CBSG News

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Linking the Captive Community with *in situ* Conservation Needs

One of the goals of the CBSG, strongly supported during our recent Futures workshop, is to use our workshop processes to assist the establishment of conservation linkages between the captive community and *in situ* conservation needs. This goal is met in part by the participation of more than 300 zoo and aquarium biologists in our collective set of past workshops. This has assisted close contacts and identification of common interests between the wildlife biologists and managers in range countries.

Out of the more than 100 PHVA and CAMP workshops that we have conducted in more than 45 countries, a clear pattern of need has emerged to design and conduct survey and monitoring techniques on a local species-population-habitat basis. This needs to be done in the context of providing training to local biologists in the conduct of valid techniques that they can apply on a continuing basis to determine presence, distribution, and possibly densities and gross age and sex structure of the individual populations. The building of infrastructure capability in-country is the focus of the training while applying it directly to a species in urgent need of decisions regarding conservation action.

The tamaraw (*Bubalus mindorensis*) on Mindoro Island in the Philippines is a recent example of this need. A PHVA was conducted for this species in June 1996 at the request of the Philippine government. Simon Hedges, Chairman of the Asian Wild Cattle Specialist Group, has done an outstanding job in developing locally-tailored techniques with local biologists in the context of very cost-effective training programs. A highest-priority recommendation from this workshop was to organize a training course to demonstrate appropriate methods for surveying wild populations and to initiate a tamaraw survey. This course should start in December 1996 or January 1997. The training course in survey methods is to be followed with an island-wide presence/absence survey plus a more extensive survey in the Iglit ranges to determine a minimum population size for the area.

A detailed budget of US$24,300 has been prepared by S. Hedges in consultation with biologists in the Philippines while at the workshop. It includes costs for the five weeks of training and surveys for 20 survey workers and several instructors and coordinators. Also included are the travel costs for three instructors/coordinators. Commitments of local support have been made including graduate students, wildlife personnel, and local people on Mindoro so that about 60 people can assist in intensive simultaneous data collection process.

We are seeking funding and collaborating partners in this very worthwhile project. It offers an opportunity to develop working relationships with biologists in the Philippines and contribute to the *in situ* conservation of a highly-endangered species. Please communicate with me at the CBSG office if you want more details.

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

The CBSG Institutional Conservation Council : these generous contributors make possible the work of the Conservation Breeding Specialist Group

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14 August 1996

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 the CBSG in particular and the conservation community in general. We are interested in exchanging newsletters and receiving notices of your meetings. Contributions of $25 (U.S.) to help defray the cost of publication would be most appreciated. Please send contributions or news items to:

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Staff

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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 the 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.

CBSG's Second Futures Search...

Widening the Circle: Building Partnership Capacity for Greater Impact

The CBSG Steering Committee, at its 1992 annual meeting in Vancouver, suggested that a strategic planning process be initiated for CBSG to guide directions, activities, and responsibilities for the next 10 years. In February 1993, a strategic planning workshop was held in Ocho Rios, Jamaica. This, and the subsequent *CBSG Futures Search* report, were the first steps in a continuing process of futures scenario-building for CBSG and they have been a basis for our response to the very rapid changes occurring globally in science, communication technology, and social and political responses to a growing human population. The *CBSG Futures Search* launched CBSG on an expanded and greatly-deepened vision of our role in global conservation into the next century and identified our strengths and how these could be built upon to meet the ever-growing challenges facing the world's biodiversity.

The CBSG moves at a rapid pace unmatched by most organizations on the planet. In keeping with this, we found that we had met most of the *CBSG Futures Search* goals by the end of 1995 as we reviewed our progress on the goals set in Jamaica. From 3-6 June, 1996, 43 people from 11 countries participated in a second Futures Search workshop, *Widening the Circle: Building Partnership Capacity for Greater Impact*, to plot CBSG's activities and directions for the next five years. The meeting was generously hosted by John Lukas and his staff at White Oak Conservation Center in Yulee, Florida.

Workshop participants participated in small and plenary group exercises designed to develop a vision for CBSG into the next century. The groups emerged around the following themes that surfaced as critical future directions for CBSG: Conservation Science and Technology; Communications Technology, Training and Partnership Capacity Building; CBSG Regional Networks; and Funding.

The Conservation Science and Technology Group noted that the heart of CBSG is its ability to respond to conservation challenges based on sound science. To begin to address how more science resources could be generated to combat the biodiversity crisis, the group constructed a model that described current trends and activities as well as directions for the future. Needs were identified for funding, people, further multi-disciplinary research and collaboration, and improvement of the image of conservation science.

The group recommended the development of an internal CBSG Science Network (Sci.Net) as well as a second group of partners that exist outside the formal structure of CBSG, including other conservation organizations, called CBSG Partner Network (Par.Net). It was envisioned that Sci.Net would consist of many disciplinary-specific groups (e.g., population biology, reproductive biology/genome resource banking, nutrition, captive husbandry, behavior, wildlife management, etc.) and each coordinated by one or two co-leaders. The group recommended that an analysis of past CBSG activities, including the PHVA process surveys carried out by Drs. Harrie Vredenburg and Frances Westley, could serve to identify potential partners (e.g., conservation, academic and scientific organizations).

The Communications Technology, Training, and Partnership Capacity Building Working Group identified the need to use innovations in communication technology to expand the network, improve CBSG's image, and disseminate information rapidly and effectively. Goals developed around the working group themes were: training and education, communication, and partnership capacity building. Seven specific issues emerged: 1) the need for an integrated central database with rapid linkage to regional databases; 2) recruitment of more individuals into the CBSG network; 3) building communications capacity for knowledge transfer and for continuing and expanding the network (including teleconferencing and satellite/regional connections); 4) building the human element into the PHVA process; 5) linking processes to enhance partnerships (including capacity building in lesser developed countries and the development of an ecosystem focus driven by a species-based approach); 6) expansion of the current Facilitator's Training workshops; and 7) the need to include indigenous peoples in processes (e.g., incorporation of rapid rural assessment techniques in CBSG processes and building human demography into the VORTEX software program).

The CBSG Regional Network group identified the need for each regional network to undertake a local and regional review with the intent of exploring the strengths, weaknesses, opportunities and threats to the network nodes. A need to identify resources needed to support, sustain, and strengthen (from within and outside of the regions) was recognized so that the development of additional nodes would not create a financial demand on the main CBSG office.

The Funding group noted CBSG's "jewel-like" value to its international constituency. Although voluntary support from zoos, aquaria, and the private sector has allowed CBSG to carry out its work, it continues to operate at the edge of a financial cliff. The group identified the need to develop a solid, dependable funding base as the highest priority. Goals related to funding were identified including: clarifying CBSG's image and unique role in the conservation community; investigating alternative forms of governance; exploring formation of an "adoptive" partnership with one of CBSG's strongest supporters; and discussing ways to generate income through business opportunities.

The document resulting from the workshop currently is in draft form and will be reviewed by the CBSG Steering Committee at its meeting in August 1996. A final version of *Widening the Circle: Building Partnership Capacity for Greater Impact* will be available from the CBSG office in October 1996.

Submitted by Susie Ellis, Senior Program Officer, CBSG.

Executive Summary...
Komodo Monitor PHVA

The Komodo monitor, *Varanus komodoensis*, is the world's largest extant lizard. It reaches a length of 3 m and a weight of 80 kg. It is endemic to four southeastern Indonesian islands in the Lesser Sunda region: Komodo, Rinca, Gili Motang, and Flores. Three of these islands (Komodo, Rinca, and Gili Motang) are part of the Komodo National Park (KNP). This species is vulnerable due to its restricted range and the possibility of extinction from a number of threats such as decline or loss of prey, habitat loss, competition with exotic species, and natural catastrophes. The management and conservation objective is to maintain a genetically-viable, self-sustaining, free-living Komodo dragon population.

In order to achieve this goal, it is necessary to understand the risk factors that affect its survival. Risk evaluation is a major concern in endangered species management and one goal is to reduce the risk of extinction to an acceptable level. Software to assist simulation and quantitative evaluation of risk of extinction is available and it was used as part of Population and Habitat Viability Assessment (PHVA) Workshop. This technique can improve identification and ranking of risks and can assist assessment of management options.

Recent estimates place the total population of the Komodo monitor at less than 3,000 individuals within the KNP. About 1,600 individuals have been estimated to live on Komodo (33,937 ha), 1,100 on Rinca (19,825 ha) and 70 on Gili Motang (3,328 ha). About 100 individuals have been estimated to live in Wae Wuul, a protected area outside of the park located in West Flores. In the north part of the island, the Komodo monitor is also protected around Riung. Outside the protected area, *V. komodoensis* is present mainly along the west coast southward as far as Nangalili bay and eastward as far as Maumere. No management or official jurisdiction exist in these areas to monitor or protect the species beyond the park boundary. The island of Padar, which is part of the KNP, harbored the Komodo monitor till 1970. After this, no evidence of this species has been reported. A depletion of prey (mainly deer) because of intensive poaching is considered to be the main cause of the disappearance of the Komodo monitor from Padar s island.

The KNP was established in 1980, and the first management unit was established in 1984. The park has a total area of about 173,300 ha. An extension of the park boundaries, which will include two islands north of the park, has been proposed. There are two villages on the island of Rinca and one on Komodo, all of them with a population increase of more than 5% a year. A restriction on further settlements on Komodo has been proposed. The KNP has the largest population of Komodo dragons in the world, which was the main reason for appointing the area as a conservation area.

The three main objectives for the establishment of the park were: 1) protection of ecological processes as a life support system and preservation of its biodiversity, especially the Komodo dragon; 2) development of the area as a place to facilitate research and education to better the quality of human life; 3) enhancement of sustainable uses of the park and surrounding areas such as ecotourism and traditional uses of the park resources and surrounding areas. To achieve such objectives, several measures are being implemented including a master plan, zoning system, guarding system, habitat and population management plan, monitoring system, research scheme, tourism scheme, community program, and coordination of all of these activities.

Forty-four biologists, managers, and decision makers attended a PHVA Workshop in Cisuara, Indonesia at the Safari Garden Hotel on 4-7 December 1995 to apply recently-developed procedures for risk assessment and formulation and testing of management scenarios to the Komodo dragon. The workshop was proposed by the PHPA and was a collaborative effort of the PHPA, TSI/PKBSI, and CBSG. The purpose was to review data from wild and captive populations to assess extinction risks and different management scenarios, evaluate the effects of removals from the populations, examine possible strategies for reintroduction to Padang, and develop stochastic population simulation models. These models estimated risk of extinction and rates of genetic loss from the interactions of demographic, genetic, and environmental factors. Other goals included determination of habitat and capacity requirements, role of captive propagation, and prioritized research needs.

The first day consisted of a series of presentations summarizing data from wild and captive populations. After a presentation on the PHVA process, the participants formed three working groups (wild population, captive population, and population biology and modeling) to review in detail current information, to hear all ideas, and to develop management scenarios and recommendations. Stochastic population simulation models were developed with ranges of values for the key variables to estimate the viability of the wild population using the VORTEX software modeling package. Using data compiled from the literature and from consultation with workshop participants, a series of baseline population values for the parameters required by the VORTEX program were developed. These were then used to model the populations on three islands, Gili Motang, Rinca and Komodo. Flores has its own unique set of threats because the population is not protected in a park or wildlife area. Therefore, it was felt that it should be modeled separately.

This workshop report included a set of recommendations for research and management of wild and captive populations as well as sections on the history of the population, management in the KNP, and the population biology and simulation modeling.

Recommendations

Wild Populations

Models indicated that populations on Komodo and Rinca Islands were reasonably secure, however, all scenarios assumed that populations have been stable over a number of generations. Slow rates of change in these populations, which may be occur

Komodo...

ring, will be difficult to detect. Consistent and systematic population census data will be crucial for detection of such changes. Methodologies for accurate and sensitive censuses need to be refined using the best available expertise in quantitative field census techniques.

1. Assess current methodology and implementation of research on: a) population assessment of the Komodo monitor; b) population assessment of prey species; c) habitat assessment and mapping; and d) scat analysis for evaluation of prey preference.

2. Investigate age-specific survivorship in wild populations, in particular of adult females and of yearlings. Investigate breeding participation rates of females in wild populations.

3. The CBSG should make available the hardware, software, and training necessary to allow the routine use and refinement of VORTEX models of populations and management activities.

4. Use captive populations to determine sex ratio at hatching (sacrificing surplus clutches is likely to be required to verify sexing methods currently under development) and age at first reproduction.

5. Field studies are urgently needed to determine the size, distribution, and degree of fragmentation of populations on Flores. The extent of any additional threats to these populations and their habitat also requires investigation.

6. Levels of migration between all islands (in particular to and from Gili Motang) need to be estimated.

7. Develop population models for prey species, aiming specifically to assess required population sizes.

8. Translocation from wild populations would represent the most efficient and safe source of animals, should reintroduction to Padar Island be considered.

9. Repopulation of Padar Island is important for increasing population size and to restore part of the dragon's historical range. However, more detailed evaluation of prey population capacity, habitat assessment, and dragon carrying capacity is needed to develop a plan.

10. Control of pests and exotic species (e.g., feral dogs, rats) should continue.

Komodo National Park

11. Provide training for KNP staff in park management skills, ecology, and tourist communications.

12. Improve tourist education resources and facilities at the KNP.

13. Appoint a coordinator (e.g., the park director) to head a small management committee to evaluate and advise on ideas and recommendations received for management of the park.

14. Coordinate PHPA activities with local and national governments to incorporate useful recommendations from the Komodo PHVA into the master plan (already being developed) for the KNP and the entire Komodo monitor range.

15. Develop an environmental awareness curriculum to be included in formal education throughout the country.

16. Continue and expand the existing Komodo Working Group.

17. Increase participation by local communities inside and outside the KNP within the Komodo monitor range.

18. Continue monitoring of the local human population within KNP to insure minimum of damage to the habitat. The human demography within the park needs to be evaluated to assist projections of long-term impacts on the KNP.

19. Develop an integrated management plan based on the Regional Spatial Development Plan (RTRWP).

Captive Populations

20. A management plan and husbandry manual should be compiled, published in Indonesian, and distributed to all zoos working with Komodo dragons.

21. Improve founder representation of the existing population that fully utilizes all wild-caught specimens in captivity.

22. A captive management program in Indonesia for the Komodo dragon will require a species coordinator, a studbook keeper and a captive management committee to draft and implement a captive population master plan.

23. There needs to be global coordination of the captive populations (Komodo dragon CBSG Global Animal Survival Plan or GASP) to fully utilize all of the wild-caught founders and provide a viable captive population as long-term protection against unexpected catastrophes in the wild.

This report was submitted by Ulysses S. Seal, Jansen Manansang, Dwiatmo Siswomartono, Tony Suhartono, and Jito Sugarjito.

Executive Summary...

Tamaraw PHVA

The endangered tamaraw (*Bubalus mindorensis*) is endemic to Mindoro Island in the Philippines. Historically, the population may have numbered 10,000 in 1900 but it has since declined to 300–400 animals due to habitat loss, hunting, and disease. They may be fragmented into several subpopulations with no opportunity for natural exchange. Efforts to establish a practical conservation management and research program for this species have been hampered by conflicting recommendations from outside organizations and multiple changes in supervising authority which have resulted in altered priorities, unreliable funding, and suspension of activities. A Population and Habitat Viability Assessment (PHVA) for the Tamaraw was recommended by the Asian Wild Cattle Specialist Group (SSC/IUCN) at a Asian Wild Cattle CAMP Workshop in Thailand in June of 1995. Participants included Ruben Callo and Mary June Maypa of the Philippines Department of Environment and Natural Resources (DENR).

The CBSG was officially invited by Delpfin J. Ganapin, Jr., Undersecretary for Environment and Programs Development of the DENR, to conduct a PHVA for the species in the Philippines on 15-17 May of 1996. The workshop was endorsed by Wilfred S. Pollisco, the Director of DENR, and included: Dr. Ruben L. Villareal, Chancellor of the University of the Philippines at Los Baños; Hon. Josephine Sato, Governor, Occ. Mindoro; and Hon. Victor A. Ramos, Secretary DENR; as well as Philippine biologists, researchers, and wildlife managers. The objectives of the course and workshop were to assist local managers and policy makers to: 1) formulate priorities for a practical management program for survival and recovery of the species in wild habitat; 2) develop a risk analysis and simulation population model for the species which can be used to guide and evaluate management and research activities; 3) identify and initiate useful technology transfer and training; and 4) identify and recruit potential collaborators for the conservation program.

A briefing book was distributed to participants. A draft report was prepared during the course with all recommendations reviewed and agreed by the participants. More than 40 Filipino scientists, biologists, managers, and NGO members participated in the workshop. Foreign CBSG team participants included Doug Armstrong, :Omaha Zoo; Jon Ballou, Smithsonian Institution; Ulysses S. Seal, CBSG; Simon Hedges and S. Sompoad, Asian Wild Cattle Specialist Group; and Harri Vredenberg and Francis Westley from Canadian universities. After opening welcomes, a series of short presentations were made summarizing recent history and current knowledge of the threats, biology, and management of the tamaraw in the wild and in captivity. These presentations are included in the report. Much unpublished information was made available for the workshop and the many gaps in our knowledge of the species were clearly identified.

The participants were formed into four working groups reflecting their expertise and interests and the key problems for tamaraw conservation and most of the work over the three days was done by these groups. The groups were: Wild Population, Captive Population, Population Biology and Modeling, and People Participation. Each group developed an outline of its tasks and then developed key areas with extensive review of available information and discussion of needed actions. Each group presented the results of their work in three plenary sessions to assure that everyone had an opportunity to contribute to the work of the other groups and to assure that all issues were carefully reviewed and discussed by all workshop participants. This process allowed for a full review of all of the recommendations that are a part of this executive summary and to reach agreement and their acceptance by all participants. The discussions were intense, but orderly, with the result that many contentious issues were openly debated. It is clear that there has not been sufficient communication among all of the stakeholders in the conservation of this species to reach working resolution of problems and misunderstandings that have arisen over the years. The derived recommendations, however, do represent a consensus of the workshop participants.

The management and research recommendations for the wild and captive populations are very specific and capable of implementation. Of particular note is the need for the scientific survey and census of the tamaraw populations. This can be implemented through a training program, taking into account the difficult habitat, their low numbers, and their dispersed distribution. A carefully-designed program was prepared by the Wild Population group. It needs to be begin no later that December 1996 - January 1997 to allow initiation of the surveys early in the dry season. The two specialist groups (Asian Wild Cattle and CBSG) are prepared to assist in this process if the DENR and the government of the Philippines wish to begin this process and if there are people who can undertake the commitment to the training and the actual field work.

A second project that can be implemented immediately, involving international collaboration and partnership, is the establishment of a genome resource bank with semen collection from the current male tamaraws in captivity. They represent a valuable genetic resource that is not likely to be effectively utilized for a natural breeding program because of their age and the shortage of females. Collection and storage of their semen would allow this material to be used at a later time since,, with proper technique semen can be stored for at least 40 years. A participant in the workshop, Dr. Doug Armstrong of the Omaha Zoo, has extensive experience with reproductive biology techniques in wild cattle species. He is also highly skilled in their husbandry, drug immobilization, and clinical management so that he could share a range of experience. He is interested in undertaking such a project and would have some support from his institution.

It is clear from the history of this species and from the reviews and analyses conducted in this workshop that the survival and recovery of a viable populations the tamaraw is going to be a long process requiring a sustained effort and collaboration among all stakeholders. A process to assist this endeavor was undertaken in this PHVA workshop. We have found that a continuation of this process of a friendly, but neutral and objective, review of the programs and analysis of information and experience gained in the program by all stakeholders can be of assistance and can contribute to stronger collaborative efforts. We recommend that there be another such workshop in late 1997 after some information is gathered in the proposed surveys. The CBSG is interested in continuing this collaboration with our Philippine colleagues and would be ready to again assist, if wanted.

Recommendations

Wild Population

1. Protect the known Tamaraw populations in Iglit Ranges and Aruyan by creating a dedicated tamaraw protection force (TPF). This force should be created, equipped, and deployed as soon as possible. (High Priority)

2. Organize a training course to demonstrate appropriate survey methods and initiate a tamaraw survey. This course should start December 1996 - January 1997. (High Priority)

Tamaraw...

a. Organize a training course in survey methods to be followed with an island-wide presence/absence survey plus a more extensive survey in the Iglit ranges to determine minimum population size in the area.

b. Conduct more extensive surveys/censuses in areas identified as important in Part 1 above.

c. Initiate follow-up monitoring of population status and threats in all areas with major tamaraw populations. This complete program should be initiated as soon as possible and will probably require about two years.

3. Assess the need for habitat management (e.g., burning and possible reforestation) and possible experimental treatments (should include training of habitat management personnel).

4. Monitor all populations (population status and threats).

5. Develop management plans for all important areas.

6. Recommend that any areas containing major tamaraw populations be declared as protected areas (if they are not already included).

7 Enforce existing legislation is needed.

8. Initiate a long-term study (3-5 years minimum) of ecology and behavior of tamaraw in wild.

9. Collect hair samples, horns, skulls (plus any other required material) from any carcasses or other remains plus any animals taken by hunters.

10. Conduct an independent evaluation of TCP2 program annually.

Population Modeling

1 It is imperative that more accurate estimates of all potential populations be obtained. Accurate estimates will be essential to establish time frames for further management action and convey the degree of urgency in implementing these management actions.

2 Initiate long-term field studies to determine baseline values of those life-history parameters shown to most significantly affect population viability.

3 Quantify the annual loss of tamaraw due to hunting and other threats.

4 Evaluate historical levels of genetic variation in tamaraw to determine if the observed low variation is a recent characteristic of this island species. Samples from the current wild population(s) should collected when there is an opportunity.

Captive Population

1. Implement substantial, comprehensive improvement of the captive management program. (High Priority)

2. Transfer the existing Gene Pool site to a more accessible area and develop a biodiversity conservation and research center with tamaraw as the flagship. (High Priority)

3. Establish a program of routine semen collection and genome resource banking from the males currently held at the Gene Pool as soon as possible. (High Priority)

4. The veterinary professionals working with the Tamaraw Conservation Program will make a written recommendation within one month to the Philippine Department of Agriculture to establish more stringent requirements for the transfer of domestic ruminants and swine to Mindoro. These requirements are intended to prevent the transmission of disease to the island which helps protect both the local ranchers and the tamaraw population. Testing requirements should include negative tests for Foot and Mouth Disease and brucellosis. (Essential Action)

5. Establish a protocol for sample collection and health assessment of tamaraw currently in captivity and for animals that may come into captivity in the future. (Essential Action)

6. Within six months, the TCP veterinarians will perform a serologic survey of cattle in the vicinity of the current captive population location to detect potential disease threats in proximity to the captive population (Essential Action). Cattle will be surveyed for exposure to:

Foot and Mouth Disease
Hemorrhagic Septicemia
Leptospirosis
Brucellosis
Bluetongue
Pseudorabies
Mycobacteria paratuberculosis (Johne's disease)

7. The existing Tamaraw Conservation Program Operations Manual will be thoroughly reviewed and updated within six months. (Essential Action)

8. Increase the captive population of tamaraw by preferential capture of females from the wild. Numbers will depend on the recommendation of the population geneticists but an additional six founder males and ten founder females may be sufficient. A complete review of all options available for capture will be completed and a plan will be developed using the best capture method prior to beginning the capture program. (Contingent Priority: dependent upon results of field surveys and actions taken on high priorities above).

9. The capture of tamaraws from the wild should come from different sites to insure genetic diversity in the captive population. (Contingent Priority)

10. Establish two separate reserve populations with one on Mindoro Island located far from tamaraw habitat and cattle ranches. The initial population base will be animals currently held in captivity and relocated to the new site on Mindoro. When the time is appropriate, additional animals may be added to this population to establish a core captive population. A second population should be located outside of Mindoro Island as protection against an island-wide catastrophic event. The second herd could be established from first generation offspring of the wild-caught founder animal core herd on Mindoro. (Contingent Priority)

People Participation

Short Term:

1. IEC - plug the program on tamaraw conservation. Use as many means of information as possible including:

a. mass media

b. disseminate popularized reading materials
c. resource awareness at the barangay level via interpersonal communication
d. training seminars
e. curriculum integration

2. Law Enforcement.
a. Increase level of awareness re: laws on tamaraw conservation
b. Recommend hiring wildlife wardens and forest rangers to enforce laws
c. LGU to appoint barangay guards/wardens to regularly report to DENR/PNP

3. Livelihood and technology transfer:
a. training
b. demo farms
c. clinics in following areas:
1) food production in home gardens (crops, poultry, livestock)
2) improve farming system
3) cottage/home industries with minimum extraction & harvesting

Medium Term:

1. Continue/sustain implementation of educational campaigns and law enforcement.
2. Continue livelihood and technology transfer.
3. Encourage investors in cottage industries.
4. Develop marketing systems for farm products/handicrafts.
5. Continue lobbying for CADC and AD.

Long Term:

1. Improve access to communities.
2. Total community development.

This report was edited by J. de Leon, N. Lawas, R. Escalada, P. Ong, R. Callo, S. Hedges, J. Ballou, D. Armstrong, and U. S. Seal.

Executive Summary...

Javan Hawk-Eagle PHVA

The critically-endangered Javan Hawk-Eagle (*Spizaetus bartelsi*) is endemic to Java in Indonesia. It was recently designated the national bird of Indonesia which increased public awareness and interest. Historically, the population was widely distributed in the wet tropical forests of Java but has since declined to 80-108 pairs of birds as the result of habitat loss from extensive deforestation on Java, sporadic hunting, and disturbance. They may be fragmented into several subpopulations in west, central and east Java with limited capability for natural exchange. Efforts to establish a practical conservation management and research program for this species have been hampered by a lack of information on their current distribution, difficulties in protecting them in remote areas, uncertain priorities, and lack of funding. A Population and Habitat Viability Assessment (PHVA) for the Javan hawk-eagle was suggested by Ir. Soemarsono and Ir. Dwiatmo of PHPA in December 1995. A PHVA was also recommended at the landmark collaborative Conservation Assessment and Management Program (CAMP) Workshop in Spain in April of 1995. Participants in the CAMP included scientists, managers and representatives of 12 raptor conservation organizations who had agreed, for the first time, to work together on this global raptor threat status assessment project of mutual interest.

The CBSG was officially invited by Ir. Soemarsono, Director-General Perlindungan Hutan dan Pelestarian Alam, Depart. Kehutanaan, (PHPA, Ministry of Forestry), and Ir. Dwiatmo Siswomartono, Director of BKFF (Department of Conservation of Flora and Fauna in PHPA), to conduct the PHVA for the Javan hawk-eagle in Indonesia in May 1996. Drs. Jansen Manansang and Tony Somampau offered to host the course and workshop at Taman Safari Indonesia (TSI). Taman Safari Indonesia is the official Indonesian Center for Reproduction of Endangered Species in Captivity.

The objectives of the course and workshop are to assist local managers and policy makers to: 1) formulate priorities for a practical management program for survival and recovery of the Javan hawk-eagle in wild habitat; 2) develop a risk analysis and simulation population model for the species which can be used to guide and evaluate management and research activities; 3) identify specific habitat areas that may need protection and management; 4) identify and initiate useful technology transfer and training; 5) develop a captive program using the confiscated birds and define its relationship to the conservation of the wild population; and 6) identify and recruit potential collaborators within Indonesia and in the international community.

The Javan hawk-eagle is considered critically-endangered due to its restricted range, declining numbers, and the possibility of extinction from a number of threats such as decline or loss of prey, habitat loss, poaching, and natural catastrophes. The management and conservation objective is to maintain a genetically viable, self-sustaining, free-living Javan hawk-eagle population. In order to achieve this goal, it is necessary to understand the risk factors that affect survival of the hawk-eagle. Risk evaluation is a major concern in endangered species management and a goal is to reduce the risk of extinction to an acceptable level. A set of software tools to assist simulation and quantitative evaluation of risk of extinction is available and was used as part of PHVA workshop. This technique can improve identification and ranking of risks and can assist assessment of management options.

Forty-four biologists, managers, and decision makers attended a PHVA workshop in Cisuara, Indonesia at the Safari Garden Hotel on 6-8 May 1996 to apply the recently-developed procedures for risk assessment and formulation and testing of

Hawk-eagle...

management scenarios to the Javan hawk-eagle. The workshop was a collaborative effort of the PHPA, TSI/PKBSI, and the Conservation Breeding Specialist Group (CBSG) of the Species Survival Commission/World Conservation Union (SSC/IUCN). The purpose was to review data from the wild and captive populations as a basis for assessing extinction risks, assessing different management scenarios, evaluating the effects of removals from the populations, examining possible strategies for reintroductions, and developing stochastic population simulation models. These models estimate risk of extinction and rates of genetic loss from the interactions of demographic, genetic, and environmental factors as a tool for ongoing management of the subspecies. Other goals included determination of habitat and carrying capacity requirements, role of captive propagation, and prioritized research needs.

The first day consisted of a series of presentations summarizing data from the wild and captive populations. After a presentation on the PHVA process, the participants formed four working groups (Wild Population, Captive Population, People Management, and Population Biology and Modeling) to review in detail current information, to hear all ideas, and to develop management scenarios and recommendations. Stochastic population simulation models were developed and initialized with ranges of values for the key variables to estimate the viability of the wild population using the VORTEX software modeling package. Using data compiled from the literature and by consultation with workshop participants, a series of agreed-upon baseline population values for the parameters required by the VORTEX program were developed. These were then used to model the three potentially-separated populations on Java. The central Javan population fragments have their own unique set of threatening processes, mainly because the population there is not protected in a park or wildlife area and they are modeled separately.

This workshop report includes objectives for recovery of the population, a set of recommendations for research and management of the wild and captive populations and on public education and information as well as sections on the history of the population, its management, and the population biology and simulation modeling of the population.

Recommendations

Population and Management Goals

A management goal of a 30-40% increase of the numbers of breeding pairs in the wild Javan hawk-eagle population in 10 years can be achieved with management and protection.

Wild Populations and Modeling

The total population of the Javan hawk-eagle is estimated at 80–120 pairs. Unexplored habitat and improved census methodology may increase this number to 105–200 pairs. However, the population is fragmented into perhaps three major subpopulations with further habitat fragmentation within each subpopulation. The degree of movement and exchange between these subpopulations and fragments is unknown. The models indicate that the survival of Javan Hawk-eagle populations is very sensitive to changes in mortality of each of the age classes. The most optimistic population and risk projections, with current data on the species and with data from other eagle species, indicates an annual rate of increase of about 3%. This is a result of its relatively low reproductive potential with a single egg in a clutch, high hatching rates, and nesting in alternate years. Increased mortality from human activities is a major threat to the survival of the species throughout its range in Java. Slow rates of increase in these populations, with optimal management, will be difficult to detect. Consistent and systematic population census data will be needed for detection of such changes. Methodologies for accurate and sensitive censuses need to be refined, using the best available expertise in quantitative field census techniques.

1. Apply current methodology for mapping possible habitat availability for the species and for statistical sampling of distribution and numbers. Implement research on: population assessment of the Javan hawk-eagle, habitat assessment and mapping, and nest losses due to human interference.

2. Investigate age-specific survivorship in wild populations, in particular of adults, yearlings and nests. Investigate breeding participation rates of the females in wild populations.

3. Provide the hardware, software, and training necessary to allow the routine use and refinement of VORTEX models of the Javan hawk-eagle populations and management activities.

4. Use captive populations to determine sex ratio at hatching, age of first reproduction, distribution of clutch sizes, egg fertility, and hatching rates.

5. Field studies are urgently needed to determine the size, distribution, and degree of fragmentation of Javan hawk-eagle populations. Determination of dispersal ranges of juvenile birds needs to be done. The extent of any additional threats to these populations and their habitat also requires investigation.

6. Should re-introductions of captive birds be considered, it is essential that the results be monitored by radio-telemetry of every bird of the first 10 released for at least two to three breeding seasons to allow investigation on habitat selection and use to assist the determination of potential available habitat and establishment of breeding.

Public Education and Awareness Program

7. Establish a "JHE Foundation" to facilitate activities on the conservation of the JHE.

8. Develop an environmental awareness curriculum to be included in formal education throughout the country.

9. Increase the participation of local communities inside and outside the protected areas within the Javan hawk-eagle range.

10. Provide training for park staff in management skills, ecology, and tourist communications.

11. Improve tourist education resources and facilities.

12. Appoint a coordinator to head a small management committee to evaluate and advise on the ideas and recommenda-

tions received for management of the Javan hawk-eagle.

13. Coordinate PHPA activities with local and national governments to incorporate useful recommendations from the Javan hawk-eagle into a Master Plan (already being developed) for the species.

14. The demography of the human population within and near the protected areas needs to be evaluated to assist projections of long term impacts on the Javan hawk-eagle habitat and risk of removals.

Captive Populations

15. The birds in captivity need to be integrated into a coordinated management and captive breeding program. Development of suitable housing, management, and health care is a high priority. Determination of the sex of the captive birds is a high priority as a basis for a breeding program.

16. A management plan and husbandry manual should be compiled, published in Indonesian, and distributed to all collaborators working with the Javan hawk-eagle.

17. Utilize founder representation of the existing captive population for a breeding program, for studies of the biology of the species, and for public education.

18. A captive management program in Indonesia for the Javan hawk-eagle will require a Species Coordinator, a Studbook Keeper and a Captive Management Committee to draft and implement a captive population masterplan.

19. The birds currently in captivity probably were all taken as chicks from the nest and reared in captivity under widely-different conditions. They are not likely to be suitable for reintroduction into the wild even with quarantine, treatment, and conditioning.

20. Review current land-use practices to prevent the conversion of potential JHE habitat into uses incompatible with JHE conservation.

Executive Summary...

Namibian Cheetah and Lion PHVA

Originally, cheetahs were found from the Cape of Good Hope to the Mediterranean, throughout the Arabian Peninsula to the southern part of the former Soviet Union. Population numbers have declined from more than 100,000 in 1900 to approximately 9,000–12,000 free-ranging cheetahs in Africa. Two population strongholds remain: Kenya/Tanzania in East Africa and Namibia/Botswana in southern Africa. In Namibia, the species' numbers are estimated to have declined by approximately 50% in the past 10 years, leaving a population of about 2,500 animals. The declining numbers are a result of the decline of the cheetah's habitat and the prey base as well as conflicts with people. As humans turn more and more of the cheetah's habitat into farmland for livestock production, human/cheetah conflicts have emerged and cheetah are routinely killed as livestock predators.

Namibia also is home to a unique and significant lion population which is seriously threatened by human conflicts, range loss, and potential disease threats. Historically, lions ranged over most of the northern half and partly over the remainder of the country. Few historical quantitative population estimates are available, though total lion numbers were estimated at 500 in 1975 and 700 individuals in 1980. it Since that time, the population of lions in Namibia has been declining, and is now estimated at only 320–340 animals. This trend represents up to a 50% decline in lion numbers over the past 15 years. About 85% of the lions in Namibia are currently restricted to two protected areas, the Etosha National Park (180–200 lions) and Khaudom Game Reserve (100 lions).

To address these and other problems, a PHVA Workshop for the Namibian cheetah (*Acinonyx jubatus)* and lion *(Panthera leo)* was held from 11-16 February 1996 in Otjiwarongo, Namibia. The workshop was a collaborative endeavor of the Namibian Ministry of Environment and Tourism, the Cheetah Conservation Fund, the AZA Felid Taxon Advisory Group, the AZA Cheetah and Lion Species Survival Plans, and CBSG. The meeting was hosted by the Cheetah Conservation Fund and generously sponsored by British Airways, White Oak Conservation Center, Columbus Zoo, NOAHS Center, Philadelphia Zoo, Fort Worth Zoo, Zoo Atlanta, Oklahoma City Zoo, Rio Grande Zoo, Houston Zoo, Caldwell Zoo, Franklin Park Zoo, Binder Park Zoo, and the Nashville Zoo.

Participants were welcomed and the meeting was officially opened by His Excellency Dr. Sam Nujunma, President of the Republic of Namibia. The Mayor of Otjiwarongo and the U.S. Ambassador welcomed the participants, followed by a welcoming presentation by the Namibian Minister of Environment and Tourism (MET).

The first day's activities were attended by more than 100 participants from 10 countries, represented by stakeholders in the future of the two species: MET officials, farmers, conservationists, and scientists. Overview presentations concerning the status of both the cheetah and lion and the goals of the workshop process set the stage for the week-long activities. The first afternoon was designed to address farmers' concerns; most farmers could not attend the workshop after the first day. They expressed their primary dilemma as wanting to know how to maintain commercial livestock farms without being forced to kill cheetahs and lions in order to protect their livelihoods.

Stakeholders were divided into seven homogeneous groups: farmers with lion problems, ministry personnel, farmers with cheetah problems, and two groups each of conservationists and scientists. Each group was asked to list three to five of their most urgent problems relating to the species with instructions to state them using consensually-reached, issue-based statements (e.g., "The critical problems for us are...."). The second portion of the task centered around generating a discussion of needs with each group asked to explicitly state their own needs, followed by a

Cheetah...

"why" statement. For example, rather than saying "We need more open communication" or "We need to retrieve carcasses of dead lions and cheetahs," participants were asked to use statements such as "We need more open communication in order to understand in what way Ministry policies or initiatives help protect these species" or "We need to retrieve carcasses of dead lions/cheetahs in order to analyze threats, such as disease, to our populations."

A brief synopsis of each group's results was presented. A group of four participants then presented commonalities and differences between the problems and needs expressed by each of the stakeholder groups. Common themes clearly converged:

1. Communication/education/cooperation

2. Basic research, including identifying critical threats, long-term monitoring to detect population trends, range, habitat, and prey to ensure viable populations, and global management of captive populations

3. Funding to implement the first two themes

4 Economic considerations including impact, asset value of lions and cheetahs, integrated wildlife and livestock management (land-use), restricting range of lions and cheetahs, practical solutions to the needs of people, and evaluation of appropriate sustainable land-use systems

The following four days of the PHVAs for the two species focused primarily on the distribution, status and threats to those species, and existing and proposed management strategies. Six working groups were developed (Wild Management Goals and Strategies, Disease, Genetics, Human/livestock interaction and communication, Life History/VORTEX modeling, and Captive Populations). Each was comprised of international as well as Namibian participants. The tasks of the working groups for the next four days then were to:

1. Identify the main issues and problems.

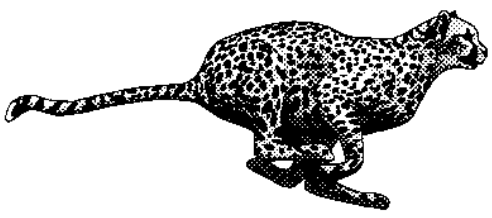
2. Determine goals in terms of identified issues and problems.

3 Develop promising strategies and solutions to address (1) and (2) in light of available data and prioritize them in light of the needs expressed by the various stakeholder groups.

4. Turn the highest priority strategy into realistic action steps in terms of particular time frames and, where possible, to identify available and potentially-available resources.

5. Daily oral reporting of discussions for input from other participants.

The Management Goals and Strategies working group identified the greatest problems for cheetahs the are the general population decline as well as killing of significant numbers of cheetahs (more than 6,000 in the past 20 years) by farmers on private lands. For cheetahs, the highest priority action identified was to stop the population decline via strategies such as: improving and developing more accurate censusing and monitoring methods; monitoring population trends; conducting public education and outreach; and developing a coordinated national strategy for the disposition of problem cheetahs.



The Management Goals and Strategies working group also identified the accelerated decline and range available to lions as a major problem. The population has declined from 700 animals since 1980 to approximately 350 at present. The highest priority action strategy was maintaining the lions' present habitat and prey base, particularly in Etosha and Kaudom, by communicating to MET and the government the importance of Etosha and Kaudom for the continuing viability of lion populations in Namibia and by carrying out maintenance as specified in Park Management Plans.

The Livestock/Human Interaction working group identified the following general problem areas: stock loss from both lions and cheetahs; farming practices and land use; communication; and education. The highest priority for action identified by this group was the reduction of stock losses by cheetah and lion. Priority strategies for resolving problems caused by cheetahs included: protecting small stock with guard dogs, donkeys, or using herdsmen; synchronizing the livestock calving season with the game calving season; keeping calves less than six months old in protected camps and providing adequate prey base for cheetah to reduce the need to eat calves; removing bottom strands of cattle fence to allow free movement of stock; and controlling other predators.

Priority action steps to address stock loss from lions included: upgrading and predator-proofing fences; increasing the incentive to tolerate lions by promoting their positive value through trophy hunting and ecotourism; establishing a central coordinating office to facilitate communication between farmers with problem animals and hunting operators or game farmers who may want the animal; and the capture of problem lions for relocation outside the country.

For cheetahs, the Life History/VORTEX Modeling working group recommended that it would be necessary to:

1. Determine the confidence limits of the census methods used to estimate population size as a basis for estimating the number of years required to detect different rates of population change (decline or increase) and as a basis for monitoring the population and adjusting management

2. Improve the estimates of female annual mortality rates as a useful guide to population growth rates

3. Improve the estimates of the number of females not producing a litter each year as a useful guide to the growth potential of the population

4. Analyze available data on litter size and cub survival on an annual basis to match with rainfall and provide an estimate of environmental variation in reproduction to improve the modeling of population growth potential and extinction risks because these measures may provide an index of changes in prey avail-

ability, nutritional status of the population, and predation on the cubs

5. Evaluate the impact of continued excess loss of adult females during the dry phase years on stability of the population size and on the management target for the population and develop estimates of the excess (above natural mortality) losses that can be sustained by the population during the dry phase years or that are needed to maintain the population at the management target

6 Evaluate possible inbreeding depression effects and the impact of the excess loss of males on the rate of inbreeding.

For lions, the Life History/VORTEX modeling working group recommended that it was necessary to:

1. Determine the confidence limits of the census methods used as a basis for estimating the number of years required to detect different rates of population change (decline or increase) as a basis for monitoring the population and adjusting management

2. Analyze available data on litter size and cub survival on an annual basis to match with rainfall and provide an estimate of environmental variation to use in the models because these measures may also provide an index of changes in prey availability and nutritional status of the population. These parameters could be used as a basis for monitoring the status of the population and also may provide useful indices of the effects of management interventions

3. Evaluate the impact of continued excess loss of adult females during the dry phase years on stability of the population size and on the management target for the population. Estimates of the excess losses that can be sustained by the population during the dry phase years should be developed

4. Evaluate possible inbreeding depression effects and the impact of the excess loss of subadult males and breeding structure on the rate of inbreeding.

The Disease working group agreed that disease is a potential threat to the viability of both lion and cheetah populations in Namibia. Three general needs were identified: defining the diseases that are threats to both wild and captive populations; setting standards for disease surveillance and preventive measures; and creating models of disease threats as catastrophes that could be modeled for both the Namibian lion and cheetah populations using VORTEX.

The highest priority identified by this group was defining the diseases that are real or potential threats to both lion and cheetah populations. For lions these included Feline immunodeficiency Virus (FIV), canine distemper virus (CDV), and rabies. Infectious diseases in cheetahs included anthrax (especially in Etosha) and, potentially, feline coronovirus, CDV, FIV, and Rabies. Suggested ways of implementing this strategy included: determining the prevalence of infectious diseases in Namibia; determining the pathogenicity of strains of infectious diseases in Namibia such as FIV and CDV; training Namibian veterinarians and laboratory personnel in the procedures to diagnose diseases in lions and cheetahs; training farmers and field personnel to collect biomaterials; defining the applied research projects to identify effective preventive measures; creating a captive management plan to minimize diseases; and identifying funding to meet the needs for surveillance, in situ training, and applied research. The working group then developed action steps, which if approved by the MET, could be used to define disease threats.

The Genetics working group identified the main problem as the genetic and demographic prognosis for small, isolated, free-ranging populations of both lions and cheetahs in Namibia and, for the cheetah especially, a lack of understanding of the management consequences of having small founder populations of cheetahs on game farms/reserves. One suggested solution/strategy to address this and other identified problems included the use of molecular genetic indices, including DNA analysis with mini- and micro-satellite probes with appropriate analyses and consideration of facilitated genetic exchange, developing practical guidelines for selecting founders of known origin, and for managing small populations based on demographic simulation models.

The Captive Populations working group noted that there are two types of captive-held animals in Namibia: 1) those permanently held in captivity (i.e. pets, tourism) and 2) those animals held temporarily prior to translocation. There are about six facilities holding lions primarily for tourism and 50-80 cheetahs are held in permanent captivity, the majority as pets. The Captive Populations working group suggested that the Namibian Government consider appointing a commission comprised of representative parties (MET, farmers, hunters, etc.) to examine existing regulations in light of the recommendations of the PHVA and then to promulgate appropriate legislation. It also was suggested that the Namibian government consider implementing a cheetah policy with the information in this PHVA document used as a starting point in the development and elaboration of a cheetah management plan. Currently there is a lion policy that also might be re-examined in light of the synthesized information resulting from the PHVA workshop. Both of these options might be examined over the next twelve months.

Expansion of Genome Resource Banking (GRB) for both lions and cheetahs was identified as a priority strategy by the Management Goals and Strategies, Disease, and Captive Populations Working Groups. The cryopreservation of biomaterials in a GRB is an emerging "tool" that has enormous implications for the assessment, conservation, and sustainable use of natural resources. It is not established for the purpose of replacing living animals in nature or in zoos, but to support existing efforts to preserve species and all its currently available genetic diversity. General considerations in establishing Genome Resource Banks were that they be developed in accordance with guidelines established by the IUCN/SSC/CBSG.

On the last day of the workshop, the comprehensive set of problems, priorities, suggested strategies/solutions, and action steps for the conservation and management of Namibian lions and cheetah were reviewed, intensively discussed, and consensus reached on all, forming the basis of this document.

This report was edited by Susie Ellis and Ulysses S. Seal, CBSG.

Executive Summary...

Conservation Workshop for Mexican Lagomorphs

A conservation workshop for Mexican Lagomorphs was held from 11-14 January 1996 at the Universidad Autonoma Metropolitana-Unidad Iztapalapa in Mexico City. The workshop was comprised of two parts: a Conservation Assessment and Management Plan (CAMP) for endemic Mexican lagomorphs and a Population and Habitat Viability Assessment (PHVA) for the volcano rabbit, *Romerolagus diazi*. The CAMP workshop focused primarily on the distribution, status, and threats to wild populations of lagomorphs in Mexico.

The results of the CAMP underline the need for further collaborative efforts to conserve the lagomorphs of Mexico. The deteriorating conservation status of many species, even during the last decade, emphasized the need for immediate action. The participants reached consensus that efforts to conserve these species primarily should focus on field programs, and that additional information on distribution, population status, ecology and biology are of vital importance.

Assessments and Recommendations

Eight Mexican lagomorph taxa were considered by the CAMP for Mexican lagomorphs. Of the eight taxa, four were assessed as threatened according to the new IUCN Red List criteria: *Sylvilagus insonus* (Critical), *Sylvilagus graysoni* (Endangered), *Romerolagus diazi* (Endangered), and *Lepus flavicularis* (Endangered). Four taxa were listed as low risk (Near Threatened) according to the new IUCN Red List criteria: *Sylvilagus cunicularis, Sylvilagus mansuetus, Lepus callotis,* and *Lepus insularis.* Of all the threats facing the lagomorphs of Mexico, the most striking are hunting, human interference, and habitat loss because of agriculture and farming.

Romerolagus diazi was recommended as a candidate for a PHVA workshop. Tentative PHVA workshops were recommended for *Sylvilagus insonus, Sylvilagus graysoni,* and *Lepus flavigularis.*

Recommendations for research management were made in the following categories:

Survey	8 taxa
Monitoring	8 taxa
Life history studies	8 taxa
Limiting factors research	6 taxa
Habitat management	6 taxa
Limiting factors management	5 taxa
Taxonomic research	3 taxa
Captive management/husbandry	2 taxa
Other research	4 taxa

For one taxa, *Romerolagus diazi,* a Level 2 captive program was recommended (based in part on IUCN Red List criteria). The PHVA for *Romerolagus diazi* focused primarily on the distribution, status and threats to that species. At the workshop, six working groups were established: Habitat, Distribution, VORTEX modeling, Threats, Education, and Captive Breeding. The workshop provided a unique opportunity to bring together Mexican lagomorph biologists who have worked with *Romerolagus* in Mexico, international representatives from the IUCN/SSC Lagomorph and Conservation Breeding Specialist Groups, and North American Zoos.

Estimates of habitat and population numbers were derived in both the Distribution Working Group and Habitat Working Group through consensus of field biologists. The zacatuche is not currently protected by active management nor through the presence of a viable system of protected areas in its geographic range. Presently there are 163 protected areas distributed throughout Mexico, with eight protected areas in the area of the Pelado/Tlaloc Volcano complex. These areas are small and isolated and currently have no protection or assigned managers; existing to date only as "paper parks." The estimated population of the volcano rabbit is approximately 7,085; comprised of 1,811 in Pelado, 1,816 in Tlaloc, 3,458 in Ixta-Popo, and approximately 3,056 in peripheral areas.

The Modeling Working Group relied primarily on data derived from the CAMP workshop held just before the PHVA. A baseline model for the population at Volcano Pelado was constructed by the workshop participants as a group. VORTEX modeling indicated that severe forest fires contribute markedly to population extinction. Consequently, detailed research programs should be developed to explore the dynamics of fire management in zacatuche habitat. Preliminary models suggest that populations are more sensitive to changes in juvenile mortality than adult mortality, but that both play a critical role in determining population dynamics. Comprehensive longitudinal studies should be undertaken using well-established mark/recovery techniques to provide insight into dispersal dynamics and reproductive characteristics of the populations. Overall modeling indicated that with equivalent levels of mortality and fecundity, smaller populations are at greater risk of extinction than are larger populations because of the destabilizing action of stochastic demographic and environmental variation. Management plans directed at expansion of suitable habitat can be successful in improving volcano rabbit population viability, but only if factors such as fire and human disturbance are kept to a minimum.

The working group on Threats identified three primary causes of losses of individuals: hunting; predation by exotic species (feral cats and dogs); and human-set fires used to generate new grass growth for domestic livestock. Six primary causes for habitat loss also were identified: human-caused fires; illegal extraction of wood, volcanic rock, and soil; unrestricted development of new agriculture areas; harvesting of zacaton grass to make brooms; establishment of new human settlements, road construction, and recreation centers; and accumulation of refuse and garbage in the habitat. Several general recommendations were made to ameliorate these threats, focusing on: the develop-

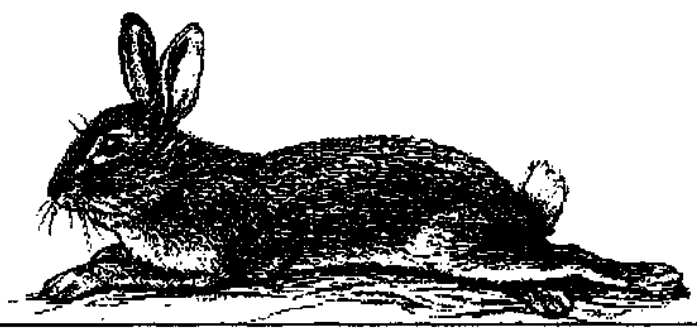
ment of vigilance programs conducted by people living in the countryside for hunting and fire control; improved information transfer in the form of hunting guides and education programs; establishment of eradication and population control programs for feral animals and local pet populations; finding alternate food sources for domestic livestock; plan and share information about alternative forest use and conservation; and establishing a garbage control and recycling program.

The Education Working Group analyzed problems related to education pertaining to the zacatuche, established working diagnostics and definitions of the same, and then made programmatic recommendations. The general goals identified were to approach the community in a number of different ways, to carry out an assessment (encompassing economic, socio-cultural, and historic factors) of the community pertaining to natural resources, and to establish relationships between the community, environmental educators, and other groups to develop concrete actions designed to be beneficial to the local community as well as the conservation of the zacatuche. Specific steps to reach these goals are outlined in the working group report.

One of the recommendations from the CAMP workshop was the development of a collaboratively-managed captive breeding program for the volcano rabbit. The Captive Breeding Working Group developed guidelines for the management of existing as well as any new captive breeding programs that might be developed. This group recommended the formation of a consortium comprised of the various zacatuche stakeholder organizations (e.g., AMCELA, the Lagomorph Specialist Group, NATURALIA, CNF, UNAM, and UAM Iztapalapa and Xochimilco). This consortium would collaboratively develop and implement programs of research, education, conservation, and genetic and demographic management, leading to the optimization of limited resources for the conservation of the species.

On the last day of the workshop, the comprehensive set of recommendations for the conservation and management of *Romerolagus* were reviewed, intensively discussed, and consensus was reached on all. These recommendations form the basis of the working group reports. Among the recommendations was a resolution suggesting that the zacatuche be adopted as a conservation symbol in Mexico. This resolution was passed unanimously by all workshop participants..

This report was prepared by Susie Ellis and Phil Miller, IUCN/SSC/CBSG.



Executive Summary...
Kirtland's Warbler PHVA

When a species, such as the Kirtland's warbler (*Dendroica kirtlandii*), is reduced to one small population, its demise can be the result of random events. The events leading to extinction can be varied and they may interact in what is known as an extinction vortex. The recovery team for the Kirtland's warbler reviewed the species' extinction risks in a Population and Habitat Viability Assessment (PHVA) workshop held at Minnesota Valley National Wildlife Refuge on 7-9 January 1992. The PHVA provided a framework for asking difficult questions about managing habitat for the warbler's future. The Kirtland's warbler may be one of the most well-researched warblers in North America, but many questions concerning its management remain. The workshop was a cooperative venture between the U.S. Fish & Wildlife Service and the Conservation Breeding Specialist Group.

VORTEX, a computer population simulation modeling software program used for the analysis, was developed by Dr. Robert Lacy of the Conservation Biology Department of the Chicago Zoological Park. The model was set up to act like a population of Kirtland's warblers. The simulated population had the same life history parameters, such as clutch size and mortality rate, that were calculated for the real Kirtland's warbler population. The population was run through a gauntlet of risks, like increased cowbird parasitism, habitat destruction, and drought, for 50 years.

The PHVA environment allowed workshop participants to integrate their experience and research results to analyze the projected future of the Kirtland's warbler. After repeated simulations of multiple scenarios, participants could view and compare the extinction probabilities and population trajectories for multiple permutations and combinations of parameter values. The model is a well-developed, thought experiment allowing the recovery team to try "what-if" scenarios within various management strategies. It is possible, through modeling, to project and test effectiveness of management strategies at reducing species risk of extinction based upon current knowledge.

The workshop was an introduction to the technique of modeling using VORTEX. By the end of the PHVA workshop, the recovery team decided to include population modeling as part of their future meetings. The model will be continuously updated as they gain new knowledge about Kirtland's warbler population biology and management.

The single Kirtland's warbler population is limited by breeding habitat and threatened by cowbird parasitism. The recommendations were based on the history of the population and the dynamics of small populations. They were made with the assumption that the recovery plan's goal was a Kirtland's warbler population that would be as self-sustaining as possible. With the exception of cowbird control, financial and political considerations of the scenarios were not explored.

Warbler...

Recommendations

1. Brown-headed cowbird control should continue at no less than 75% of the current level.

2. At least one person on the recovery team needs to be responsible for having a working knowledge of the current research on cowbird behavior relative to landscape patterns. We suggest that one or more features of the existing landscape that attracts cowbirds could possibly be modified.

3. A second, distinct population of Kirtland's warblers needs to be fostered in appropriate habitat. This would be an excellent opportunity to develop techniques for establishing and maintaining warbler populations. To establish a second population, more research needs to be focused on cross-fostering, captive-rearing, and overwintering birds in captivity.

4. We suggest that habitat be managed by controlled burns rather than through plantations. We endorse the recovery team goal of 37,500 acres (15,000 ha) of annually-available, suitably-aged habitat to support approximately 1,000 pairs of Kirtland's warblers. Plantations seem to be less that "average" habitat from the perspective of the warbler. Although natural regeneration has been poor on most areas where prescribed burns were done, the resulting habitat will likely be more suitable.

5. The recovery team needs to continue to monitor Kirtland's warbler demography and the species response to different habitat types through annual censuses of singing males and capture-recapture efforts.

6. We support the recovery team's decision to include population modeling as a tool at each meeting.

This report was edited by Ulysses S. Seal, CBSG.

Executive Summary...

Formosan Black Bear PHVA

As a result of habitat destruction and over-exploitation, the bear population in Taiwan has decreased both in numbers and in distribution. The Formosan bear was proclaimed an endangered species under the Cultural and Natural Heritage Act in 1986. Results from a few preliminary surveys within the past five years indicated that probably over 100 bears still exist. Over 90% of the sightings were recorded along the central mountain range at over 1,000 m in elevation, where there is little human habitation. The distribution stretches from Chatien Mountain in the north to Tawu Mountain in the south. Some sightings also were recorded in the eastern coastal mountain range. Aside from this sighting information, the general biology and other information pertinent to conservation of this species is completely lacking.

There are many threats against the Formosan black bear. Because of its high economic value, it has been targeted by aboriginal hunters. Bears also raid agricultural fields and thus are sometimes considered a pest. Being the largest carnivore on Taiwan, the bear can create fear among the public. Additionally, the gall bladder is considered a valuable medicine in traditional oriental culture and bear paw is considered a delicacy. As a consequence of differing attitudes among people towards the use of this species, a diverse spectrum of viewpoints exist regarding approaches necessary for its conservation, leading in turn to varied policies among governmental agencies.

As a first step in developing a unified approach for protecting this species from extirpation in Taiwan, the Taipei Municipal Zoo held a Population Habitat Viability Analysis (PHVA) workshop, on 14-17 June 1994. Dr. Ulysses Seal, chairman of the IUCN Conservation Breeding Specialist Group (CBSG), Dr. David Garshelis, bear biologist with the Minnesota Department of Natural Resources (U.S.), and Y. Sherry Sheng, Director of the Portland Zoo, were asked to participate in the workshop and provide lectures about small population viability and current status of Asiatic black bears in the world. The primary function of these specialists was to demonstrate and assist in the application of a population modeling technique (VORTEX) by integrating available data on Asiatic and American black bears and to generate risk analyses for the Formosan bears. The workshop was facilitated by Dr. Seal and Dr. Ying Wang, professor of wildlife biology, Taiwan Normal University

Attendants of the four-day meeting were composed of scholars, specialists in bear biology and Chinese medicine, non-government organization (NGO) representatives, governmental officials, aboriginal representatives, and international experts. During the first day, the current status of the Formosan bear and other related research were presented to provide the background for subsequent discussion.

Six working groups were formed after the daytime session to deal with the following issues: law, policies, and international cooperation; utilization and management of the Formosan bear; conservation and management of wild populations; captive breeding and management; conservation education; and VORTEX simulation modeling of risk analysis.

Each working group was led by a specialist coordinator to facilitate the group discussion. Attendants were free to join any of the groups. After a brief introduction of the participants of each group, an outline was developed for the subsequent day's discussion. During the morning session of the second day, the VORTEX model was presented in a plenary session; bear data were then incorporated in the model to make preliminary runs of risk analysis. During the afternoon session, individual group discussions resumed. After two, half-day discussions, a plenary session was convened in the afternoon of the third day, and each group presented the results of their discussions related to short and long-term conservation goals for the Formosan black bear.

In order to effectively incorporate each group's recommendations in an action plan for the conservation of the Formosan black bear, the plenary session reorganized results to highlight five major themes most pertinent to the threats impinging on this species which were posed as the following questions:

1. What are the greatest risks facing this population? Although few data specific to this population are presently available, VORTEX analyses were used to assess the risks of poaching and consequent population fragmentation on population viability.

2. How can we most effectively control poaching?

3. How can further habitat deterioration be prevented; moreover, how can habitat be increased to ensure a viable population size?

4. How can various viewpoints and values, stemming from different cultural traditions and ethnic groups, be integrated to reach a consensus about utilization of Formosan black bears?

5. How can we improve our degree of knowledge regarding the population status, and what are the best ways of dealing with the apparent population crisis?

During the plenary discussion, participants provided comments related to these points from the point of view of their group discussion. These responses were synthesized by each group coordinator and are summarized as follows:

Assessing Risks

The VORTEX analysis combined available data for the Formosan bear, captive bears in mainland China, and wild American black bears. The model predicted that under reasonably good protection (poaching rate <5%), the population would increase, and it could possibly reach carrying capacity (assumed to be about 2,000 bears) in about 80-100 years, depending on the present population size (estimated at 100-400 bears). If the poaching rate is 7.5%, the population would remain stable or could slightly increase. If the poaching rate is 10%, the model indicates that the population will decrease to a critical number which is highly subject to extinction sometime over the next 100 years, regardless of the present population size (the population size after 100 years would be reduced to <50). If the poaching rate is 15%, the population would be extirpated within 50-80 years. If we consider protected areas as having lower levels of poaching (e.g., 5%) than elsewhere, the population in the protected areas could increase (to some carrying capacity) while populations outside these protected areas would continue to decrease and eventually become extirpated (in the sense that there would be no reproductive females). In the long run, the total island-wide population would become so fragmented that it would likely not be viable. These model runs were only preliminary assessments, based mainly upon data extracted from other sources. To accurately assess and effectively protect this particular population, a field study investigating the effects of poaching would be of paramount importance. Additionally, in the course of such a study, valuable information would be obtained on other aspects of the distribution and biology of this little-known bear, which could be used to refine the inputs of this model.

Controlling Poaching

To reduce the level of poaching, the government must be urged to modify laws and enforcement strategies. For example, the government should consider developing a force of forest rangers and conservation police. In the meantime, a system should be established whereby local people are rewarded for reporting bears incidentally captured in traps set for other species, and police could be rewarded for assisting in the release of incidentally-captured bears and for apprehending poachers. Rewards also should be established for achievements by local people in the conservation of black bears. For successful conservation in the long-term, we should invite local people to develop and participate in resource management plans. There also must be greater control of the commercial use of bear parts. At the present time, all types of consumptive use of bears must be stopped, excepting traditional medicinal use. If necessary, it is suggested that the legal importation of gall bladders from North American bears might fulfill the need of local markets. In the meantime, people should be educated to use substitute products and more research should be directed at finding effective substitutes for bear gall in traditional Chinese medicine.

Protecting Habitat

Under existing law, the government needs to strictly enforce restrictions against the overuse of the land above 1,000 m, because this area contains the only remaining range of the black bear. Further development should be prohibited on lands over 2,500 m, due to its additional value in soil and water conservation. If necessary, development could be prohibited or mollified in specific cases through the process of environmental impact assessment. Buffer zones and corridors should be established around and between parks in the high mountain region to avoid habitat fragmentation and ensuing risks associated with small population size. Where lands pertinent to bear survival are owned by a variety of agencies, a commission should be formed by all representatives and organized by the primary conservation agency in charge. This commission's responsibility would be to ensure that the various landowners act in a consistent way to protect land from development, establish new protected zones or corridors, or set up research stations.

Developing a Consensus about the Value of Bears

Various groups responsible for public education, including national parks, zoos, schools, and NGOs should stress the relationship between the bear and its environment and the bear's position as a flagship species for conserving entire ecosystems. The public also should be educated to reduce unnecessary fear of the bear. The community involved in traditional Chinese medicine should be educated regarding the risks that their use of bear parts impose on the viability of the bear population. This community should also be given a broader concept of the use of traditional medicinal practices and the potential for substitutes for bear products. Nonconsumptive use of bears also should be promoted in the framework of ecotourism, but concurrently, tourists and others should be encouraged to avoid activities that might adversely affect the environment of bears.

Implementing Strategies

A working group on Formosan bears should be formed to

Bear...

monitor the progress of the recovery of this population. This group should meet regularly to review the problems facing this population and revise, if necessary, strategies to most effectively provide solutions. An action plan for recovery should be established by this group using an integrated database from wild and captive studies. Monies should be obtained from both public funds and private enterprise for the establishment of a Formosan black bear foundation which could support long-term research, conservation efforts, and educational campaigns aimed at fostering a healthy view towards conservation of Formosan black bears.

PHVA Report...

Peninsular Pronghorn

Our first workshop in Mexico was also the first opportunity for many of those involved with conservation of the peninsular pronghorn to come together as one group and discuss the difficult issues related to conservation of this highly-endangered animal. The following is taken from the draft Population Habitat and Viability Assessment (PHVA) report from the workshop which will soon be published in final form.

Historically, the peninsular pronghorn population on the Baja California peninsula of Mexico occupied approximately 40,000 km2 from San Felipe and San Quintin in the north to Bahia Magdelana in the south. In 1925, the population contained an estimated 500 individuals. Between 1950 and 1980, population distribution and abundance rapidly declined to very critical levels, due principally to the impact of human activities. Presently, about 150 individuals inhabit approximately 3,600 km2 within part of the Vizcaino Desert.

A PHVA workshop was conducted for the peninsular pronghorn to analyze the current situation. A group of specialists representing various governmental and nongovernment institutions from Mexico and the United States participated in the workshop. This was the first such workshop developed in Mexico with the participation of IUCN/CBSG.

Thirty persons from 17 institutions participated in the workshop held 16-18 November 1994, at the Center of Biological Investigations of the Northeast, S.C. in La Paz, Baja California Sur, Mexico. Participants were given an extensive explanation of the VORTEX population simulation software package and its uses. Goals identified by Workshop participants were:

1. To develop a management plan for the recovery of the antelope.

2. To identify the institutions (present and potential) and their interests and commitment to the recovery program.

3. To define the need and priorities for recovery of the subspecies.

4. To collect and record basic information on social, biological, and nonbiological factors.

Working groups were organized on the following topics: life history/modeling, distribution and status, threats, habitat quality and trends, conservation education, research, and general management. The following were among the key points discussed in these groups:

1. VORTEX modeling of the pronghorn population indicated that the population was very sensitive to increases in fawn mortality, with adult mortality also an important factor.

2. Distribution of the subspecies was reduced by more that 90% from that which existed historically and this antelope has been declared an endangered species nationally and internationally.

3. Threats to the population include poaching, habitat loss, habitat quality reduction, and high mortality of both fawns and yearlings.

4. The habitat quality is considered to be reduced in carrying capacity and it is reflected in the low antelope density.

Regarding conservation strategies, the participants:

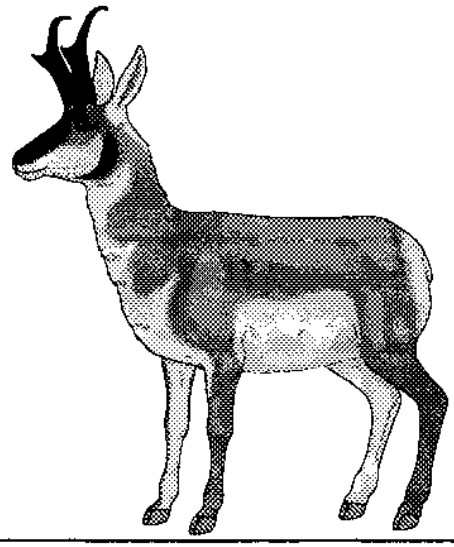
1. Proposed to develop an environmental education campaign at local, state, national, and international levels with the participation of government and nongovernmental organizations. Some of the actions that were identified are currently being developed.

2. Identified research priorities for the population, primarily considering basic biology and monitoring of the species and land use.

3. Prioritized recovery measures, the most important being: presence in the area, inter-institutional analysis and regulation of the use of the land, monitoring of the population, and rearing in semicaptivity.

A schedule was identified to initiate and continue recovery activities. Work priorities and responsibilities were defined and the role of participating institutions identified (e.g., funding or legal support).

This report was submitted by Phil Miller, CBSG Program Officer.



PHVA for Lion-tailed Macaque: A Follow-up Action Plan by ZOO/CBSG India

Population and Habitat Viability Assessment (PHVA) workshops have become accepted tools for collection and assessment of data, both published and unpublished, in interactive exercises structured by principles designed to extract a maximum of factual as well as insightful information. This information, in the form of recommendations, can be applied to conservation action or construction of a management action plan to save the species.

A PHVA workshop was held in October 1993 for the lion-tailed macaque, *Macaca silensus*, (LTM) in Madras, India. The workshop was organized by Zoo Outreach Organization (ZOO)/ CBSG, India and the Madras Zoo and supported by several zoos holding LTMs with CBSG/SSC providing facilitation and technical support.

Following the distribution of the report, ZOO has reviewed the recommendations and planned a series of follow-up actions to insure their implementation. An executive summary and recommendations are included in this issue of CBSG News along with a plan for encouraging relevant authorities and individuals to implement them.

Three factors should be considered with regard to the follow up action of a PHVA:

1. The CBSG which developed the PHVA exercise into its present (and still evolving) state is an advisory and technical body, not an implementing agency. Implementation is the job of the identified 'stakeholders,' i.e., the wildlife and zoo agencies and non-government organizations (NGO) in the range of the species.

2. Because the wildlife and zoo agencies in developing countries are usually governmental organizations and since recommendations may involve one or more of them as well as other large organizations or institutions with many concerns, there is need for some outside (perhaps local, perhaps not) organization or individual to inspire or generate activities with regard to the target species.

3. Follow-up for PHVAs can be difficult for several reasons. The organization which truly made the event happen may not be located in the range country and may not have access to local people, organizations, or policy makers and official agencies, or it is unable to keep abreast of current events regarding the species and its habitat. Follow-up activity is costly and after a PHVA workshop has been conducted, the primary sponsors might feel that they have done all they can for some time. Delays in the report may create a vacuum which is filled by other projects which then consume time and energy. Finally, the recommendations themselves may call for research that requires a catalyst.

ZOO/CBSG, India is now attempting to provide the impetus for implementing recommendations. We have already made a beginning with a variety of educational activities which are described below:

1. Lion-tailed macaque kits, consisting of the PHVA briefing books, stickers, a T-shirt, and posters, were sent to all zoos holding LTMs, all branches of the Zoological Survey of India (the nodal governmental research agency), other wildlife research institutes, universities, and colleges (particularly in the range area), and field officers and policy makers in the range area.

2. A flier (with detachable sticker), describing the plight of the LTM and what was learned in the PHVA, was produced in the three regional languages of the range states of the LTM as well as in English. These were sent in quantities of 500–1,000 to zoos in the range states of LTM, selected range stations, other zoos in India holding LTMs, the Central Zoo Authority, researchers in LTM habitat, and institutes concerned with educating people about LTM. This effort was funded by a local industry, the Lakshmi Mills in Coimbatore.

3. A note describing the PHVA and LTM was published in the British Airways Tourism for their *Tomorrow* publication which was produced by the thousands and circulated around the world. An attractive wallet calendar featuring LTM was produced by British Airways Assisting Conservation and given away at British Airways offices throughout the world. Many hundreds of these were donated to India and sent to zoo managers and field officers to give to their personnel and the public.

4. Discussions were held with major LTM players, both in India and abroad, about additional information, activities, and project funding that could be supplied, and requests for assistance in implementing this program were sent.

Activities for Catalyzing Action

Recommendations which require action from the legal authorities responsible for wildlife:

We propose to organize a one-day meeting consisting of chief wildlife wardens of all three range states, a ministry representative, two key researchers, and three CBSG facilitators and modelers to: 1) discuss recommendations which require official input in aid of an action plan specifically for LTM; 2) coordinate the three states; 3) explore central government funding possibilities; and 4) identify areas where authorities want assistance from universities, research institutes, and voluntary organizations. Estimated cost: US$300.

Recommendations which require daily follow-up and coordination:

Create a position of 'LTM facilitator' to be held ideally by an Indian post-graduate who worked on LTMs who will pursue LTM activities exclusively and move for the establishment and funding of a central coordinating unit. Find a desk, phone, fax, and copying machine for the facilitator. Estimated cost for three years: US$10,000.

Macaque...

Recommendations to change the legal status of all LTM areas with viable populations:

Draw up a list of LTM areas and investigate the feasibility of changing their legal status. Start lobbying by contacting all Indian volunteer agencies and informing them of the need to do this. There are powerful interests which would not want this to take place, such as some of the tea planters, some tribals, farmers, etc. There is a need to find out who these people are and create alternatives or compensation plans for them.

Recommendations regarding threats:

Search for funding and find a graduate student to: 1) study threats to the survival of the LTM; 2) their need to be controlled; 3) a record of all fire incidents; 4) incidence and application of pesticides/fertilizers in and around LTM habitats; and 5) the effect of fruit, liana, and other MFP extraction on LTM ecology. Estimated cost: US$3,000.

Recommendations regarding translocation, supplementation, reintroduction:

ZOO will administer a doctoral research project funded by San Diego Zoo on social behavior of LTMs. The work will give valuable insight necessary for successful supplementation in wild. Estimated cost: US$10,000, funded by San Diego donor.

For threats resulting from forest dependence, ZOO has designed an ecodevelopment project as an alternative to some present income-earning methods. For example, establishing insect farms run by rural and tribal people for producing insects eaten by LTMs for use by zoos. A trial farm will be set up this year. Indian zoos holding LTMs will be given insects free of cost on a trial basis to build up interest as well as a clientele for this project. This will also have the effect of improving zoo diets which do not include any animal protein at present. Estimated cost, initial trial farm set up: US$1,000; grant development for international aid funding of ecodevelopment project: US$500.

For threats resulting from the use of LTMs as medicines, ZOO will sponsor a researcher to determine what medicines are made with LTM products and which ills they are supposed to cure. Substitute medicines will be found (medicinal plants would be ideal) and ecodevelopment projects planned for tribal women to farm these medicines. This can be done with a local botanical research organization, the Foundation for Revitalization of Local Health Traditions. ZOO will organize widespread education and publicity in local languages about the good qualities of the plant medicine and facilitate the establishment of a market for ecodevelopment products. Estimated cost, education and marketing of medicinal plants: US$1,000.

Recommendation concerning education of local people living near LTM habitat:

ZOO has published literature in all local languages for literate persons. Other items with very simple messages for semi-literate and illiterate persons will probably be more effective. The fact is, however, that most of us don't know *how* to educate tribal and rural people. Therefore, ZOO will sponsor a research project to determine tribal symbols and non-linguistic means of communication so that useful materials can be made that local people will keep and carry around (e.g., cloth carry-bags, umbrellas, calendars, bedcovers). Estimated cost, research: US$1,200; production of innovative educational material for distribution to tribals: US$5,000.

Recommendation for establishing LTMs as a flagship species for the conservation of the entire region of the Western Ghats:

ZOO will try to determine the mechanism for doing this and then call on non-government organizations to lobby for it. Such projects will need to be undertaken by the LTM facilitator.

Recommendations regarding husbandry measures for LTM:

ZOO will put together a compendium of the most appropriate articles on LTM husbandry since the PHVA and circulate them to LTM-holding zoos. Estimated cost : US$150.

The experiment using insects as food can apply both to diet as well as enrichment. We will design insect feeders which dispense live insects for the animals to catch and eat. Estimated cost of making 30 insect feeders: US$3,000.

Recommendation regarding creating and fostering partnerships between areas of expertise and supplying zoos with basic equipment for research:

ZOO will write to individual zoos, universities, colleges and institutes encouraging partnerships. Determine what is necessary for a research kit containing minimal equipment for basic research. If a zoo doesn't have these, find a way to get them. Build up a fund for supporting this project. This should also be done by the LTM facilitator. Estimated cost of networking 300 institutions: US$100. The estimated cost of research items is not possible to presently estimate.

Recommendation regarding basic biological information currently not available:

ZOO will work up a series of detailed research project suggestions and circulate them to university, college, and ecology, zoology and wildlife biology departments to inspire them to suggest such projects to their students. Estimated cost, consultant for creating project suggestions: US$100; cost for circulating material to about 300 individuals and institutions: US$100.

This article was submitted by Sally Walker, CBSG, India.

CBSG, India

PHVA Report...

Baird's Tapir

The following is taken from the Executive Summary of the Population and Habitat Viability Assessment (PHVA) draft report for Baird's Tapir (*Tapirus bairdii*) . The PHVA was our first workshop of its kind in Panama and it was very successful, integrating tapir biologists, local wildlife managers, and Panamanian governmental officials in a detailed analysis of the threats directed against Panama's (and the Neotropic's) largest land mammal.

Baird's tapir is distributed from southern Mexico to northwest Colombia and Venezuela. The species is listed on Appendix I of CITES and it is classified as Endangered according to the IUCN Red List criteria. An estimated 3,000 tapirs still occupy the tropical forests of Panama. There are four primary regions that support *T. bairdii*: 1) the northern region, including the Bocas del Toro and Chiriqui areas with approximately 1200 animals; 2) the Azuero region, with approximately 50 animals; 3) the southern region, including the San Blas and Darien areas, with approximately 1500 animals; and 4) the Serrania de Maje region, with approximately 60 animals. These four regions are effectively disjunct, resulting in separate populations with no exchange.

A number of serious threats influence the future viability of Baird's tapir populations in Panama. Human-mediated habitat destruction and fragmentation continue in the country; in fact, more than half of the geographical range of T. bairdii has been destroyed over the last 40 years. Poaching of tapirs by humans, for food or other purposes, also have dramatic impacts on the tapir populations. The tapir is one of the first tropical forest species to be adversely affected by human disturbances, and the continuous encroachment of civilization upon tapir habitat can have serious consequences for the future of the species.

As a first step in developing a unified approach for protecting this species from extinction in Panama, the Asociación Nacional para la Conservación de la Naturaleza (ANCON) held a PHVA Workshop at the Rio Chagres Nature Center, near Panama City, Panama, on 1-3 December, 1994. The Conservation Breeding Specialist Group (CBSG) of the IUCN/Species Survival Commission was asked to conduct the workshop to assist in assessment and subsequent planning. Twenty-three biologists, wildlife managers, and non-government organization (NGO) representatives from both the United States and Panama attended the three-day workshop. One purpose of the meeting was to review data from wild populations as a basis for developing stochastic population simulation models. These models estimate risk of extinction and rates of genetic loss from the interactions of demographic, genetic, and environmental factors. Results from these models are then used as a tool for ongoing species management. Other goals included review of the current state of knowledge regarding habitat requirements, species distribution and population sizes, the role of direct threats as factors in the decline of the species, and the role to be played by captive breeding in the long-term management of the species.

The workshop opened with a series of presentations summarizing data on the status of both wild and captive populations of Baird's tapir. A brief presentation on the PHVA process, the principles of population biology, and the use of the VORTEX population simulation software package was made as an introduction to the use of the models and the problems associated with small, isolated populations. The participants then formed three working groups – population biology and modeling, wild populations, and captive populations – to review in detail current information, to develop input parameters for the simulation models, and to develop management scenarios and recommendations. Stochastic population simulation models were initialized with ranges of values for the key variables to estimate the viability of the population using VORTEX.

Modeling tapir populations using VORTEX demonstrated the extreme sensitivity of these populations to adult mortality. Removing an additional 6% of adults from the population, above and beyond normal mortality, results in a switch from population growth to population decline. This decline does not occur under higher levels of juvenile mortality, as long as adult mortality is low. Additionally, under stressful environmental conditions, such as drought, an annual adult poaching rate as low as 3% leads to population instability. Moreover, the risk of population extinction is greatly increased under these poaching scenarios. Taken together, these data suggest that a 3-6% annual adult poaching rate is not sustainable for any of the populations currently existing in Panama. As a result, tapir management planning must investigate strategies for reducing the rate of poaching to sustainable levels. Considerations of wild tapir population status led to the following recommendations:

1. Investigate the possibility of restoration of tapir habitat previously degraded through human activity;

2. Establish reintroduction programs in order to address the genetic problems associated with inbreeding in small isolated populations;

3. Systematically compile information regarding tapir natural history, distribution, and habitat quality without disdain for the knowledge possessed by residents of the local communities;

4. Prioritize conservation efforts in those areas deemed susceptible to fragmentation, such as the Central Cordillera;

5. Work toward making the tapir a symbol of conservation efforts in Panama;

6. Create a local Tapir Working Group in Panama;

7. Work with native people (Kuna Indians) in order to more rapidly evaluate the species' status in areas these people inhabit; and

8. Evaluate the use of captive breeding as a wild population management tool.

A data collection sheet was constructed by the participants for use with local people as a tool to collect important information on tapir population characteristics. With such a tool, it is hoped that more effective conservation of tapirs and their habitat can be effected.

Tapir...

There are currently less than 20 tapirs in zoos in Panama. The primary goals of captive tapir management include:

1. Establish educational programs acting locally, nationally, governmentally, and internationally;

2. Establish a coordinated captive breeding program in Panama;

3. Develop programs for investigation and research that will benefit the tapir in Panama; and

4. Establish goals for reintroduction.

It is vital to establish outreach programs for people living in areas of Panama where tapirs exist. Such programs increase awareness and appreciation of the species. Moreover, these programs can be effective in communicating the devastating effects of overhunting. For captive programs to work in Panama, it will be important to make scientific information on tapirs, translated into Spanish, available to researchers. Furthermore, regarding captive tapir husbandry, it is critical that captive tapirs be managed as a single effective group and held at multiple cooperating facilities. Perhaps most importantly, the participants proposed to form the Panama Tapir Committee, which will be primarily responsible for deciding how captive tapirs are managed in Panama and which inter-zoo transfers are to be made.

The goal of reintroduction is a highly desirable one for effective tapir management, but the participants felt it necessary to delay this goal until current threats to wild populations are identified and resolved. While this phase is in effect, disease surveys on captive and free-ranging tapirs are to be conducted in order to identify disease problems. Furthermore, research should be conducted on genetics, reproduction, and behavior of tapirs, and husbandry and veterinary protocols should be developed for captive animals.

Effective conservation of Baird's tapir in Panama will be a complicated issue, with input from biologists, governmental organizations, and local communities. Perhaps only through concerted integration of wild and captive population management can the goal be achieved.

This report was submitted by Phil Miller, CBSG Program Officer.

Barasingha PHVA

A Population and Habitat Viability Assessment (PHVA) workshop for all three subspecies of barasingha was held on 3-6 July 1995 at the Wildlife Institute of India, Dehra Dun, under the auspices of the Department of Forest, Uttar Pradesh, CBSG-India, Wildlife Institute of India, and the Central Zoo Authority with the Forest Departments of Madhya Pradesh and Assam as collaborators.

The barasingha PHVA was also held in connection with a Wildlife Institute of India training workshop on CBSG processes and population biology. This training workshop focused on workshop modules developed by the CBSG, e.g., PHVA, Conservation Assessment and Management Plan (CAMP), and Regional Captive Action Plans/Recommendations (RCAP/Rs). Dr. U. S. Seal, CBSG chairman, Dr. John Ballou, and personnel from the Wildlife Institute and CBSG, India conducted the two-week training.

The first week was taken up largely by the PHVA for barasingha after which the attendees disbursed, leaving the CBSG and CBSG, India team members and participants of the full training workshop to finish the report as part of their training exercise. Part I of the training workshop was a genuine PHVA; Part II included a variety of topics and continued through 15 July. Participants of the training workshop consisted of selected WII faculty and students and field officers.

An additional component of the exercise was that the Central Zoo Authority had requested that the Center for Cellular and Molecular Biology (CCMB) collect blood samples of barasingha at Lucknow Zoo and begin a series of analyses to ascertain parentage of individuals, subspecies markers, and the degree of heterozygosity. Zoos in other parts of the world with identification problems of barasingha subspecies are being invited to send their samples to India for analysis. The five Indian zoos which are holding barasingha presently are Lucknow, Kanpur, Delhi, Chhatbir, and Mysore.

This article was submitted by Sally Walker, CBSG, India.

PHVA for Indian Gharial

CBSG, India held its first all-Indian instigated, organized, funded, and facilitated Population and Habitat Viability Assessment (PHVA) workshop on 16-18 January 1995 for the Indian gharial. The workshop was held at Jiwaji University, Gwalior. This workshop followed the CBSG PHVA Facilitators Workshop held in Minnesota and two of the persons trained there lead and modeled for the gharial PHVA.

The objective of the workshop was to assess the current status of gharial after two decades of egg collection, captive hatching and rearing, supplementation, and management. Recent wildlife agency decisions to terminate supplementation of wild populations resulted in the withdrawal of active assistance towards recuperation of the species. The workshop was initiated by the School of Studies in Zoology at Jiwaji University which has been involved actively in research activities and conservation of this species for ten years with the Madhya Pradesh Forest Department as a major collaborator. The Ministry of Environment and Forests, Government of India, financed most of the workshop. The Zoo Outreach Organization/CBSG, India facili-

tated the workshop and collected additional funds from western zoos holding gharial to be used for an education program, for additional copies of briefing material for distribution to all zoos and related organizations, and for the report.

In the past two decades, about 4,000 gharial have been released into 12 rivers in four states under the 'Grow and Release' program in which eggs were collected and hatched and then hatchlings were reared to sizes that increased their probability of their survival. The workshop recommended specific research activities to further check populations which had been supplemented. The age of the animals when released and the sex ratio may also need to be redefined according to scientific findings.

Components which make up 'ideal' habitat for gharial were defined and sites which fall outside protected areas, but which were felt to be highly suitable and stable, or those which migrant gharials are trying to recolonize were recommended for protected status under the Indian Wildlife (Protection) Act.

Ten direct and eight indirect threats were identified and the Mahanadi River emerged as the most seriously threatened region. Inbreeding could be a more serious threat than previously considered according to the modeling exercise.

All captive facilities combined can generate a spatial capacity sufficient to propagate as many animals as required. If this were done, it was recommended that zoos holding gharial should undertake a coordinated breeding program and to create or upgrade gharial enclosures so as to be more educationally relevant and more mindful of the welfare of the animals. The workshop participants agreed that lack of public education had been a major lacuna in the Crocodile Conservation Program and they appreciated the detailed program drawn up by the working group.

This article was contributed by Sally Walker, Convenor, CBSG/ India.

Conservation Assessment and Management Plan for Bird and Mammal Species Endemic to Panama

Over the past 20 years, the Neotropics have become a focal point for conservation efforts. Most species inhabiting this ecologically-important region are particularly susceptible to human disturbance (both hunting and habitat destruction), and a significant number now are considered threatened. Many of these species are candidates for use as bio–indicators for monitoring and management of protected areas throughout Latin America, as well as for flagship species for the conservation of Neotropical rainforests.

Panama is one of the most important centers for biodiversity in Central America, yet there exists little information concerning its wildlife. There are more than 230 species of mammals, 929 species of birds (with 145 migratory species), 224 reptile species, 160 amphibians, and some 7,897 species of vascular plants. Nonetheless, there has been a decrease in the number of species due to habitat destruction particularly, deforestation. Other factors also affect species survival, including the use of pesticides, pollution, trade, and poaching. As such, there are numerous species in Panama that are on the road to extinction, including mammals, birds, reptiles, and amphibians, indicating that there is great need for actions to provide for their protection and recovery in the wild.

Panama is making great efforts to conserve its biodiversity. Protected areas integrate 14 national parks (encompassing 1,340,372 hectares or 18% of the country); there also are seven forest reserves, nine wildlife refuges, two protected forests, and six other categories comprising 748,511.5 hectares, making a grand total of 2,088,883 hectares. These protected areas provide refuge for a large number of species, and they have been designed to overlay the distribution of many endemic species.

In November 1994, a Conservation Assessment and Management Plan (CAMP) workshop was held at facilities of Asociación Nacional para la Conservación de la Naturaleza (ANCON) at the Environmental Education Center Río Chagres in Panama. The workshop was sponsored by the Walt Disney World Co., Wildlife Conservation Society, American Airlines, and the Zoological Society of San Diego. A total of 24 participants from four countries reviewed available data for the endemic birds and mammals of Panama and discussed the status of the wild populations of these species. Considerable emphasis was placed on in situ programs, and the further development of the networks among Panamanian researchers. Few of these species are currently found in or require captive programs.

The results of the CAMP underline the need for further collaborative efforts to conserve the endemic birds and mammals of Panama. The deteriorating conservation status of many species, even during the last decade, emphasized the need for immediate action. The participants reached consensus that efforts to conserve these species should focus on field programs, and that additional information on distribution, population status, ecology, and biology are of vital importance. Following are a summary of the CAMP recommendations.

Categories of Threat

One hundred and four (104) distinct avian taxa (subspecies) and 38 distinct mammal taxa, distributed in Panama, as well as Costa Rica and Colombia, were considered by the CAMP for Bird and Mammal Species Endemic to Panama. Of the 142 taxa, 97 (68%) were assigned to one of three categories of threat, based on the New IUCN Red List criteria:

Panama...

Extinct (?)	1 taxon
Critical	15 taxa
Endangered	37 taxa
Vulnerable	44 taxa
Conservation Dependent	2 taxa
Low Risk	37 taxa
Data Deficient	6 taxa

Threats

For the purposes of the CAMP process, threats were defined as 'immediate or predicted events that cause or may cause significant population declines.' The primary threat to the endemic avifauna of Panama is deforestation and the consequent destruction and fragmentation of habitat. These are caused by different factors in different regions.

In the Macizo Central region, avian species are confined to altitudes higher than 900 m. In the central and western portions of Macizo, deforestation is destroying the vegetative cover, affecting the survival of forest species, particularly black guan (*Chamaepaetes unicolor*) and quail (*Geotrygon spp.*). This area comprises the northern limit for 28 species of South American avifauna and the limit for various North American migratory species.

The Pacific Central region of Panama is characterized by high levels of deforestation, the effects of which date back to the pre–Colombian period. The forests are reduced to remnant patches along rivers and waterways. The reduction of the lowland forests of this region has drastically affected populations of scarlet macaws (*Ara macao*). This has been one of the results of agricultural development and ranching in the past years. Because of soil characteristics, forest regeneration is very difficult once they are destroyed. The lower forests of the southwest Azuero peninsula are endangered, which affects Ara macao.

Coiba Island is the largest island in Panama and it is home to 20 races of Passeriformes and the largest scarlet macaw population in the country. The principal threat for Coiba Island is eco– tourism and its associated human interference.

The eastern region of Panama consists of two slopes, one on the Atlantic side and one on the Pacific. On the lower side of the central portion there is an important forest area. In this zone, the high rate of deforestation as well as agricultural development and ranching represent the major threat to the birds of Lake Bayano and to the birds which use it as a migration corridor. In this area, deforestation rates have changed considerably in the past few years largely because of state and private logging campaigns.

Perhaps the greatest impact on the eastern province and the Darién region will be the proposed construction of the Pan-American Highway which will connect Panama and Colombia.

The mammal species of Panama face a variety of potential threats concomitant with habitat loss associated with various human activities. During the CAMP process, it was determined that endemic Panamanian mammals are placed at risk by habitat loss, pesticide use, human persecution or interference, hunting, genetic problems, predation, illegal trade, and disease.

The loss of habitat is the most widespread threat and affects the majority of endemic mammal species. Habitat loss is directly associated with human activities such as logging, burning, ranching, agriculture, road construction, and industrial development. These activities are either directly or indirectly related to the threats encountered.

Pesticides are a threat that affect a high proportion of species, particularly those whose range extends into areas of agriculture where these products are used. Human persecution equally, affects the population status and trends of many mam-

Table 1. List of avian species that will be seriously affected by the construction of the Pan-American Highway.

Crypturellus kerriae
Odontophorus dialeucos
Geotrygon goldmani
Otus clarkii
Lepidopyga coeruleogularis
Hylocharis grayi humboldtii
Goldmania violiceps
Goethalsia bella
Brachygalba salmoni
Pteroglossus sanguineus
Capito maculicoronatus
Piculus callopterus
Xenerpestes minlosi
Margarornis bellulus
Thamnophilus nigriceps
Xenornis setifrons
Oncostoma olivaceum
Aphanotriccus audax
Manacus vitellinus
Carpodectes hopkei
Campylorhynchus albobrunneus
Thryothorus spadix
Myadestes coloratus
Basileuterus ignotus
Dacnis viguieri
Chlorospingus tacarcunae
Euphonia anneae
Tangara fucosa
Tangara palmeri
Chlorospingus inornatus
Psarocolius guatimozinus
Trogon bairdii

Table 2. List of mammals that will be seriously affected at the local and regional level by the construction of the Pan-American Highway.

Marmosa invictus	*Tylomys fulviventer*
Cryptotis mera	*Tylomys watsoni*
Lasiurus castaneus	*Tylomys panamensis*
Saguinus geoffroyi	*Reithrodontomys Dariénsis*
Saguinus oedipus	*Isthmomys pirrensis*
Orthogeomys Dariénsis	*Rheomys raptor*
Neacomys pictus	*Coendou rothschildi*
Rhipidomys scandens	*Diplomys labilis*

malian species. Humans often eliminate any animal populations considered to be pests; rodent species are the most affected by these activities. Threats not as directly associated with human activity are disease, predation, and the situation in which species are considered 'rare.'

A large portion of protected areas are designed around the distribution of the many mammals contained within them. Those animals that range partially within protected areas derive benefits from them as well.

The Pan-American Highway

The proposed construction of the Pan-American Highway linking Panama and Colombia merited special consideration within the CAMP for Endemic Birds and Mammals of Panama. It is likely that the project could have an important impact on the biodiversity of the area with repercussions at the local, regional, and world level.

Among the three phases of the project (planning, construction, and the actual functioning of the highway), the last two may generate the most important environmental impacts, particularly the activities surrounding the project (movement of earth and deforestation, among others) and their associated effects (e.g., colonization and changes in land use practices). These activities will cause habitat fragmentation and destruction and isolate populations of birds and mammals about which, for the most part, are little known. The avian species that could be seriously affected at the local and regional level are presented in Table 1; mammals are presented in Table 2.

The impact of spontaneous colonization by humans has created a swath of deforestation 15 km wide along the existing part of the highway in the Chepo–Yaviza zone in Panama (200 km). The concomitant uncontrolled increase in the human population likely will be accompanied by land speculation and general destruction of the local natural areas. Some endemic plant and animal species are restricted to a corridor of remnant forest through which this proposed project will run. If the proposed project is built, the Darién National Park will be seriously fragmented and two of its most important centers of endemism (Cerro Tacarcuna and Cerro Pirre) will be drastically separated by the highway.

In Colombia, the proposed project will cross the Los Katios National Park which comprises a small (70,000 ha) protected remnant of an important biogeographic region of the Darién. This area represents the 'last stand' for many species of regional flora and fauna. The highway project may bring about the conversion of areas of high biodiversity to monoculture (primarily bananas grown for export). The construction of the road to Juradó (Choco) will trigger extensive ranching and logging in the foothills of the Cerros Tacarcuna, Pirre, Alto Quia, and Nieve. Both these activities are known to cause drastic changes in the diversity of birds and mammals and their population densities.

The increased overland traffic between the two countries will provide an easy means for immigration by Colombians (and other South Americans looking for alternatives) to the Panamanian territory. Resulting deforestation and fragmentation of forests will contribute to more rampant illegal wildlife trade, which at this time includes species such as Ara chloroptera (green–winged macaw), Ara severa (chestnut–fronted macaw), *Ara araruana* (blue and gold macaw), and many *Amazona* species. Also likely to increase will be poaching of various cracid species (guans, curassows, and chachalacas), most of which are already threatened. The uncontrolled invasion of the area affected by the highway by people from the central part of Panama and from Colombia will lead to social conflicts and will likely contribute to the displacement of indigenous peoples of the area with the loss of their culture and traditional practices that use local natural resources.

For the above reasons, the workshop participants agreed that the detriment to biodiversity in the corridor through which the proposed road will run is significant, and further, that the construction of the highway would lead to irretrievable losses and changes in the plant and animal life of the region.

Research Management Recommendations

For all taxa, recommendations were generated for the intensive management and research action necessary for conservation. Workshop participants attempted to develop an integrated conservation approach. In all cases, an attempt was made to make management and research recommendations based on the various levels of threats impinging on the taxa.

Panama...

Seventy–four of the 142 taxa (52%) were recommended for Population and Habitat Viability Assessment (PHVA) workshops. Tentative or 'pending' PHVA workshops were recommended for 13 taxa (9%). Recommendations for Research Management were:

Survey	109 taxa
Monitoring	125 taxa
Life history research	34 taxa
Limiting factors research	24 taxa
Limiting factors management	18 taxa
Habitat management	38 taxa
Taxonomic research	13 taxa
Husbandry research	1 taxon

For most taxa, more than one type of research management was recommended. Workshop participants agreed that field investigations and management programs to aid conservation of Panamanian species should be the highest priority among all activities recommended by the CAMP. Data were especially lacking from the field; surveys, ecological studies, and applied investigations of species biology (including investigations of hunting and habitat modification pressures affecting the species) are of paramount importance. Monitoring of populations is also a high priority, particularly when undertaken in conjunction with larger scale programs to monitor the status and ecological health of protected areas and other natural habitats.

Captive Programs

None of the avian taxa were recommended for captive programs at the time of the workshop. Two mammal species, Oersted's squirrel monkey (Saimiri oerstedi) and the Coiba Island agouti (*Dasyprocta coibidae),* were recommended for Level 1 and Level 3 programs, respectively (based in part on New IUCN Red List criteria).

Captive programs for 18 taxa were listed as 'pending,' meaning that recommendations for such would be postponed until further information was available, either from survey, a PHVA, or from sources which need to be queried. One hundred and eighteen taxa were identified as not requiring captive programs.

The participants in the CAMP for the endemic bird and mammal species of Panama wish to emphasize that they do not view the recommendations of this document as 'stand–alone' initiatives. Rather, these activities should be seen as components of the overall need for the conservation of Neotropical ecosystems. Many of the species reviewed in the CAMP are excellent candidates (as bio–indicators, key species, or flagships) to help facilitate larger–scale conservation programs. Their inclusion is urged in the planning stages of projects related to research, monitoring and further management of Panamanian forests, protected areas, and other natural ecosystems.

Submitted by Susie Ellis, César Márquez Reyes, Eduardo Alvarez–Cordero, and Julieta de Samudio.

Joint CBSG-IUDZG Resolution...

Implementation of the U. N. Convention on Biological Diversity

The following joint resolution of the Conservation Breeding Specialist Group (CBSG/SSC/IUCN) and the International Union of Directors of Zoological Gardens - The World Zoo Organization (IUDZG-WZO) was passed at the 50th annual conference of the IUDZG-WZO in Dublin on 5 October 1995:

REALIZING that biological diversity that comprises genes, species, and ecosystems is one of earth's most valuable assets for supporting economic development and maintaining human welfare all over the world.

RECOGNIZING that the Earth Summit Conference 1992 in Rio de Janeiro has produced several international commitments to support the implementation of the concept of sustainable development. One of these commitments was reflected in the U. N. Convention on Biological Diversity. At the time of the signing, the convention was signed by 157 heads of countries, states, or their representatives.

RECOGNIZING that the first conference of the Parties (COP1), held in Nassau, Bahamas in November 1994 decided on the venue of the second conference of Parties (COP2) to be Jakarta, November 6-17, 1995 with its theme, "Biodiversity for equitable welfare of all people."

RECOGNIZING that in view of the rapid loss of biodiversity and the risk of the development and implementation of biotechnology, the Second Conference of the Parties (COP2) to be strategic momentum for concrete global and justifiable action plan as a new approach for global partnership that should be reflected within international and regional cooperation for conservation and development.

RECOGNIZING the aim of the World Zoo Conservation Strategy as to help conserve earth's rapidly disappearing wildlife and biodiversity on a global scale.

RECALLING the joint CBSG-IUDZG resolutions in Singapore in 1991 on the UNCED Conference in Rio de Janeiro in 1992, the designation of the decade of the 90's as the "Save the Wildlife Decade" in Vancouver, September 1992 and the Ratification of the International Convention on Biological Diversity and the International Framework Convention on Climate Changes in Sao Paolo, August, 1994.

CONSIDERING the deliberations in the annual meetings of CBSG and IUDZG, the World Zoo Organization and the workshop on Futures Search for the IUDZG-WZO held in Koln, May 1995.

WE RESOLVE to urge all signatory parties to implement concrete actions in undertaking obligations embodied in the Convention on Biological Diversity, for the benefit of life on earth, for present and future generations.

Executive Summary...

Mediterranean Monk Seal PHVA

The Mediterranean monk seal is the world's most endangered phocid seal. No reliable estimates of total population size exist, but it is probably less than 500. There are two widely-separated but potentially viable populations: one on the Atlantic coast of North Africa and the other in Greece (Aegean and Ionian Seas). There have been no major changes in the size and distribution of the North African population nor in the broad distribution of the eastern Mediterranean population over the past 20 years. However, populations in other parts of the Mediterranean have declined or disappeared altogether.

Greek scientists, conservation organizations, and wildlife authorities have developed a collaborative Greek National Program for the Protection of the Monk Seal under the coordination of Elliniki Etairia. The goal is to eliminate human-caused mortality of seals in the Greek population and to restore and maintain a genetically-viable, self-sustaining, free-living monk seal population. To achieve the recovery goal, it is necessary to understand the risk factors affecting survival of the monk seal and to reduce the risk of extinction to an acceptable level. Software tools to assist simulation and quantitative evaluation of risk of extinction are available and were used as part of Population and Habitat Viability Assessment Workshop. This technique identifies and ranks risks and assists in assessment of management options.

Forty-five biologists, managers, and decision-makers attended a Population and Habitat Viability Assessment (PHVA) Workshop in Athens, Greece at the Elliniki Etairia premises on 4-7 April 1994 to apply these recently-developed procedures to the Greek population of Mediterranean monk seals. The Conservation Breeding Specialist Group and the Seal Specialist Group of the IUCN/Species Survival Commission were invited by Elliniki Etairia to collaborate and facilitate the discussion and decision-making process. The purpose was to review data on the wild population as a basis for developing stochastic population simulation models. These models estimate risk of extinction and rates of genetic loss from the interactions of demographic, genetic, and environmental factors. Other goals included determining habitat requirements, the role of direct threats (including killing by fishermen), the potential role of indirect threats (such as disease), and prioritized research needs.

Based upon a consensus of the participants, the following life history values were selected for the modeling process. All adult males were assumed to be available for breeding. Age of maturity for females was set at either five or six years based upon comparisons with the Hawaiian monk seal and limited data for the Mediterranean monk seal. The interbirth interval value used was two years (50% of females produce a pup each year). The risk of disease was included in some of the models. The initial population in 1993 was set at 90, 180, or 360 (reflecting an agreed range of numbers). Carrying capacity was set at 500. An equal sex ratio at birth was assumed. All simulations started with a stable age distribution. Inbreeding depression was not included in the scenarios. A range of values for mean juvenile mortality (20, 40, and 60% for the interval between birth and one year), and mean adult mortality (either 2, 4, or 6% from age of maturity until death) was used to determine the sensitivity of the intrinsic rate of increase and probability of extinction to these parameters. Projections were run for 200 years and each scenario was run 200 times.

Recommendations for Wild Populations

1. Provided that deliberate killing is drastically reduced or eliminated, the probability of survival of the Greek Monk seal population is very high. Therefore, the highest priority must be given to reducing deliberate killings of seals. Actions should reduce the antagonism that fishermen feel towards monk seals. Existing public awareness and sensitization programs in Greece already have had some success. However, more immediate action also is required including increased enforcement and legislation forbidding the carrying of firearms on boats and the killing of seals. Since guards have been present in the Northern Sporades National Park and fishermen using traditional methods have been given exclusive access to certain areas, no deliberately-killed seals have been found. These management actions should be continued and they can be used as a model to reduce deliberate killing elsewhere. Such efforts should be concentrated in areas where killing is particularly frequent.

2. Even if reducing deliberate killing is effective, it will not eliminate the probability of extinction unless the potential rate of population growth is relatively high. Presently, the actions necessary to ensure this are not known. Therefore, there is an urgent need to develop a multi-disciplinary integrated program to study the factors affecting reproductive success, survival, feeding success, and migration in the Greek monk seal population. An early evaluation of results will make it possible to determine priorities for additional management actions.

3. Care is necessary in interpreting fishermen's reports on the status of wild populations because they are likely to classify any sighting of two seals that differ substantially in size as a mother and pup even if the two individuals actually are a large adult and a smaller, sub-adult. Further work is needed to assess the different approaches used to interpret seal sightings by fishermen (the problem with the interpretation and accuracy of the reports given by the fisherman is general, i.e. color, age, action, etc.).

4. The composition of field teams and their continued presence in particular areas should be maintained as much as possible and descriptions of individual animals should be recorded in a standard format that makes it possible for newly-recruited observers to accurately identify individuals.

5. Further analysis of the available data on the characteristics of shelters used by monk seals for resting and breeding is needed to allow for potential additional habitat.

Recommendations Concerning Direct Threats

Habitat Degradation and Disturbance

1. Analysis and assessment of the projected land use developments and the threats they may pose must be made in relation to the size and location of important monk seal habitats.

2. Priorities must be set for protecting those areas known to contain important breeding caves, although other peripheral caves must not be excluded. Habitat carrying capacity must not be further reduced by land use developments.

3. Where surveys indicate high levels of pollutant sin seals and their foods, the source of the pollutants must be identified and the problem corrected.

4. There must be more emphasis on cooperation and collaboration of the various working teams with governmental bodies in directing conservation activities on the species and its respective habitats.

5. In the execution of present and future research activities high priority must be placed on minimum disturbance to the seals.

6. Contingency plans must be prepared with the cooperation of all teams available to deal with potential crises, especially an oil spill close to or in monk seal habitat as well as a broad range of potential threats.

Interaction with Fisheries

1. The highest priority be placed on reducing deliberate killings by fishermen. Public awareness, sensitization of the fishermen, and environmental education are considered important long-term actions. The latter, in particular, may be considered a general recommendation applying to both habitat and fishery aspects. However, such efforts do not suffice as conflicts of interest are simply too strong. The continuous presence of a team in the area is considered important to maximize awareness and sensitization, though in some cases, it might stimulate conflicts in the absence of acceptance by fishermen.

2. At the policy level, fisheries must be considered an integral part of work carried out on the Mediterranean monk seal. The specific characteristics of the fishery in each area (fleet structure, fishing gear, exploited species) must be carefully studied in relation to community policy and the interactions between seal and fisheries monitored.

3. On the basis of monitoring activities, those areas where greatest damages to nets are caused by seals must be identified and designated as high priorities on which to concentrate on reducing fishermen's antagonism. Areas where killing is occurring frequently should have the highest priority for action to reduce kills.

4. Protected zones with exclusive fishing rights for local coastal fisheries and other protection measures are strongly recommended. An important working example in Sporades was mentioned where the establishment of a marine park has been considered as a positive measure by the fishermen and no killed seals have been found in the last five years.

5. The effective control of protected areas is crucial. Port police must be provided with all necessary equipment and manpower to be successful. The possibility must be explored of non-government organizations working together directly or indirectly with competent authorities on effective patrolling of protected areas. Further, continuous and adequate funding must be secured through national and international sources for safeguarding and surveillance against illegal activities within the National Marine Park of the Sporades and other such protected regions in the future.

6. Direct compensation measures for fishermen (i.e., nets, money) appear to be associated with many problems (e.g., difficulty of accurately assessing gear damage and escalating demands by fishermen). These issues must be handled very carefully on a case-by-case basis.

7. Efforts are needed to reduce other sources of income loss to the fishermen (e.g., illegal fishing, amateur fishermen). The licensing system for amateur fisheries must be re-evaluated (e.g., individual license, vessel license, fishing gear) and regulations must be made to decrease overall fishing effort. Strong lobbying action is needed to restrict illegal use of scuba diving equipment for spearfishing, concentrating first on areas representing important monk seal habitats.

8. Provide improvements in the technical infrastructure of the fishery such as ice-making facilities and VHF radio to serve as important supportive measures which will continuously remind the fishermen of a positive intervention associated with the presence of the seal. Such actions should be considered as part of an incentive program to reduce killing.

9. Reorientation programs to other fishing activities not in direct antagonism with the monk seal should be examined as a possible way to reduce local conflict with seals.

Recommendations Concerning Indirect Threats

1. Adherence to appended guidelines for collecting, handling, and shipping biological samples from the Mediterranean monk seal, for evaluating the presence of infectious diseases and pollutants and for assessing genetic diversity, is essential for all individuals working with these animals because sampling is only done when animals are handled for other reasons.

2. Vaccination of free-ranging Mediterranean monk seals as a preventative measure should not be performed. However, a contingency plan to deal with the implications of a disease outbreak in an isolated sub-population should be developed and made available if a vaccine is demonstrated to be of significant value in a model seal species.

3. Concerted efforts should be made to integrate information from opportunistic sampling of Mediterranean monk seals for environmental contaminants with information collected on the distribution of these contaminants in the seals' ecosystems.

4. Opportunistic sampling of material from Mediterranean monk seals should continue for the purpose of evaluating population genetics.

5. Communication and collaboration among field biologists and basic scientists are essential if decisions are to be made and insight obtained on how to manage Mediterranean monk seals.

CBSG Schedule - 1996-97

Following is a *tentative* schedule of events that the CBSG staff will be attending. This schedule is presented for those wishing to meet with the staff at opportune times and places. Personnel abbreviations are: (S) Ulysses Seal, (E) Susie Ellis, (B) Onnie Byers, (M) Phil Miller.

1996

August

18 - 20	Indianapolis, Ind.: Society for Cryobiology Annual Meeting (S)
21 - 22	Denver, Colo.: CBSG Steering Committee Meeting (All staff)
23 - 25	Denver, Colo.: CBSG Annual Meeting (All staff)
23 - 25	Denver, Colo.: IUDZG (S)

September

2 - 11	Phoenix, Ariz.: Sonoran Pronghorn Meeting (M)
2 - 10	Capetown, South Africa: Third International Penguin Conference and CAMP Review (E)
17 - 21	Honolulu, Hawaii: AZA Meeting (S)
30 - 8 Oct	Costa Rica: CAMP and PHVA (S)

October

1 - 7	Italy: Falconiformes CAMP (E)
8 - 9	Montreal: SSC Staff Meeting (E)
10 - 13	Montreal: SSC Steering Committee (S,E)
17 - 19	Malaysia: CBSG/SEAZA Workshop
22 - 25	Malaysia: SEAZA
28 - 31	Texas: Aquifer Project (S,M)

November

9 - 10	Yokahama, Japan: (S)
10 - 12	Chiba, Japan: JAZGA (S)
13 - 16	Thailand: Eastern Sarus Crane PHVA (S)

December

1 - 7	Omaha, Nebraska: Facilitator Training Workshop (B,E,M,S)
7 - 14	China: Panda Masterplan Workshop (S,M)
15 - 18	Beijing, China: University of Beijing Workshop (S,M)

1997

January

4 - 12	Uganda: Chimpanzee PHVA (S,M)
30 - 31	Dallas, Tex.: Save the Tiger Fund Council Meeting (S)
?	Costa Rica: Mesoamerican Felid CAMP Review (S,B)
?	Antananarivo, Madagascar: Madagascar Prosal CAMP and PHVA (E,S,M) Belo
?	Brazil: Brazilian Primate CAMP; Muriqui PHVAs (S)
?	Indonesia: Pheasant PHVA and CAMP (S)
?	Columbia: Columbian Primates CAMP; Mountain Tapir PHVA (E,S or M)
?	Inda: Mammals CAMP (B)

March

2 - 15	Cuba: (S)

June

?	Mexico: ALPZA
?	Papua, New Guinea: Tree Kangaroo CAMP and PHVA (B,M,S)
?	Irian Jaya, Indonesia: Tree Kangaroo CAMP and PHVA (B,M,S)

August

14 - 17	Berlin, Germany: CBSG Annual Meeting
17 - 21	Berlin, Germany: IUDZG
?	Puebla, Mexico: Cactus CAMP and PHVA (E,S)

1998

October

9 - 11	Yokohama, Japan: CBSG Annual Meeting

CBSG Office Notes...

E-mail Available

The CBSG Office now has E-mail capability. For those wishing to use this computer communications, the address is:

cbsg@staff.tc.umn.edu

New Banking Information

Banking information for the CBSG Office has been changed. Please send wire transfers to:

FIRST BANK NA ABA No. 091000022
for credit to CBSG Account No. 1100-1210-1736

As in the past, checks should be payable to CBSG in U.S. funds drawn on a U.S. bank.

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 55124-8151 USA