P.H.V.A. for Sri Lankan Star Tortoise and C.A.M.P. for Sri Lankan Chelonians

The PHVA for Sri Lankan Star Tortoise and CAMP for Sri Lankan Chelonians took place on 10-12 December 2003, at the National Zoological Gardens Sri Lanka. It was organised by ARROS, Amphibian and Reptile Research Organisation of Sri Lanka, Zoo Outreach Organisation, CBSG, South Asia and sponsored by AB Adverture Parks, Turtle Survival Alliance at Ft. Worth Zoo & Minnesota Chapter of the American Association of Zookeepers.

The Inaugural began with lighting of the traditional oil lamp. Dr. Anslem de Silva introduced the CAMP and PHVA workshops. Sally Walker, Convenor, CBSG South Asia explained the CAMP and PHVA Process. Dr. Indraneil Das, Chair, South Asian Reptile Specialist Group gave a presentation on chelonian diversity of the Indian Subcontinent. The Chief Guide, Mr. Dayananda Kariyawasam, Project Director, Protected Area Management and Wildlife Conservation of the Ministry of Environment of Sri Lanka gave the Keynote address. Sanjay Molur, Convenor, South Asian Reptile Specialist Group gave the Vote of Thanks. After refreshments in the zoo cafeteria the PHVA Workshop began.

Background
PHVA workshop for Sri Lankan Star Tortoise
The Indian Star Tortoise, *Geochelone elegans* is distributed in India, Sri Lanka and Pakistan. The species is known for its brightly coloured and patterned shell, an attractive combination of colour and temper that has made it vulnerable to trade, particularly the Sri Lankan population due to larger body measurement and more dramatic marking. In Sri Lanka, many people believe there is no international trade due to the efficacy of search effort by Sri Lankan customs officials and also the success of captive breeding in many parts of the world. However, there is evidence of domestic use for food and pets other threats unrelated to trade, such as injuries inflicted by human beings, injury due to burn in brush fires, local consumption as food, road kill, and parasitic infections. For these reasons and also to closely examine some of the beliefs held relating to trade and other factors it was decided to conduct a PHVA workshop for Star Tortoise.

Conservation Assessment and Management Plan (C.A.M.P.) Workshop for Sri Lankan Chelonians
In 1998 a Conservation Assessment and Management Plan Workshop for 173 Reptiles and Amphibians of Sri Lanka was organised for five days from 26 to 30 November 1998, in the University of Peradeniya, Faculty of Medicine in which of the 9 chelonians, 8 were assessed. Of the 8 chelonians 5 were assessed as Endangered and 3 as Vulnerable. In the intervening five years, the Sri Lankan conservation community has conducted some surveys and projects. A C.A.M.P. review of the eight chelonians to run along with the P.H.V.A. for Star Tortoise will provide an opportunity for reptile researchers of Sri Lanka to review the status of chellonians to see if their status has either improved or diminished. As a South Asian Regional C.A.M.P. and Global Reptile Assessment (G.R.A.) is planned for 2004, it

will be a good preparation for this larger event, e.g., a means of discovering gaps in information which need to be filled, and also a "heads up" for researchers and managers should there be dramatic changes in status since 1998.

Preliminary Report Summaries of PHVA and CAMP
PHVA
The Sri Lankan Star Tortoise, *Geochelone elegans*, is distinct from the Indian population of the same species because of years of geographical barrier between the two. In recent years, comparative taxonomic studies of the population of this species within Sri Lanka also indicates that there could be two distinct evolutionary significant units of populations within the island, according to Indraneil Das, a turtle and tortoise taxonomy expert and Chair of the IUCN SSC Reptile Specialist Group.

The Star Tortoises are a popular species of reptiles that are in demand as pets all over the world. Their size, temperament and disposition makes them ideal for animal lovers. In the workshop it was agreed by participants that they are caught from the wild, and this could be leading to a slow extirpation of the species from areas of high harvest. Star tortoises in Sri Lanka also face other threats such as from collection by locals for meat, medicine, scarring or damaging from agricultural implements, man-made fires, etc., according to Anslem de Silve and his students who have conducted recent field studies. For example, in one instance, a population of stars found in good numbers in a location in Sri Lanka in the early 1900s, is now totally extinct from that area as a result of human interference.

A Population and Habitat Viability Assessment (PHVA) was organized for the Sri Lankan Star Tortoise, where all the participants with field experience contributed to the running of a population simulation model to determine the probability of extinction of the species. In a few early trials, a basic model was constructed wherein information from experience in captive breeding and from other literature sources were compiled to compensate for gaps in knowledge of the biology of the species.

Unfortunately, there was a problem with both computers and the VORTEX programme at the workshop, and it was not possible to complete simulations. It was agreed by the group that Sanjay Molur and C. Srinivasalu would run the programmes after the workshop as and when they could repair the programme, and communicate with participants. All participants gave their email numbers for this purpose. This process is going on.

According to this model and the simulations which have been run till date, the following can be concluded. Irrespective of the rate of juvenile mortality, the populations of 100, 400, 700 and 1000 went extinct when there was an added harvest rate of just a minimum of 5 individuals in each age class. When the mortality rate was increased to 85% in the first year of hatching populations with 3000 and 5000 individuals also went extinct, irrespective of harvests. This indicated that for any number of individuals in a population the species went extinct within 20 years. Smaller populations just did not have any chance of survival beyond the 10th year.

There is not yet sufficient information on the contiguity of distribution of the species in Sri Lanka for the purposes of modeling. We have limited the number of individuals at certain threshold numbers because more numbers of individuals could not be modeled due to the speed of the computer running the programme. Metapopulations are not yet modeled, but this will be done in the near future.

However, on the basis of juvenile mortality of single populations a scenario in the field similar to those modeled indicates a high probability of extinction in the wild if the rate of juvenile mortality was high combined with man-made catastrophes such as fire and harvest (for food, medicine, trade) if such were to continue

C.A.M.P. Workshop
Two Working Groups were formed to work through the Taxon Data Sheet for Land and for Marine forms. Information had been collected at the 1998 CAMP Workshop and from Biological Information Sheets from participants. This information had been typed into the CAMP Data Entry Programme in advance of the workshop. The participants contributed information, much of it new or in more detail. This was the second experience most of the participants had had with CAMP workshops and they were in a better position to know the significance of certain data and to contribute.

The Table below reveals several changes in status between the 1998 workshop and the 2003 workshop.

Table : Status of Sri Lankan Chelonians according to 1998 and 2003 Assessments in Conservation Assessment and Management Plan Workshops

Scientific name	Family	1998 Cat & Crit	2003 Cat & Crit
Caretta caretta (Linnaeus, 1758)	Cheloniidae	EN -- A1cd	CR-- A3cd
Chelonia mydas (Linnaeus, 1758)	Cheloniidae	EN -- A1cd	EN-- A3cd
Eretmochelys imbricata (Linneaus 1766)	Cheloniidae	EN -- A1cd	CR-- A3cd
Lepidochelys olivacea (Eschschottz, 1829)	Cheloniidae	EN -- A1cd	EN-- A3cd
Dermochelys coriacea (Vandelli, 1761)	Dermochelyidae	EN -- A1cd	CR-- A3cd
Geochelone elegans (Schoepff, 1795)	Testudinidae	VU -- A1cd	VU-- A2cd
Lissemys punctata punctata (Bonnaterre, 1789)	Trionychidae	VU – A1C	VU-- A2cd
Not Assessed at the 1998 CAMP			
Melanochelys trijuga thermalis (Lesson, 1830)		NA	VU-- B1ab(iii)
Melanochelys trijuga parkeri		NA	EN-- B1ab(iii) + 2a(iii)

When the Taxon Data Sheets are analysed for the final Report, it will be better known whether these changes were due to changes in conditions for the animals, new information that was not known before, additional information which had not been collected, or a combination of all.

Various working groups were formed as part of the workshop as a whole : a Habitat Working Group which is currently unavailable due to computer corruption, Education WG, Research WG and Disease WG. In addition Action Plans for land and marine forms were constructed by Working Groups. These reports were collected and distributed at the end of the workshop, along with participant's certificates.

Although the PHVA workshop was not entirely successful due to the non-viability of the VORTEX programme on our computer, the general feeling seemed to be that the exercise taken together was very worthwhile. The staff of the National Zoological Garden was introduced to these processes for the first time and were extremely pleased to know about them. They, very enthusiastically supported by their Director, have asked for ZOO and CBSG, South Asia help in organizing other such workshops, in particular a Freshwater Fish CAMP. The Ministry representative who attended most of the workshop was extremely impressed with the workshop and gave an excellent Report to her superior officer, the Secretary to Government, MoEF. Subsequently the Secretary indicated to H.A.N.T. Perera, Zoo Director that it would be entirely possible to get such endeavours similarly funded in future.

Sponsors

The PHVA CAMP costs for local participants was funded by the Ministry of Environment and Natural Resources, Sri Lanka. Sponsors of the external experts, resource persons, modellers, etc. were the Turtle Survival Aliance (TSA), Ft. Worth Zoo and the Minnesota Chapter of the American Association of Zookeepers AAZK.

Appendix I
Working Group Reports

Distribution and Habitat Group
Group members: R.G.R.S Ranathunga, A. Gamage, Y.G.P. Karunarathene, Vijaya Ananda, A.M. Riyas Ahamed, L.J. Mendis Wickramasinghe, N. Weerasinghe, V.A.M.P.K Samrawickrama, Nimal D. Rathanayake, Anuk Ilangakoon, Pubudu Darshana Weerarathne, Weerawardane, Roshan K. Rodrigo, Sujeewa Jayasinghe, H.M.A.R. Ekanayake, C.K. Weerakoon

Number of location occurred in district

Hambanthota	6
Monaragala	7
Ampara	7
Batticaloa	3
Trincomalee	4
Mullathive	2
Killinochchi	7
Anuradhapura	8
Polonnaruwa	5
Puttalam	3
Matale	5
Kurunegala	1
Kandy	2
Badulla	2
Gampaha	2
Colombo	1
Kaluthara	3

Habitat / localities
Locations inhabited by the star tortoise were listed based on visual observations according to different districts of Sri Lanka. Where direct observations were not available past literature was used to identify locations where the Star Tortoise occurs in Sri Lanka. These were listed separately under each district. For each locations of occurrence the kinds of habitats in which the species is found and the prevalent threats were listed.

Once the locations were decided upon protected areas under the "DWLC" were looked at to determine were high densities of the species were found. The criteria used to determine high density was based on study carried out by Anslem de Silva at "Andigama". High density was defined as areas where there were one animal per ha. Taking this as an index low density was assumed to contain approximately one animal per 20 ha.

Working Group photos

The conservation/protected area grid map 10x10 km. grid) was used to map out these areas. 17 DWLC protected areas were discussed by the group which included officers of the DWLC. According to the observations of the group members and DWLC officers 5 protected areas have a high density of star tortoises while all other protected areas considered had low densities. Details such as the habitat within these protected areas and their area are also known and recorded here. Most of the high density habitats were those that contained scrubland, sand dunes, beach vegetation and grasslands surrounding tanks. These are types of habitat favored by the star tortoise.

RESEARCH AND PLANNING (*SRI LANKAN TURTLES & TORTOISES*) (PHVA)
Group members: E.M. Lalith.Ekanayake, V.A.M.P.K.Samarawikrama, Roshan, K.Rodrigo, Ganga Wijesinghe, Pubudu Weerarathna, Mendis Wikramasinghe, Nimal Rathnayake, Anslem de Silva, Raju Vyas, Subramanian Bhupathy, Indraneil Das.

1.Morphological and biochemical taxonomy including fossils (*Geochelone elegans, Melanochelys trijuga* (both sp.*), Lissemys punctata, Caretta caretta*)
2.Research on population aspects (sex ratios, size class, distribution, mortality, home range, recruitment, population genetics, life-table analysis, population viability analysis, fragmentation)
3.Habitat use (differential habitat use by sex/ size class, habitat features, micro-habitat use, HIS)
4.Disease (comparative study wild vs captive populations, parasites, zoonotic diseases, disease control, diseases and injuries, treatment of injuries)
5.Nutrition (food and feeding habits, nutrient value of food, food selection, ontogenetic dietary shift)
6.Behavioural biology (temporal activity patterns, thermoregulation, adaptive habits, Interrelationships with other species/ conspecifics
7.Breeding biology (clutch size, breeding season, incubation temperature, effects of temperature on sex, embryology,)
8.Threats (assessment of trade, local use, quantification of habitat loss, road mortality)
9.Husbandry & other *ex-situ* conservation (husbandry practices)
10.Distribution (surveys, studies on migration, biogeography)
11.Miscellaneous biology (competition, predation, haematology, anesthesia)
12.Sociological studies (people attitude towards tortoise)

EDUCATION WORKING GROUP GROUP (SRI LANKAN TURTLES & TORTOISES)
Group members: *Jayanthi, Arunthathy, Daniel, Ravi, Chithra, Avanthi, Abirami, Riyas, Jayalath, Jagath.*

--Create public awareness on tortoise conservation
--Training school nature clubs (particularly through Wildlife & Nature Protection Society [Contact: Jayalath Ferdinando]
--Forming Tortoise Saving Clubs
--Educating the public, law enforcement agents and politicians about the provision of Flora & Fauna Act
--Conduct or organize Teacher Training Programs
--Writing articles in news papers
--Preparation of education materials in local languages
--Educating through pamphlets, brochures, bookmarks, book covers, hats, T-shirt on theme on conservation, biology, trade, ecology & diseases
--Suggest the inclusion of wildlife education in the school curriculum
--Encouraging the public to inform wildlife authorities about offenders, poachers and traders
--Advertising about tortoise conservation and its value using popular personalities
--Promote roadside signage against road kills
--Utilizing media to educate the public about tortoise conservation and protection
--Forming an e-group

Disease Group
Group members: *Mukesh K. Chalise, Ganga Wijesinghe, Avanthi Ekanayake, C.K. Weerakoon, Ramani Jayalath, Arunthathy Ponnusamy, Jayanthi Alahakoon*

Diseases recorded in Star Tortoises

In captivity
1.External parasites are recorded in captive star tortoises. Ticks – Ticks of the genus Aponomma was recorded in the zoo collection. Ticks and fleas were found in private collection at Padaviya, Colombo and Kandy

2.There were internal parasites including haemoparasites and G.I. tract parasites.

3.*Plasmodium* like heamoparasites were detected in tortoises those were positive for ticks.

4.Faecal examination revealed nematode eggs and in one tortoise there were adult worms of the family Pharyngodonidae.

5.In the zoo there was an outbreak of a respiratory tract infection which killed almost 80% of tortoises within a very short period. This infection started during a rainy season and spread very rapidly. Main clinical signs were frothy nasal discharge and anorexia. Post-mortem revealed pneumonia. Culture and ABST revealed *Pseudomonas* and the tortoises were treated with antibiotics and supportive treatments were given.

Gastritis and enteritis were recorded in one of the Star tortoises at the zoo.

Diarrhoea was recorded in one privately owned tortoise and the cause was not investigated.

Humpedness is a common condition seen in captive tortoises due to calcium and vitamin D3 deficiency.

Ulcerative shell necrosis was recorded in a collection of tortoises in Kandy. Skin rashes were recorded in 2 collections from Peradeniya and Kegalle.

3. Wild star tortoises from Andigama were infested with ticks of the genus *Amblyomma.* As in captive tortoises

these Star tortoises that had ticks were positive for *Plasmodium* like haemoparasites.

Fecal examination has revealed nematode eggs.

Although these wild tortoises were positive for ticks, haemoparasites and nematode eggs in faeces these reptiles didn't show any signs of clinical disease. Ulcerative shell necrosis was also detected. Ulcerative shell necrosis was detected from wild tortoises from Andigama. A wild Star tortoise from Ambalanthota was infested with ticks and fungal skin rash.
Wild Star tortoises are killed by forest fires and road traffic accidents (road kill ?)

Appendix II — Action Plans

Action Plan for Star Tortoise and Freshwater Terrapins of Sri Lanka
Working Group members *Renuka Bandaranayaka, Ramani Jayalath, Dammika Malsinghe, Anslem DeSilva, Mukesh Chalise, P.O. Nameer, C. Srinivasulu*

Star tortoise Geochelone elegans
Distribution and habitat — Widely distributed except hilly country.

Threats — Harvest [for food, medicine, pet trade] — Road accidents/mortalities, fire flood, diseases, habitat l oss, Indiscriminate use of pesticides

Status — Vulnerable

Priority areas for Conservation — Awareness programmes for people to mitigate. Strong implementation of existing legislations. Set up antipoaching groups involving local communities

Priority areas for Management— Practical approach of mapping Star Tortoise distribution to Sri Lanka to identify potential habitat conservation prioritization programmes.

***Ex situ* Conservation** — Carry out captive breeding programmes to replenish depleting wild populations.

Flap-Shell *Lissemys punctata*
Black Turtle (2 ssp.) *Melanochelys trijjuga parkeri* and *M. t. thermalis*

Distribution and habitat — Restricted in distributed to plains.

Threats — Harvest [for food, medicine, pet trade], Road accidents/mortalities, Habitat loss, Indiscriminate use of pesticides, Wild population is under pressure in some areas due to high density of leeches, Prey base depletion due to pesticide loads and alien species (carnivorous fishes)

Status — Vulnerable

Priority areas for Conservation — Awareness programmes for educate people. Strong implementation of existing legislations. Set up antipoaching groups involving local communities

Priority areas for Management— Alien species management by time bound removal programme. Initiate research programme to determine impact of ecto parasites (leeches) on the population in high leech density areas Research study to understand its ecology in terms of habitat and food requirements

***Ex situ* Conservation** — Carry out captive breeding programme to replenish wild populations of Black turtles.

Action Plan for Marine Turtles in Sri Lanka

Summary:
Five species of marine turtles are known to nest on Sri Lanka's coastline and inhabit her waters. All five are threatened species with the Hawksbill and Leatherback turtles Critically Endangered while the Green, Olive Ridley and Loggerhead are Endangered. Due to several threats such as gillnet entrapment, egg collection and slaughter for meat, habitat destruction, natural predators, pollution etc. the populations are impacted. Data on sea turtle populations and their biology are inadequate for proper management at present. Although all five species are legally protected in Sri Lanka implementation of the law is not adequate.

Nesting:
All the major nesting sites of marine turtles are located along the southwest, south and southeast coasts. Some of these nesting sites are located within protected areas such as Bundala National Park, Ruhuna National Park and Yala East National Park.

Threats:
Sri Lanka's turtle populations are affected by various human activities. Marine turtle habitats are degraded both at sea and on land. Mining for the construction industry has significantly reduced Sri Lanka's inshore coral reefs whilst tourism development and beach armouring has seriously disturbed several important rookeries. Turtles are directly exploited for egg harvesting and the slaughter of nesting females for their meat and shells (hawksbill only). One of the most significant threats to Sri Lankan marine turtles is incidental bycatch in marine fisheries. Nesting areas within national parks are generally not affected by human activity but natural predation levels are very high in these areas especially by wildboar.

Priority Issues and Recommendations:
1.Need for further research and monitoring. As the present information available on marine turtle populations around Sri Lanka is insufficient for management and conservation efforts to be applied further research on the biology, ecology and behaviour of marine turtles is needed.

***2. in situ* and *ex situ* conservation** -- Development of *in situ* conservation measures are necessary for major nesting areas situated outside protected areas. *Ex situ* conservation measures should be done where *in situ* conservation is not possible. However, these measures should be done on a proper scientific basis using scientifically justified methodology.

3. Education and awareness -- Increased knowledge on ecology, biology and behaviour of sea turtles can play a key role in conservation and management of the species. Education and awareness programmes must be conducted for different target groups such as school children, government institutions, NGO's, coastal communities etc.

4. Community involvement in conservation and management -- Community members must be involved and informed in research, conservation and management

to achieve success in implemented programmes. This will result in better communication between communities and authorities while conflicts can be mitigated. This would also lead to a better understanding of the resource and its non-consumptive use.

5. Alternative livelihood development -- Conservation of marine turtles needs a community based ecosystem approach as it means not only conserving the animals but also its habitat. However this could conflict with resource use practices of members of local communities not only those who directly exploit sea turtles. Therefore it is important to develop appropriate non-consumptive alternatives for human communities living adjacent to turtle habitat. Well-controlled and carefully managed eco-tourism could play a major role in this respect.

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