild animals.
4. The problem of surplus animals is covered in a very careful language in the Strategy. However, both the conservation and the animal welfare community expect zoos to come forward with a professional ethic on this problem.
5. There was a broad discussion on scientific and conservation education in zoos. It was suggested that the World Zoo Organization could ask, for example, the World Bank for support to study how to teach sciences at zoos as the basis of conservation.

In the end, we agreed that it is not necessary at this time to rewrite the Strategy completely, but that there are a few areas which need further explanation. This can be done in a new preface to the WZCS when it will be reprinted or in an addendum. Such an addendum should also tell something about what has been achieved so far in implementing the Strategy. An appendix should contain a list of translations of the WZCS and where they are available.

To assess implementation of the WZCS, it was suggested to the World Zoo Organization to survey the various zoo associations for a progress report of their region. We need to know which actions have been undertaken to implement the WZCS as well as the strategic plan "Zoo Future 2005" to reach the goals. ■

Submitted by Gunther Nogge, Koln Zoo.

Book Review

Primate Conservation: The Role of Zoological Parks

Edited by Janette Wallis, American Society of Primatologists
1997

Primate Conservation begins as an overview of the zoo community's role in the area of conservation, but the scope of the book has a much greater perspective on primate conservation. The opening chapter by Janette Wallis is a fascinating review of zoo programs and highlights the need for more primate conservation programs. The part of the chapter that chronicles the history of zoo animal acquisition was excellent and the evaluation of zoo programs on health improvements for captured animals and conservation programs really gives the reader a much greater insight into contemporary zoo conservation.

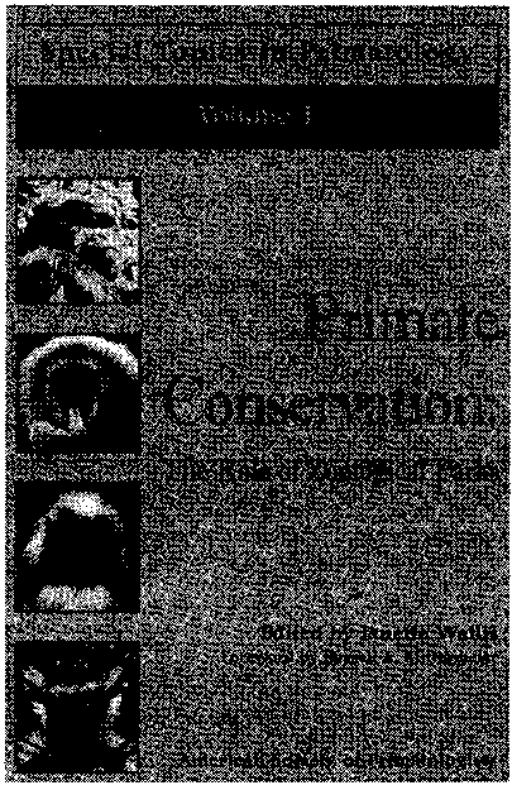
Conservation awareness in zoos started changing in the 1950s and the 60s. By the mid-70s conservation was a major concern of many American and European zoos. The initiation of the Species Survival Plan was implemented in the 70s and is now a major component of zoos' overall conservation programs.

Throughout the book there are many chapters that highlight specific in situ programs, such as those for the cotton-top tamarin, lion-tailed macaque, bonobo, gibbon and golden lion tamarin. These specific chapters demonstrate how zoos can develop and help expedite important primate conservation programs.

This book should be required reading for primatologists, zoo personnel, conservationists, and academics. *Primate Conservation* provides a number of positive reasons why scientists should make the effort to work more closely with zoos on developing strong primate conservation programs. ■

Submitted by Norm Rosen, University of Southern California and CBSG.

Proceeds from the sale of this book go directly to the American Society of Primatologists' Conservation Fund For more information on the Conservation Fund, visit the web page at: www.asp.org/asp/conservation/



Contents

- From Ancient Expeditions to Modern Exhibitions: The Evolution of Primate Conservation in the Zoo Community
- The Role of North American Zoos in Primate Conservation
- The Conservation Role of Primate Exhibits in the Zoo
- Zoos and *In Situ* Primate Conservation
- Zoo-based Conservation of Malagasy Prosimians
- Developing a Conservation Action Program for the Cotton-top Tamarin
- The Gateway Zoo Program: A Recent Initiative in Golden Lion Tamarin Reintroductions
- Steady-state Propagation of Captive Lion-tailed Macaques in North American Zoos: A Conservation Strategy
- Drills: Research and Conservation Initiatives, 1986-96
- Multi-disciplinary Strategic Planning for Gibbon Conservation in Thailand and Indonesia
- Partners in Conservation: Establishing *In Situ* Partnerships to Aid Mountain Gorillas and People in Range Countries
- Bonobo Conservation: The Evolution of a Zoological Society Program

Announcements

Captive Breeding of Critically Endangered Puaiohi

In a rush against extinction, biologists at The Peregrine Fund's Keauhou Bird Conservation Center on the Big Island of Hawai'i have successfully bred the Puaiohi (*Mydadestes palmeri*) in captivity. This first ever event provides hope for the critically endangered Puaiohi, whose population is estimated at about 150 individuals. The first hatch occurred in March 1998 with 21 chicks hatching as of July. The young Puaiohi are expected to be released in early 1999 into managed areas of the 'Alaka'i Swamp where the species once occurred.

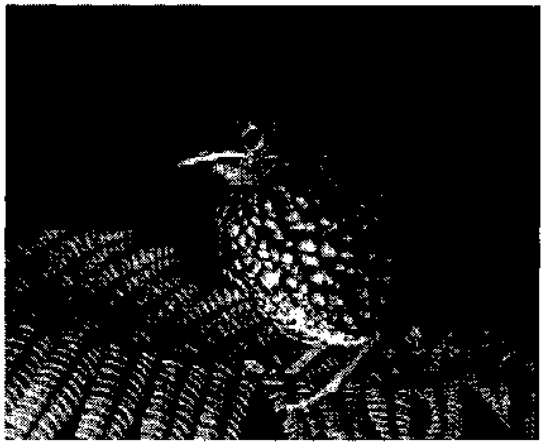


Photo by Joseph Kuhn

The work to save the Puaiohi is part of a larger program initiated in 1994 that focuses on all of the endangered forest birds in Hawai'i. The program involves The Peregrine Fund, U.S. Fish and Wildlife Service, State of Hawai'i's Division of Forestry and Wildlife, the Biological Resources Division of the U.S.G.S. and private landowners. Restoration efforts include monitoring of the wild population, protection of nests, captive propagation and reintroduction.

The propagation and reintroduction techniques used for the Puaiohi were initiated in 1995 on the 'Oma'o (*Myadestes obscurus*), a surrogate and non-endangered congener. Peregrine Fund biologists began working on the Puaiohi in 1996, when several eggs were collected from the wild and successfully hatched in captivity. These young formed the nucleus of the captive flock that produced the 1998 checks. Captive propagation techniques include artificial incubation, hand-rearing, and multiple clutching. Reintroduction techniques developed for the 'Oma'o will also be utilized and refined for the release of the Puaiohi.

Workshop on Migratory Waterbirds

The 2nd International Conference on Wetlands and Development will be held in Dakar, Senegal in November 1998. Wetlands International is organizing a two-day workshop during the conference on Strategies for Conserving Migratory Waterbirds on 11 and 13 November. This workshop will focus on developing and reviewing draft documents and conservation guidelines for the African-Eurasian Waterbird Agreement (AEWA). Contact Bert Lenten, Interim Secretary of the AEWA for more information (fax: +31 70 378 61 46; email: b.lenten@n.agro.nl).

First European Zoo Nutrition Conference

The first European Zoo Nutrition Conference will be held from 8-11 January 1999 in Rotterdam, organized by the Rotterdam Zoo in cooperation with the Veterinary Faculty of Utrecht and the EAZA Research Group. Topics will include the current status of nutrition in Europe, European nutrition research targets in the future, feeding ecology and specific nutrition research on various species. Contact J. Nijboer for more information (fax +31 10 4434414; email: j.nijboer@inter.nl.net), or visit the conference web site at: www.Rotterdamzoo.nl.

Population Viability Analysis Conference

A conference entitled "Population Viability Analysis: Assessing Models for Recovering Endangered Species" will be held on 15-16 March 1999 in San Diego, CA. The conference will focus on issues in the development and application of demographic and genetic PVA models for conserving threatened and endangered species. For registration information, contact William Hull (tel: +1 510 465 4962; email: whull@cgbd.org) or visit the conference web site at: www.cccweb.com/tws-west/pva.

CBSG Office Updates

Staff Changes

The time has come for CBSG to say farewell to Jenna Borovansky and Saleen Richter. Jenna is returning to Yale University to finish her graduate degree after participating in the Tree Kangaroo PHVA Workshop in Papua New Guinea. They will both be greatly missed at the CBSG Office. We wish the best of luck to them in their future pursuits!

CBSG also welcomes our new Administrative Assistant, Jenny Shillcox. Jenny joined the CBSG Office in July after working as a zookeeper at the Kansas City Zoo. She has already become an invaluable addition to the office and is responsible for the latest edition of the *CBSG Donor News*. Also interning with us for three months is Mariska Kuus from The Netherlands, who is creating a computerized CAMP data entry program for use in CAMP workshops and for integrating CAMP results into one database.

New E-mail Address

There are many ways to keep in touch with the CBSG Office, including our new email address:

CBSG e-mail address:	office@cbsg.org	Address:	CBSG
CBSG web site:	www.cbsg.org		12101 Johnny Cake Ridge Road
Telephone:	01-612-431-9325		Apple Valley, MN 55124-8151
Fax:	01-612-432-2757		USA

CBSG Annual Meeting

The 1998 CBSG Annual Meeting will be held from 9-11 October at Yokohama, Japan. Our Annual Meeting will be co-hosted by the Zoological Gardens of the City of Yokohama and the Japanese Association of Zoological Gardens and Aquariums (JAZGA).

This meeting will again be a working meeting. Working group chairs will introduce their topics in plenary session in preparation for the tasks to be accomplished by the working groups. Tentative working group topics include:

- Marsupials
- Primates
- Carnivores
- Marine Mammals
- Ungulates
- Storks, Ibises and Spoonbills
- Invertebrates
- Reintroduction
- Genome Resource Banking
- Behavior

Reports and recommendations from these working groups, as well as summary reports from each of the regional zoo associations, will be published in the next issue of *CBSG News* in late 1998.

Next year, the 1999 CBSG Annual Meeting will be held from 15-17 October in Pretoria, South Africa. We hope to see you next month in Yokohama!

CBSG Schedule 1998 – 1999

This schedule changes constantly; contact the CBSG Office for an update before final scheduling.
CBSG Staff Attending: (S)=Ulysses Seal, (E)=Susie Ellis, (B)=Onnie Byers, (M)=Phil Miller

1998	Travel	Meeting Dates	
September		8	MN Zoo: Collection/Conservation Planning 10AM -12:30 PM, (S,B)
		13-15	Tulsa, OK: AZA Meeting (E)
		18-20	Yulee, FL: White Oak visit for CCF (E)
	21,24	22-23	Bloomington, MN: CBSG Program Officers Meeting (S,E,B,M,Westley)
	25,27	26	New York, NY: Conference on Animals and the Law (S)
		30	MN Zoo: Collection/Conservation Planning Mtg. 1PM - 4:30 PM (S,B)
		28- 1 Oct	Chile: Humboldt Penguin PHVA (E, Lacy, Diebold)
October	3, 7	4-6	Taipei, Taiwan: Int'l Zoo Educators Conference (S)
		7	Yokohama, Japan: CIRCC Mtg. (B)
	6,14	8	Yokohama, Japan: CBSG Steering Committee Mtg (S,E,B,M)
	6,14	9-11	Yokohama, Japan: CBSG Annual Mtg (S,E,B,M)
		12-14	Nagoya, Japan: IUDZG Mtg (S)
	16,18	17	Omaha, NE: AAZV Mtg (S)
		21-22	Oakdale, MN: Computer Graphics Instruction (M)
		23	MN Zoo: Collection/Conservation Planning Mtg. 1PM - 4:30 PM (S,B)
		24-26	Minneapolis, MN: Human Dimensions Network Mtg. (S, M, B)
		16-31	Windhoek, Namibia: Cheetah Census Planning Meeting (E, Wildt)
November		3-6	CBSG Office: Grenville Lucas Visit
		4-6	Glencoe, IL: Midwest Rare Plant Task Meeting (S, B or M)
	13, 19	14-16	Chiapas, Mexico: Anguid Lizard CAMP (E)
		30- 4 Dec.	Seattle, WA: NMFS Meeting (S, E, M, J.Edwards, M. Hagedorn)
December	7, 14	8-13	Chengdu, China: Tech. Committee on Giant Panda Breeding Mtg (E, Wildt)
1999			
January	27, 1	28-31	Alberta, Canada: Eastern Slopes Grizzly Bear PHVA (S, E, M)
??	??	??	North Carolina: Red Wolf PHVA (S,M)
February	19,27	20-26	Jersey, UK: PHVA Facilitator's Course (S)
March	4,8	5-7	Orlando, FL: North American Felid TAG Meeting (S)
		1 week	SSC Steering Committee Meeting (S)
April			Sumatran Tiger PHVA
May		22-26	Cincinnati, OH: Conference on Breeding Endangered Species in Captivity (S, B)
		27?	Cincinnati, OH: CBSG Steering Committee Meeting
July		1 week	Brazil: Atlantic Forest Primate CAMP (S)
September		23-28	Apple Valley, MN: AZA Conference (S,M,B)
October		14	Pretoria, South Africa: CBSG Steering Committee Mtg
		15-17	Pretoria, South Africa: CBSG Annual Mtg
		18-21	Pretoria, South Africa: IUDZG-WZO Mtg (S)
November		3-weeks	Havana, Cuba: Plant CAMP, PHVA (S)
			Havana, Cuba: Animal CAMP, PHVA (S)
??	?	?	San Diego, CA, USA: Disease, Risk Mtg. (S, B)
??	?	?	Bonobo PHVA
??	?	?	Hanoi, Vietnam: Primate CAMP (S, B)

CBSG *News*

Newsletter of the Conservation Breeding Specialist Group
Species Survival Commission
IUCN – World Conservation Union

CBSG News
12101 Johnny Cake Ridge Road
Apple Valley, MN 551224-8151 USA